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Use of Industrial Byproducts in Agriculture

Compiled by
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Water Quality Information Center
National Agricultural Library
Agricultural Research Service
U.S. Department of Agriculture

1,355 citations

Abstract

Use of Industrial Byproducts in Agriculture. U.S. Department of Agriculture, National Agricultural Library.

Massive quantities of industrial byproducts are produced everyday. Governments and private industries throughout the world are researching ways to divert the byproducts from landfills and use them in beneficial ways. This bibliography is a guide to recent scientific literature regarding the use of industrial byproducts in agriculture.

The byproducts featured in this guide originate from coal combustion, construction and demolition activity, paper manufacturing, iron and steel making, tire use, and wood products manufacturing and use.

Keywords: coal ash, fly ash, scrubber sludge, fluidized gas desulfurization, drywall, gypsum board, plasterboard, construction and demolition wood, pulp sludge, paper sludge, iron and steel slag, foundry sand, used tire, scrap tire, waste tire, sawdust, waste wood, boiler ash, wood ash

For information on the Agricultural Research Service's research plans related to industrial byproducts, see Action Plan: National Program 214, Utilization of Manure and Other Agricultural and Industrial Byproducts available at <http://www.ars.usda.gov/SP2UserFiles/Program/206/NP214ActionPlan25Feb2009.pdf>.

Mention of trade names or commercial products in this report is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the U.S. Department of Agriculture.

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About This Bibliography

Massive quantities of industrial byproducts are produced everyday. Governments and private industries throughout the world are researching ways to divert the byproducts from landfills and use them in beneficial ways. This bibliography is a guide to recent scientific literature regarding the use of industrial byproducts in agriculture.

The byproducts featured in this guide originate from activities involving coal combustion, construction and demolition, paper manufacturing, steel making, tire use, and wood products manufacturing. Note that the citations include global industries, so the composition of the byproducts (which includes ash, sludge, sand, slag, wood waste, and used tires) can vary from country to country.

The citations are arranged according to the industrial byproduct. There are some citations that examine more than one industry or discuss the general use of industrial byproducts in agriculture. These are placed in a General/Mixed category.

There are 1,355 citations with abstracts (when available) in this bibliography. Citations were found through literature searches of the AGRICOLA database, produced by the National Agricultural Library, and several other public and commercial bibliographic databases. Documents cited were published from 1998 through early 2009. URLs are provided for online documents that are freely available. The inclusion or omission of a particular citation does not imply endorsement or disapproval.

To ensure timely distribution, this bibliography has received minimal editing and design. Since several databases were used, there may be some variance in the formatting of the entries.

Within each section, citations are arranged alphabetically by title. To locate information on a specific topic, for example, "corn," use the subject index beginning on page 379. To ensure that you see all the relevant citations for a particular topic, be sure to look up related terms (such as "maize" from the example above) in the subject index. An author index is also available beginning on page 417.

To obtain a specific document, please contact your local library. Information on how to obtain documents from the National Agricultural Library can be found at www.nal.usda.gov/services/request.shtml.

Acknowledgments

The following databases were used to develop this bibliography:

- AGRICOLA (National Agricultural Library)
- AGRIS (Food and Agriculture Organization of the United Nations)
- BIOSIS Previews (Thomson Reuters)
- CAB Abstracts (CABI)
- GeoRef (American Geological Institute)
- PubMed (U.S. National Library of Medicine and National Institutes of Health)
- Scopus (Elsevier)
- Water Resources Abstracts (ProQuest)

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- American Geological Institute
www.agiweb.org
- CABI
www.cabi.org
- Cambridge Information Group/ProQuest
www.csa.com
- Elsevier/Scopus
www.scopus.com
- Food and Agriculture Organization of the United Nations
www.fao.org/Agris
- Thomson Reuters
www.thomsonreuters.com

Special thanks to Eton Codling, Matt Smith, Mark Walbridge (Agricultural Research Service); John Sager (Environmental Protection Agency), and William Thacker (National Council for Air and Stream Improvement [NCASI], representing the Industrial Resources Council [IRC]) for their valuable assistance in producing this bibliography.

Coal Combustion Byproducts

1. The accumulation of boron in *Agropyron elongatum* grown in coal fly ash and sewage sludge mixture.

Wong, J. W. C.; Jiang, R. F.; and Su, D. C.
Water, Air and Soil Pollution 106(1/2): 137-147. (1998)
 NAL Call #: TD172.W36; ISSN: 0049-6979
Descriptors: application rates/ ash/ boron/ capacity/ coal/ effects/ fly ash/ growth/ mixtures/ plant composition/ seasons/ sewage/ sewage sludge/ sludges/ soil/ symptoms/ toxicity/ chemical constituents of plants
Abstract: A greenhouse pot experiment was conducted to investigate the boron (B) release capacity of coal fly ash and sewage sludge mixtures, and the accumulation of B in *Agropyron elongatum* [*Elymus elongatus*] after two consecutive growing seasons. Sludge was amended with fly ash at application rates of 0, 5, 10, 35, and 50% (w/w), and each mixture was then mixed with a loamy soil at either 1:1 or 1:5 (v/v). Both water soluble B (WS-B) and hot water soluble B (HWS-B) increased with increasing fly ash amendment rate. Shoot B concentrations also increased significantly according to the rate of ash amendment. The ash-sludge mixture improved plant growth with the highest total dry weight yield at 10% ash amendment rate. Boron toxicity symptoms in leaf tips were observed at 35% and 50% ash amendment rate at both soil mixing ratios. Hot water soluble B and WS-B decreased significantly after consecutive cropping of *Agropyron* especially at a low ratio of mixture with soil i.e. 1:5 (v/v). However, soil available B contents at $\geq 35\%$ ash application rate and 1:1 (v/v) soil mixing ratio were still excessive for normal plant growth, suggesting that deleterious effects on plant growth would be experienced in later seasons owing to the high amounts of residual B.
 Reproduced with permission from the CAB Abstracts database.

2. Accumulation of heavy metals in vegetables, pulse and wheat grown in fly ash amended soil.

Barman, S. C.; Kisku, G. C.; and Bhargava, S. K.
Journal of Environmental Biology 20(1): 15-18. (1999)
 NAL Call #: QH540.J65 ; ISSN: 0254-8704
Descriptors: aubergines/ cabbages/ cadmium/ carrots/ chemical composition/ chickpeas/ chromium/ copper/ fly ash/ heavy metals/ industrial wastes/ iron/ lead/ lettuces/ nickel/ peas/ radishes/ soil/ soil amendments/ spinach/ tomatoes/ turnips/ uptake/ vegetables/ wheat/ zinc/ *Araliales*/ brinjal/ *Capparales*/ eggplants/ pea/ vegetable crops
Abstract: Heavy metals in soil and in 12 plant species (turnips, cabbages, carrots, radishes, spinach, peas, coriander, lettuces, tomatoes, brinjal [aubergine], gram [*Cicer arietinum*] and wheat) were determined in fields receiving fly ash from a thermal power plant. The metal contents (Cd, Cu, Zn, Fe, Ni, Cr and Pb) in the soil samples were higher than in the control soil. In Cd, Zn and Pb the concentration was either below or within the critical concentration. In the edible parts of the plant Cu, Zn and Pb concentration were within the recommended permissible limits, whereas Cd, Cr and Ni concentrations were sometimes higher. Accumulation of metals in plants varied from species to species and also within the different parts of a plant.
 Reproduced with permission from the CAB Abstracts database.

3. Acidic and alkaline bottom ash and composted manure blends as a soil amendment.

Mukhtar, S.; Sadaka, S. S.; Kenimer, A. L.; Rahman, S.; and Mathis, J. G.
Bioresource Technology 99(13): 5891-5900. (2008)
 NAL Call #: TD930.A32 ; ISSN: 0960-8524
Descriptors: ash/ cattle manure/ composts/ leachates/ nutrient content/ physicochemical properties/ soil amendments
Abstract: Potential water quality impacts associated with using bottom ash (BA) and composted dairy manure (CM) as a soil amendment were evaluated in this study. Two column studies were conducted to evaluate three blends of acidic BA and CM (BA:CM, v/v) namely, B_{1ac} (95:5), B_{2ac} (90:10), and B_{3ac} (80:20) and three blends of alkaline BA and CM (BA:CM, v/v), namely, B_{1al} (95:5), B_{2al} (90:10), and B_{3al} (80:20) under constant head water table conditions. Samples from standing water (top) and leachate (bottom) were collected at weekly intervals until day 49 to evaluate the effects of different blend ratios and elapsed time on standing water and leachate chemical and physical properties. A higher CM content in both acidic and alkaline blends resulted in higher leachate concentrations for solids and nutrients tested in this study. Alkaline blends had higher standing water and leachate nutrients concentration compared to acidic blends. After day 28, standing water total dissolved solids (TDS) concentrations for all acidic blends was below the USEPA drinking water standard however, TDS value for alkaline blend was always below the standard. Similar trends were also observed for NO₃-N and phosphorus (P) concentrations for both blends. Based on these findings, it was concluded that acidic and alkaline blends B_{1ac}, B_{1al}, B_{2ac} and B_{2al} may be considered as a soil amendment material.
 Reproduced with permission from the CAB Abstracts database.

4. Adsorption-desorption studies of selected chlorophenols and herbicides and metal release in soil mixtures with fly ash.

Albanis, T. A.; Danis, T. G.; and Kourgia, M. G.
Environmental Technology 19(1): 25-34. (1998)
 NAL Call #: TD1.E59; ISSN: 0959-3330
Descriptors: 2,4 dichlorophenol/ adsorption/ alachlor/ desorption/ fertilizers/ fly ash/ herbicides/ metolachlor/ phenols/ soil/ weedicides/ weedkillers
Abstract: The influence of fly ash on the adsorption and desorption of four selected chlorophenols and two herbicides was studied in mixtures with a sandy clay loam (SCL) soil. Fly ash and soil mixtures with a range of fly ash content from 0 to 30% were used to study adsorption and desorption of four chlorophenols, 2,4-DCP, 2,4,6-TCP, 2,3,5,6-TCP and PCP as well as two selected herbicides, alachlor and metolachlor, in batch experiments. The linear isotherms indicated a constant partition of chlorophenols and herbicides between the bulk solution and mixtures of fly ash and soil, for a concentration range from 0.025 to 0.2 mg/litresuperscript 3 for chlorophenols and 0.1 to 10 mg/litre for herbicides. Mass balance estimations show that the adsorbed amounts of chlorophenols in mixtures of soil with 30% fly ash content, are up to 36.5% for 2,4-DCP,

55.8% for 2,4,6-TCP, 68.7% for 2,3,5,6-TCP and 84.9% for PCP and the respectively adsorbed amounts of herbicides in mixtures with 20% fly ash are up to 37.5% for alachlor and 43.2% for metolachlor. In contrast, the amounts of desorption decrease as the fly ash content and the number of chlorines in the phenolic ring increase. Results of leaching tests of metals from soil mixtures with fly ash showed that as the fly ash content and pH values increase, the concentration of Mg, Mn and Fe decreases in the aqueous solutions by metal precipitation. The concentrations of Ni, Cu and Zn remain at low levels and the concentration of Cr increase due to the formation of more soluble metal species at high pH values. Reproduced with permission from the CAB Abstracts database.

5. Adsorption-desorption studies of selected herbicides in soil-fly ash mixtures.

Konstantinou, I. K. and Albanis, T. A.

Journal of agricultural and food chemistry 48(10): 4780-4790. (Oct. 2000)

NAL Call #: 381 J8223 ; ISSN: 0021-8561 [JAFCAU]

Descriptors: atrazine / propazine/ prometryn/ propanil/ molinate/ adsorption/ desorption/ clay loam soils/ fly ash/ pollution control/ soil pollution/ application rate/ sandy clay loam soils

Abstract: Fly ash and soil mixtures with a range of fly ash content from 0 to 100% were used to study the adsorption and desorption of herbicides atrazine, propazine, prometryne, propanil, and molinate in batch experiments. The isotherms shapes according to Giles classification (Giles et al., 1960) were S, L, and H as the substrate changed from sandy clay loam (SCL) to fly ash, depending on the percent of fly ash in the mixture. The adsorption isotherms fit the Freundlich equation $x/m = K(f) C(1/n)$. The $K(f)$ values increase with the increase of the fly ash content. The mean percent amounts of herbicides, for a range of concentration 1-20 mg L⁻¹, adsorbed on the soil were 21.9% for atrazine, 50.7% for propazine, 29.04% for prometryne, 43.14% for molinate, 31.35% for propachlor, and 46.34% for propanil. Mass balance estimations show that the adsorbed amounts of the herbicides increase along with the fly ash content in the sorbent mixture and reach the 99% in the "pure" fly ash. In contrast, the amounts desorbed with water decrease as the fly ash content increases. The n values ranged from 0.82 to 3.05 indicating that the carbon content of fly ash plays a significant role during the sorption process and an increase of heterogeneity of solid substrate. The increase of the amounts desorbed with acetone indicates that the sorption of organic compounds onto fly ash is believed to occur principally via the weak induction forces of London or dispersion forces which are characteristic of the physical adsorption process. The results of this research demonstrate that the fly ash shows a significant capacity for adsorption of organic compounds from aqueous solution. This citation is from AGRICOLA.

6. Advances in studies in effects of fine coal ash on agricultural crops.

Wang Zhaofeng and Feng Yongju

Journal of Shandong Agricultural University (Natural Science edition) 34(1): 152-156. (Mar. 2003); ISSN: 1000-2324.

Notes: 4 tables, 43 ref. Summaries (En, Zh). Citation Notes: CN (China).

Descriptors: coal ash/ field crops

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7. Agricultural use of a flue gas desulfurization by-product.

Dick, Warren; Chen, Liming; and Nelson Jr., Sid. In: Proceedings of the 1998 91st Annual Meeting & Exposition of the Air & Waste Management Association. San Diego, CA, USA.: Air & Waste Management Association; 1998.

Notes: Chapter Number: Pittsburgh, PA, United States.

Descriptors: Agriculture/ Byproducts/ Composition/ Desulfurization/ Economics/ Flue gases/ Fly ash/ Trace elements/ Duct injection technology/ Fluesorbent materials/ Turf grass/ Air pollution control

Abstract: Few, if any, economical alternatives exist for operators of small coal-fired boilers that require a flue-gas desulfurization system which does not generate wastes. A new duct-injection technology called 'Fluesorbent' has been developed to help fill this gap. Fluesorbent FGD was intentionally designed so that the saturated SO₂-sorbent materials would be valuable soil amendments for agricultural or turf-grass land. Agricultural and turf grass studies recently commenced using spent Fluesorbent materials from an FGD pilot program at an Ohio power plant. In the first year of testing, alfalfa yields on field plots with the FGD by-products were approximately 250% greater than on plots with no treatment, and about 40% greater than on plots treated with an equivalent amount of agricultural lime. Because the FGD by-products contained trace elements from included fly ash, the chemical composition of the alfalfa was significantly improved. Detailed yield and chemical data are presented.

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8. Agricultural uses for flue gas desulfurization (FGD) gypsum.

United States Environmental Protection Agency [Also available as: EPA530-F-08-009], 2008

<http://www.epa.gov/epawaste/partnerships/c2p2/pubs/fgd-fs.pdf>

Descriptors: gypsum/ agriculture/ flue gas desulfurization/ FGD

9. Alkali soil reclamation with flue gas desulfurization gypsum in China and assessment of metal content in corn grains.

Sakai, Y.; Matsumoto, S.; and Sadakata, M.

Soil and Sediment Contamination 13(1): 65-80. (2004)

NAL Call #: TD878 .J68; ISSN: 1058-8337

Descriptors: agricultural production/ air pollution/ alkaline soils/ arsenic/ bioavailability/ boron/ cadmium/ chromium/ coal/ combustion/ copper/ crop production/ desertification/ desulfurization/ exchangeable sodium/ fly ash/ gypsum/ lead/ maize/ manganese/ nickel/ polluted soils/ reclamation/ risk assessment/ sodium/ soil amendments/ soil chemical properties/ soil ph/ soil pollution/ soil types/ sulfur/ sulfur dioxide/ atmospheric pollution/ chemical properties of soil/ corn/ desulphurization/ elemental sulphur/ Mn/ sulphur/ sulphur dioxide

Abstract: Flue gas desulfurization gypsum (FGDG), the by-product of wet and semi-dry desulfurization processes, has been used as an alkali soil amendment in China. We

evaluated the change in soil properties, agricultural production and the safety of FGDG as a soil amendment. As a result, soil pH and ESP (exchangeable sodium percentage) decreased and corn production increased in FGDG-treated plots. The metal (B, Cr, Mn, Ni, Cu, As, Cd, Pb) contents in soil, FGDG, and corn grains were quantified by ICP-MS. Consequently, the contents of almost all metals in FGDG were lower than in soil. Moreover, the contents of almost all of the metals in the corn grains in the FGDG-treated plots were almost the same or lower than those in the control plot. Statistical analysis indicated that there was no effect of gypsum application on the metal content in the corn grains. Almost all of the metal contents were lower than the standard values set by FAO/WHO for human intake. The results showed that the FGDG from wet and semi-dry FGD processes is suitable as an alkali soil amendment.

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10. Alkaline biosolids and EDTA for phytoremediation of an acidic loamy soil spiked with cadmium.

Wong, J. W.; Wong, W. W.; Wei, Z.; and Jagadeesan, H. *Science of the Total Environment* 324(1-3): 235-46. (May 2004)

NAL Call #: RA565.S365; ISSN: 0048-9697

Descriptors: Biodegradation, Environmental/ Brassica: chemistry: growth & development/ Cadmium: isolation & purification: pharmacokinetics/ Chelating Agents: chemistry/ Edetic Acid: chemistry/ Environmental Pollution: prevention & control/ Hydrogen-Ion Concentration/ Soil/ Soil Pollutants: isolation & purification: pharmacokinetics

Abstract: A greenhouse experiment was conducted to investigate the growth of Brassica juncea and Cd phytoextraction in a mimicked Cd contaminated acidic loamy soil amended with alkaline biosolids, prepared from sewage sludge and coal fly ash, in the presence and absence of EDTA at 2 mmol kg⁻¹. The acidic loamy soil was spiked with 0, 5, 20, 50 and 100 mg Cd kg⁻¹ in the form of CdCO₃ and then amended with 4% alkaline biosolids (w/w). Alkaline biosolids and 0.12% CaCO₃ amendments resulted in a higher biomass than unamended soil spiked with 20 mg kg⁻¹ Cd where plants did not survive and of the two amendments, alkaline biosolids amendment had higher plant dry weight yield and phytoextraction of Cd. Adding 2 mmol kg⁻¹ EDTA to alkaline biosolids amended soil significantly increased the solubility of Cd ions by 9- to 29-fold, but plant Cd accumulation decreased by a factor of 24-48%. The results indicate that alkaline biosolids amendment is an effective approach for assisting growth of B. juncea and phytoextraction of Cd from the contaminated acidic loamy soil, but further application of chelating agents did not enhance the phytoextraction efficiency of Cd. This citation is from PubMed.

11. Alkaline coal fly ash amendments are recommended for improving rice-peanut crops.

Swain, D. K.; Rautaray, S. K.; and Ghosh, B. C.

Acta Agriculturae Scandinavica Section B, Plant Soil Science 57(3): 201-211. (2007)

NAL Call #: 11 Ac82 ; ISSN: 0906-4710

Descriptors: coal/ crop residues/ crop yield/ farmyard manure/ fly ash/ groundnut oil/ groundnuts/ kernels/ lateritic soils/ lime/ nitrogen fertilizers/ NPK fertilizers/ nutrient

availability/ nutrient uptake/ organic amendments/ phosphorus/ phosphorus fertilizers/ plant nutrition/ potassium/ potassium fertilizers/ residual effects/ rice/ sandy loam soils/ sludges/ soil types genetic/ arachis oil/ FYM/ paddy/ peanut oil/ peanuts/ phosphate fertilizers/ potash fertilizers

Abstract: A field experiment investigating amendments of organic material including farmyard manure, paper factory sludge and crop residues combined with fly ash, lime and chemical fertilizer in a rice-peanut cropping system was conducted during 1997-98 and 1998-99 at the Indian Institute of Technology, Kharagpur, India. The soil was an acid lateritic (Halustaf) sandy loam. For rice, an N:P:K level of 90:26.2:33.3 kg ha⁻¹ was supplied through the organic materials and chemical fertilizer to all the treatments except control and fly ash alone. The required quantities of organic materials were added to supply 30 kg N ha⁻¹ and the balance amount of N, P and K was supplied through chemical fertilizer. Amendment materials as per fertilization treatments were incorporated to individual plots 15 days before planting of rice during the rainy season. The residual effects were studied on the following peanut crop with application of N:P:K at 30:26.2:33.3 kg ha⁻¹ through chemical fertilizer alone in all treatments, apart from the control. An application of fly ash at 10 t ha⁻¹ in combination with chemical fertilizer and organic materials increased the grain yield of rice by 11% compared to chemical fertilizer alone. The residual effect of both lime and fly ash applications combined with direct application of chemical fertilizer increased peanut yields by 30% and 24%, respectively, compared to chemical fertilizer alone. Treatments with fly ash or lime increased P and K uptake in both the crops and oil content in peanut kernel compared to those without the amendments. Alkaline coal fly ash proved to be a better amendment than lime for improving productivity of an acid lateritic soil and enriching the soil with P and K.

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12. Alkaline fly ash effects on boron sorption and desorption in soils.

Matsi, T. and Keramidas, V. Z.

Soil Science Society of America Journal 65(4): 1101-1108. (July 2001-Aug. 2001)

NAL Call #: 56.9 So3; ISSN: 0361-5995 [SSSJD4]

Descriptors: boron/ sorption/ desorption/ fly ash/ alkalinity/ acid soils/ calcareous soils/ equations/ application rate/ Greece/ freundlich equation/ langmuir equation/ phenomenological equation

Abstract: Application of alkaline fly ash to soils is expected to result in an increase in B sorption capacity. If fly ash is B-rich, B phytotoxicity might occur depending not only on B loads and magnitude of soil sorption capacity for B, but also on the strength of B retention by sorption surfaces of the fly ash amended soils. This strength determines the ease through which B releases into the soil solution. Aged-alkaline fly ash was applied to one calcareous and two acid soils at rates equal to 0, 5, 20, and 50 g kg⁻¹ of soil, and the impact of fly ash addition on B sorption in these soils was characterized, by means of the parameters (affinity and maximum) obtained through fitting B sorption data to the nonlinear Freundlich, Langmuir isotherms, and the phenomenological equation of Keren et al. Boron was added to the untreated and the fly ash-treated soils, left in

contact for 30 d, and its desorbability was studied. It was observed that although B sorption maximum of soils tended to increase upon fly ash addition, the affinity of B to sorption sites remained practically unaltered in most of the cases. Boron sorption was an exothermic reaction and the greatest part (more than 60%) of sorbed B in the fly ash-treated soils could be easily desorbed within 24 h, reaching 80% for the acid soils and 100% for the calcareous soil after 120 h of desorption time. It was concluded that although there was a tendency of an increase in B sorption capacity in most cases upon fly ash addition, this increase was not generally accompanied by an increase in strength of B retention by soil surfaces. A major part of added B in the fly ash-treated soils remained labile enough to be released in the soil solution in a short time.

This citation is from AGRICOLA.

13. Amelioration of alkali soil using flue gas desulfurization byproducts: Productivity and environmental quality.

Wang, S. J.; Chen, C. H.; Xu, X. C.; and Li, Y. J. *Environmental Pollution* 151(1): 200-4. (Jan. 2008)

NAL Call #: QH545.A1E52; ISSN: 0269-7491

Descriptors: China/ Coal/ Crops, Agricultural: growth & development/ Environmental Monitoring: methods/ Environmental Remediation: methods/ Gases/ Hydrogen-Ion Concentration/ Industrial Waste/ Medicago sativa/ Metals, Heavy: analysis/ Power Plants/ Seeds: chemistry/ Soil Pollutants: analysis/ Zea mays

Abstract: In this study, flue gas desulfurization (FGD) byproducts are used to ameliorate alkali soil. The average application rates for soils with low exchangeable sodium percentage (ESP), mid ESP, and high ESP are 20.9, 30.6, and 59.3 Mg ha⁻¹, respectively. The experimental results obtained for 3 consecutive years reveal that the emergence ratios and yields of the crops were 1.1-7.6 times and 1.1-13.9 times those of the untreated control, respectively. The concentrations of Cr, Pb, Cd, As, and Hg in the treated soils are far below the background values stipulated by the Environmental

Quality Standard for Soils (GB15618-1995). Their concentrations in the seeds of corn and alfalfa grown in the treated soils are far below the tolerance limits regulated by National Food Standards of China. The results of this research demonstrate that the amelioration of alkali soils using FGD byproducts is promising.

This citation is from PubMed.

14. Amelioration of coal mine spoils through fly ash application as liming material.

Ajaya Srivastava and Chhonkar, P. K.

Journal of Scientific and Industrial Research 59(4): 309-313. (2000)

NAL Call #: 475 J82; ISSN: 0022-4456

Descriptors: biomass/ bulk density/ coal mine spoil/ density/ dry matter/ exchangeable potassium/ fly ash/ lime/ liming/ liming materials/ oats/ phosphorus/ potassium/ reclamation/ spoil heap soils/ sulfur/ uptake/ colliery spoil/ elemental sulphur/ sulphur

Abstract: The feasibility of fly ash as compared to lime to ameliorate the low pH of acidic coal mine spoils under controlled pot culture conditions are reported using Sudan grass (*Sorghum sudanense*) and oats (*Avena sativa*) as indicator crops. It is observed that at all levels of

applications, fly ash and lime significantly increase the pH of mine spoils, available phosphorus, exchangeable potassium, available sulphur and also uptake of phosphorus, potassium, sulphur and oven-dried biomass of both these test crops. The fly ash significantly decreases the bulk density of coal mine spoils, but, there is no effect on bulk density due to lime application. However, when the spoils are amended with either fly ash or lime, the root growth occurs throughout the material. Fly ash and lime do not cause elemental toxicities to the plants as evidenced from the dry matter production by the test crops. The results indicate that fly ash to be a potential alternative to lime for treating acidic coal mine spoils.

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15. Amelioration of soil acidity with class c fly ash: A field study.

Schlossberg, Maxim J.; Waltz, F. Clint Jr; and Miller, William P.

In: *Coal Combustion Byproducts and Environmental Issues*. Uppsala, Sweden.)

233 Spring Street, New York, NY 10013: Springer; pp. 190-194; 2006.

Notes: 7th International Conference on Biogeochemistry of Trace Elements.; ISBN: 0387258655

Descriptors: biochemistry and molecular biophysics/ soil science/ agronomy: agriculture/ Gramineae: angiosperms, monocots, plants, spermatophytes, vascular plants/ fly ash/ soil acidity/ coal combustion product

Abstract: Coal combustion products (CCP) include fly ash and bottom ash and are generated nationally at rates of 10(8) Mg per year. Fly ashes (FA) comprise the majority of CCP production, and can possess widely-variable physicochemical properties. Current consumption/utilization of FA in the US does not approach production levels, and results in FA stockpiling. Class-C fly ash is generated from combustion of sub-bituminous and lignite coal products. This class of FA often possesses an alkaline pH, resulting from calcium, magnesium, and potassium oxide inclusions. Some Class-C FA have been reported to contain as much as 60% calcium carbonate equivalency (CCE), prompting investigations of FA as a lime substitute in agricultural/horticultural applications. Furthermore, FA often possesses small concentrations of exchangeable micronutrients. Thus, considering availability of Class-C FA, its potential beneficial use as a liming agent, and the expansive area of low-to-medium maintenance turfgrass systems currently afflicted by suboptimal soil pH levels; our objective was to evaluate the acid-neutralizing efficacy of a Class-C FA when substituted for pulverized limestone (PL) in field application. This study was conducted on a severely-acidic bermudagrass (*Cynodon* spp. L.) rough of a Georgia golf course during 2001 and 2002. Following material characterization, CaCO₃ equivalent was applied at a prescribed rate of 3.8 Mg CaCO₃ ha⁻¹, using either PL or Georgia-produced FA (CCE = 45.5%). Soil samples collected one year following showed FA to have neutralized significantly greater acidity in the upper 8 cm of soil than the PL. Furthermore, exchangeable P, Mg, and Zn levels in the FA-treated 0-8 cm of soil exceeded levels observed in the PL-treated or control plots. Due to the disparity in CCE, requisite FA application greatly exceeded that of PL, reducing economic advantage of FA-substitution. However, in locations where Class-C FA is plentiful, high-grade PL is

costly, and soil pH suboptimal for important crops; results of this study indicate soil liming with Class-C FA to be a beneficial use of this CCP. Comprehensive characterization of CCP and proper application rate (not exceeding agronomic requirements) are essential components of beneficial use.

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16. Amendment of fly ash to container substrates for ornamental plant production.

Chen, Jianjun and Li, Yuncong.

In: Coal Combustion Byproducts and Environmental Issues. June 15 -19, 2003.)

Uppsala, Sweden: Springer, 233 Spring Street, New York, NY 10013, United States; pp. 177-183; 2006.

Notes: 7th International Conference on Biogeochemistry of Trace Elements.; ISBN: 0387258655

Descriptors: biogeography: population studies/ agrichemicals/ nutrition/ horticulture: agriculture/ Acanthaceae: angiosperms, dicots, plants, spermatophytes, vascular plants/ organic matter/ fly ash

Abstract: Ornamental plants are largely produced in containerized soilless substrates that generally consist of sphagnum peat, bark, and other organic matter. Such substrates initially have a low pH (around 4.0) and limited amount of mineral nutrients. In order to raise pH and increase fertility, commercial ground limestone and chemical fertilizers have to be incorporated into the substrates. Fly ash, a coal combustion byproduct possessing alkalinity and containing essential mineral elements in silt-sized particles, could be an alternative to limestone amendments and nutrient sources for container substrates. This study examined chemical properties of four fly ash sampled from power plants in (1) North Carolina, (2) Michigan(a), (3) Florida, and (4) Michigan(b) and incorporated an appropriate amount of each fly ash or a commercial dolomite, respectively, into a soilless basal substrate, resulting in fly ash- or dolomite-amended substrates. After testing chemical properties of the substrates, seedlings of Pink Splash (*Hypoestes phyllostachya* Bak.), a herbaceous ornamental foliage plant, were planted in the basal, fly ash-, and dolomite-amended substrates. Substrate pH and plant heights were monitored during the course of plant growth. All fly ashes were able to raise the pH of the basal substrate from 3.8 to 7.4 except the one collected from Michigan(b) that was unable to change the pH regardless of the amount of fly ash used. Plants grown in the substrates amended with fly ash from North Carolina, Michigan(a), and Florida had comparable heights and similar fresh and dry weights as well as overall quality to those grown in the dolomite-amended substrate. Whereas, plants grown in the basal substrate and the substrate amended with Michigan(b) fly ash were significantly smaller and had less fresh and dry weights than those grown on the rest of substrates, thus, plants were not marketable. These results show that fly ash, after selection based on their chemical properties, can be used as alternative to commercial dolomite in soilless substrates for ornamental plant production. Utilization of fly ash as a container substrate amendment may represent a new market for the beneficial use of coal combustion byproducts.

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17. Analysis of impact of the harmful element contents on soils and crops in the farmland incurred by fly ash.

Xu Hong

Bulletin of the Chinese Society of Mineralogy, Petrology and Geochemistry 18(1): 29-32. (Jan. 1999); ISSN: 1007-2802.

Notes: Original title: Kuangwu Yanshi Diquhuaxue Tongbao. Language: Chinese. References: 6; 5 tables.

Descriptors: analysis / ash/ Asia/ China/ Far East/ heavy metals/ impact statements/ Jiangsu China/ Nanjing China/ pollution/ soils/ yields/ Environmental geology

© American Geological Institute

18. Applicability of fly-ash, phosphate solubilizing microbes and mycorrhizae for sustainable productivity of banana.

Phirke, N. V.; Chincholkar, S. B.; Yadav, K. R.; and Kothari, R. M.

Biotechnology of Microbes and Sustainable Utilization: 161-165. (2002)

Descriptors: agricultural soils/ arsenic/ bananas/ bioavailability / cadmium/ calcium/ chromium/ crop production/ crop yield/ ectomycorrhizas/ fermentation/ fly ash/ food chains/ lead/ mercury/ mycorrhizal fungi/ mycorrhizas/ NPK fertilizers/ nutrient requirements/ phosphate/ phosphate solubilizing bacteria/ phosphorus fertilizers/ rhizosphere/ roots/ soil amendments/ soil conditioners/ soil types/ sustainability/ trace elements/ dietary standards/ food requirements/ Hyphomycetes/ microelements/ nutritional requirements/ phosphate fertilizers/ *Tricholoma imbricatum*/ *Tricholomataceae*

Abstract: Research in the last two decades indicated a possibility of using fly ash to amend agricultural soil for ramified root system, and also as source of micronutrients as well as some macronutrients such as Ca and phosphate. To take advantage of these inherent attributes of fly ash, it has been utilized for the higher productivity of banana (cv. Shrimanti), at lesser cost to be more remunerative to the farmers. To optimize the use of phosphate from fly ash and reduce dependence on imported phosphatic fertilizers, the use of phosphate solubilizing microbes was developed. Attempts have been made to screen the most efficient phosphate solubilizing microbes (tentatively identified as *Aspergillus* sp.) from the elite banana rhizosphere. Their nutritional requirements are optimized on two litre scale fermentation for farm scale trials. Besides optimizing sustained availability of solubilized phosphate, the application of mycorrhizas (*Tricholoma imbricatum*) has been explored to minimize the chances of entrance of toxic elements from fly ash (Cd, Hg, As, Pb and Cr) in the food chain. Thus, a natural waste has been explored to serve as a resource of nutrients through the catalytic roles of phosphate solubilizers and mycorrhizas in eco-friendly and sustainable manner.

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19. Application of coal ash to environmental improvement: Transformation into zeolite, potassium fertilizer, and fgd absorbent.

Kikuchi, Ryunosuke

Resources, Conservation and Recycling 27(4): 333-346. (1999)

NAL Call #: TP156.R38R47; ISSN: 0921-3449

Descriptors: Waste Management: Sanitation/ flue gas desulfurization: FGD, waste processing method/ Construction Industry/ Civil Construction Materials/ Coal: Energy Source/ Coal Reserves/ Economic Growth/ Population Growth/ Power Plants/ Recycling/ Soil Improvement/ Soil Retention/ Sustainable Development/ Wastewater Treatment

Abstract: The rapid increase in population and economic growth have led to an increase in energy demand. Coal reserves are distributed worldwide, and coal is now known to be the most stable and available energy source. However, utilization of coal as an energy source involves the generation of a great amount of coal ash, and the recycling rate of the ash is rather low. Coal ash is mainly used in civil construction materials, and there is a limit to the demand for coal ash by construction industries: therefore, the increasing amount of coal ash will be a serious problem in the near future. Different applications should be considered. In this paper, three environmentally-friendly methods for coal ash recycling are described. Firstly, alkali treatment can transform coal ash to zeolite, which is used in deodorant and for wastewater treatment and soil improvement. Secondly, potassium silicate fertilizer is produced from coal ash and has a higher retentivity in the soil than that of conventional fertilizers. Thirdly, emission of sulfur dioxide is controlled by flue gas desulfurization using coal ash. It is considered that environmentally-friendly use of coal ash is important from the viewpoints of energy, economy, and environmental strategy in order to realize the concept of sustainable development.

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20. Application of emerging tools and techniques for measuring carbon and microbial communities in reclaimed mine soils.

Palumbo, A. V.; Fisher, L. S.; Martin, M. Z.; Yang, Z. K.; Tarver, J. R.; Wulfschleger, S. D.; and Daniels, W. L. *Environmental Management* 33(Supplement 1): S518-S527. (2004); ISSN: 0364-152X

Descriptors: analytical methods/ carbon sequestration/ chemical composition/ degraded land/ DNA sequencing/ fly ash/ microbial flora/ mined land/ mineral content/ polymerase chain reaction/ reclaimed soils/ sewage sludge/ soil amendments/ soil composition/ soil fungi/ soil types/ species diversity/ spectroscopy/ analytical techniques/ microbial communities/ microflora/ mined sites/ nucleotide sequence analysis/ nucleotide sequencing/ PCR

Abstract: As part of a study of the potential for carbon sequestration in degraded mine lands, we examined the carbon content of reclaimed mine soils treated with soil amendments (e.g., fly ash and biosolids) using two emerging techniques; terminal restriction fragment- length polymorphism (TRFLP) and laser-induced breakdown spectroscopy (LIBS). Both of these techniques have potential use for measuring aspects of carbon content and its role in the soil ecosystem. To better understand the relationship between the microbial community and the amount of carbon within mine soils, we examined the diversity among fungal communities in soils with different carbon content using TRFLP. TRFLP was run on 18S rDNA from polymerase chain reaction (PCR) amplification using primers specific for fungi. Results from the TRFLP were compared to sequencing of 18S clones. The diversity based on sequence analysis was much higher than that indicated by the TRFLP-based analysis. Rarefaction

analysis of the data indicated that the total diversity was even higher than we were able to measure with both levels of effort; however, it was clear that we effectively sampled the dominant populations. The LIBS technique displayed a strong linear relationship when compared to conventional techniques (LECO and Walkley-Black) of measuring carbon in soils. In addition, discrepancies were noted between the two conventional techniques for soils with high carbon content.

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21. Application of fly ash in reclamation of wastelands through plantations and floriculture.

Alka Thapliyal and Anushree Malik
Floriculture, Ornamental and Plant Biotechnology: 288-297. (2006)

Descriptors: acid soils/ alkaline soils/ floriculture/ fly ash/ microbial flora/ organic amendments/ plantations/ reclamation/ sodic soils/ soil fertility/ soil types/ waste land/ waste management/ waste utilization/ microbial biomass/ microflora/ waste ground

Abstract: This article links two terms wastelands and fly ash, which sound distinct but have several common implications. In their present forms both are waste and a rather problematic one that could spread further if poorly managed. Their management itself is difficult and economically unfavorable. At the same time both could have great potential if utilized prudently. The present article emanates from the need to realize the veiled potential and to find out how fly ash and wasteland can complement each other for the benefit of Humanity and our environment. Consequently this article introduces and deals individually with wastelands and fly ash in the first two sections followed by a synergy (concept of joint or symbiotic management of wastelands and fly ash) in the subsequent section. Lab/field scale applications of fly ash in wasteland reclamation are summarized with special emphasis on the benefits of organic/microbial culture-amended fly ash. Prospects of floriculture on abandoned fly ash dumps are also discussed.

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22. Application of phosphorus sorbing materials to streamside cattle loafing areas.

Penn, C. J. and Bryant, R. B.
Journal of Soil and Water Conservation Ankeny 61(5): 303-310. (2006); ISSN: 0022-4561

Descriptors: aluminium sulfate/ dairy farms/ fly ash/ gypsum/ losses from soil/ phosphorus/ rain/ residues/ runoff/ silt loam soils/ simulation/ soil amendments/ sorption/ water quality/ water treatment/ aluminium sulphate/ aluminum sulfate/ losses from soil systems/ rainfall/ United States of America/ water composition and quality

Abstract: Excessive soil phosphorus (P) concentrations among cattle loafing areas located in close proximity to surface waters represent great potential for P transport. This study assessed the ability of several P sorbing materials in reducing P losses from streamside cattle loafing areas. Simulated rainfall was applied at seven (time 1) and 28 (time 2) days after P sorbing material applications to runoff plots on cattle loafing areas located at Amish farms. Treatments consisted of alum, water treatment

residuals, fly-ash, gypsum, and no amendment (control). Alum addition reduced time 1 runoff P concentrations the most followed by water treatment residuals - gypsum, then fly-ash. However, runoff P losses from P sorbing materials were not significantly different from the control at time 2. These results suggest that P sorbing materials alone provide only a temporary solution to P losses from cattle loafing areas and should be used with other best management practices.

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23. Arsenate displacement from fly ash in amended soils.

Qafoku, N. P.; Kukier, U.; Sumner, M. E.; Miller, W. P.; and Radcliffe, D. E.

Water, Air and Soil Pollution 114(1/2): 185-198. (1999)

NAL Call #: TD172 .W36; ISSN: 0049-6979

Descriptors: adsorption/ anions/ arsenic/ columns/ displacement/ environmental protection/ fly ash/ groundwater/ gypsum/ interactions/ leachates/ leaching/ particles/ phosphate/ phosphorus/ pollution/ soil/ sulfate/ treatment/ arsenate/ environmental pollution

Abstract: A study in repacked columns was conducted to determine whether or not As becomes mobile when $\text{Ca}(\text{H}_2\text{PO}_4)_2$ and CaSO_4 are used as leaching solutions, and to compare the competitive interactions between PO_4 - AsO_4 and SO_4 - AsO_4 . Arsenic concentration in leachate was approx. ten times greater when $\text{Ca}(\text{H}_2\text{PO}_4)_2$ was used to leach the columns as compared to CaSO_4 . A maximum concentration of 800 micro g As litre-1 was found in the leachate in this case, which is much higher than the groundwater limit of 50 micro g litre-1 for drinking water. In fly ash, the portion of arsenate non-specifically adsorbed is believed to be much lower than that of specifically adsorbed. Sulfate anions were able to displace only non-specifically adsorbed arsenate. In this case the concentration of As in leachate was within acceptable limits. On the other hand, phosphate can compete with arsenate for all available adsorption sites, non-specific and specific. Phosphate displacement of both forms of arsenates increases As mobility in both control and fly ash treatments.

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24. Arsenic accumulation by Chinese brake fern in amended coal fly ash.

Szuri, Sheena Powell; Guanira, Katia; Ma, Lena Q ; Allen, Marshall; Moos, Lawrence; and Cai, Yong.

In: 229th National Meeting of the American Chemical Society. Abstracts of Papers American Chemical Society, San Diego, CA.; Vol. 229 (Part 1).; pp. U841-U842; 2005. ISBN: 0065-7727

Descriptors: Toxicology/ Environmental Sciences/ Forestry/ Filices: Plants, Pteridophytes, Vascular Plants/ bioremediation: applied and field techniques/ phytoextraction: laboratory techniques/ Organic Matter/ Biomass/ Environment

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25. Arsenic and lead release from fly ash stabilized/solidified soils under modified semi-dynamic leaching conditions.

Moon, D. H. and Dermatas, D.

Journal of Hazardous Materials 141(2): 388-394. (2007)

NAL Call #: T55.3.H3J6; ISSN: 0304-3894

Descriptors: arsenic/ diffusion/ diffusivity/ fly ash/ leaching/ lead/ polluted soils/ soil pollution/ soil stabilization/ soil testing/ soil types/ solidification/ remediation

Abstract: A fly ash-based stabilization/solidification (S/S) technique was investigated using field soil samples contaminated with arsenic (As) and lead (Pb). A semi-dynamic leaching test was used to evaluate the effectiveness of the S/S treatment. By assessing the cumulative fractions of leached As and Pb, the effective diffusion coefficient (D_e) and a leachability index (LX) were measured and used for evaluating the effectiveness of the S/S treatment. Overall, As release was reduced by 98.3% and Pb release was reduced by 98.5% upon addition of 25% Class C fly ash. The mean D_e decreased significantly and the mean LX was always above 9 for all treated samples, indicating that the treated soils were acceptable for "controlled utilization". The mechanism controlling As leaching from all treated samples appeared to be a mixture of wash-off and diffusion. Diffusive As release was proportional to fly ash content. The mechanism controlling Pb leaching when samples were treated with 25% fly ash appeared to be wash-off.

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26. Arsenic and nickel enrichment coefficients for crops growing on coal ash .

Zgorelec, Zeljka; Basic, Ferdo; Kisic, Ivica; Wenzel, Walter W; and Custovic, Hamid

Cereal Research Communications 36(Suppl. S, Part 2): 1219-1222. (2008); ISSN: 0133-3720

Descriptors: field crops/ coal ash/ transport/ accumulation/ arsenic/ nickel

Abstract: Around the city of Tuzla, BiH soil covered coal ash disposal sites have been used for food and fodder production since 1992. To our knowledge this is the first report on the cultivation of coal ash disposal sites for agriculture purposes. We observed high concentrations of As and Ni in alkaline coal ash. In this paper, we investigated arsenic and nickel transport and accumulation in barley and soybean grown on substrates made up of different soil and ash ratios. After three growth in the greenhouse we observed significant differences ($p < 0.05$) between the Ni enrichment coefficients of Dora cultivar of soybean and Rex cultivar of barley, but no significant difference between the As enrichment coefficients of soybean and barley. Dora cultivar of soybean and Rex cultivar of barley showed very low uptake of arsenic, the enrichment coefficient varied between 0.05% and 0.51% depending on the crop and the treatment. The nickel enrichment coefficient of Rex cultivar of barley varied between 0.01% and 0.94%. The enrichment coefficient for Ni in Dora cultivar of soybean indicated higher uptake and varied between 5.64%, and 34.79%.

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27. Arsenic and selenium speciation in aged flue gas desulfurization amended soil.

Punshon, Tracy; Jackson, Brian P.; Seaman, John C.; Adriano, Domy C.; and Burger, Joanna.
In: Seventh International Conference on the Biogeochemistry of Trace Elements. Uppsala, Sweden.) Sajwan, Kenneth S.; Twardowska, Irena; Punshon, Tracy; and Alva, Ashok K. (eds.)

New York, NY, United States : Springer Science+ Business Media, Inc.; 2006.

Notes: References: 30; illus. incl. 2 tables.

Descriptors: arsenic/ bioavailability/ coal/ combustion/ concentration/ desulfurization/ gases/ ICP mass spectra/ mass spectra/ metals/ nutrients/ pesticides/ Plantae/ pollutants/ pollution/ sedimentary rocks/ selenium/ soils/ solid waste/ speciation/ spectra/ vegetation/ waste disposal/ environmental geology

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28. Arsenic, boron, selenium, and molybdenum displacement and transport in a fly ash amended soil leached with calcium phosphate solution.

Qafoku, N. P.; Dudka, S.; Sumner, M. E.; and Miller, W. P. *Communications in Soil Science and Plant Analysis* 32(9-10): 1499-1512. (2001)

NAL Call #: S590.C63; ISSN: 0010-3624 [CSOSA2]

Descriptors: arsenic/ boron/ selenium/ molybdenum/ leaching/ solutions/ monocalcium phosphate/ fly ash/ topsoil/ Ultisols/ phosphorus/ application rate/ displacement

Abstract: Substantial amounts of arsenic (As), selenium (Se), molybdenum (Mo), and boron (B) can be added with fly ash (FA) in FA amended soils. Leaching of these potential contaminants and the effect of soil solution anion composition on their retention and displacement is not well documented in the literature. The objective was to compare the interactions between phosphorus (P) in the leaching solution and As, B, Se, and Mo on FA surfaces and to estimate the mobility of As, B, Se, and Mo in a FA amended Cecil topsoil (Ultisol). Two FAs, A (216 mg As kg⁻¹) and B (51 mg As kg⁻¹), were used. Each ash was mixed with soil at the equivalent rates of 2 and 41 kg As ha⁻¹. These mixtures were used to pack the columns, which were leached with 1.66 mmol(c) calcium phosphate [Ca(H₂PO₄)₂] L⁻¹ solution. The results show that the concentrations of As, B, Mo, and Se in the leachate and their total amounts removed from the surface horizon (0-20 cm) of a FA amended soil depend on the initial contents of these elements in FA and the rate of FA application. As appears much faster and in higher concentrations in the leachate of treatments that received the highest As rate. The maximum As concentration and the total As amount released in the leachate, were much higher in the low As FA (B) than in the high As FA (A). The low As ash, therefore, seems to be more hazardous than the high As ash when both applied in rates to yield 41 kg As ha⁻¹. The differences observed between treatments in As, B, Mo, and Se mobility are also due to the ratio soil/FA in different treatments. Because under acid conditions some variable charge minerals in the soil and FAs develop positive charge and anion exchange capacity, larger amounts of As, B, Mo, and Se may be retained and their movement through the soil column may be retarded. This could be another reason why lower amount of As, B, Mo, and Se were released in the A (acid FA) than the B treatments (alkaline FA). This citation is from AGRICOLA.

29. Assessing organic amendments used by sugarcane growers for improving soil chemical and biological properties.

Antwerpen, R. van; Haynes, R. J.; Meyer, J. H.; and Hlanze, D.

Proceedings of the Annual Congress South African Sugar Technologists' Association 77(293-304)(2003); ISSN: 1028-3781

Descriptors: cattle manure/ filter cake/ fly ash/ green manures/ organic amendments/ pine bark/ poultry manure/ soil amendments/ soil biology/ soil chemical properties/ sugarcane/ sugarcane trash/ chemical properties of soil/ clarification mud/ microbial biomass/ poultry litter

Abstract: Sugarcane has been produced as a sole crop for at least 30 years in the Midlands area of KwaZulu-Natal and for more than 75 years on the coast. On poor soils, a yield decline or plateau has been observed, despite the release of new sugarcane varieties with increased yield potential. Soil surveys conducted in the sugar industry have shown a steady deterioration of soil chemical, physical and biological properties as the period under sugarcane cultivation has increased. Proactive growers have used a range of organic amendments to improve and sustain soil quality, including filtercake, fly ash, pine bark, cane trash, poultry and cattle manures, and the incorporation of a fallow crop (green manuring). A survey conducted in 2001 to determine the efficacy of these amendments, in particular on the biological properties of soils, found that filtercake and green manuring had the greatest effect on improved soil biological properties, as indicated by microbial biomass carbon and metabolic quotient. Reproduced with permission from the CAB Abstracts database.

30. Assessing the feasibility of land application of fly ash, sewage sludge and their mixtures.

Sajwan, K. S.; Paramasivam, S.; Alva, A. K.; Adriano, D. C.; and Hooda, P. S.

Advances in Environmental Research 8(1): 77-91. (2003); ISSN: 1093-0191.

Notes: DOI: 10.1016/S1093-0191(02)00137-5.

Descriptors: absorption/ feasibility studies/ fly ash/ fly ash/ land disposal/ land application/ leachates/ leaching/ metals/ migration/ plants/ sewage sludge/ sludge disposal/ soil/ waste disposal/ wastewater disposal

Abstract: Land disposal of fly ash (FA) and sewage sludge (SS) is a major problem due largely to their potentially harmful constituents. Combined use of FA and SS however may help reduce the associated pollution potential. In this paper we summarize the results of several case studies designed to assess the feasibility of land application of FA with and without SS. A wide range of application rates was tested under laboratory, greenhouse and field conditions. The leaching of metals from soil columns amended with moderate rates of FA applications (8-16 Mg ha super⁻¹) generally had no significant impact on the metal content of leachate or their downward migration in the soil. The application of FA or SS at a much high rate (74.1 Mg ha super⁻¹) significantly increased both leaching and downward migration of metals. The use of 1:1 FA+SS mixture at 148.2 Mg ha super⁻¹ reduced metal leaching compared to the combined metal quantities leached when FA or SS applied at 74.1 Mg ha super⁻¹. The results

indicate that combined use of FA and SS at a rational rate of application should not cause any significant effect on drainage water quality. Plant studies conducted using FA and SS mixtures indicated that these materials could be beneficial for biomass production, without contributing significant metal uptake or leaching. The application of FA as high as 560 Mg ha super(-1) in a long-term field trial had no detectable deterioration in soil or groundwater quality and no substantial increases in plant uptake of metals and other trace elements were observed. Low to moderate rates of FA and SS therefore could be successfully used as soil amendments, particularly so when used as a mixture. Abstract reproduced from the Water Resources Abstracts database with permission from ProQuest LLC. © 2007 ProQuest LLC; all rights reserved. Further reproduction is prohibited without permission.

31. Assessing trace element uptake by vegetation on a coal fly ash landfill.

Woodbury, P. B.; Rubin, G.; McCune, D. C.; Weinstein, L. H.; and Neuhauser, E. F.

Water, Air and Soil Pollution 111(1/4): 271-286. (1999)

NAL Call #: TD172 .W36; ISSN: 0049-6979

Descriptors: analytical methods/ assessment/ boron/ contamination/ fly ash/ landfills/ molybdenum/ risk assessment/ selenium/ shoots/ soil pollution/ trace elements/ uptake/ vegetation types/ waste disposal/ analytical techniques/ microelements/ Mo/ United States of America

Abstract: Vegetation was collected from two sites on a soil-capped coal fly ash landfill in New York State, USA, during June of 1991 and June and August of 1992 in order to develop methods and assess the risks posed by the uptake of potentially toxic elements such as Se, B, and Mo by vegetation on contaminated sites. The mean concentrations (micro g/g dry weight) of Se and Mo in the shoots did not exceed, respectively, 0.12 and 18.7 in bird's-foot trefoil (*Lotus corniculatus*), 0.06 and 12.1 in red clover (*Trifolium pratense*), 0.07 and 5.3 in timothy grass (*Phleum pratense*), and 0.09 and 2.2 in a mixture of grasses. These concentrations were greater than those in the same species harvested concurrently from a non-landfill site. The mean concentrations of B at the landfill ranged from 29-53 micro g/g in the legumes and from 2-11 micro g/g in the grasses, less than those at one non-landfill site but greater than those at another. Within the landfill, the concentration of Se in grasses was not correlated with the concentration of Se in soil and fly ash. The concentration of Se in grasses on both landfill sites was double that of grasses on the non-landfill site despite higher mean concentrations of Se in the upper soil (0-15 cm) on the non-landfill site. Grass roots appeared to be accessing Se from the ash by means of mass flow or other mechanisms. It is suggested that contemporaneous transect sampling of at least two species be used to assess the uptake of potentially toxic trace elements on landfills or other sites where contamination may occur.

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32. Assessment of polychlorinated dibenzo-p-dioxins and dibenzofurans contribution from different media to surrounding duck farms.

Lee, W. J.; Shih, S. I.; Li, H. W.; Lin, L. F.; Yu, K. M.; Lu, K.; Wang, L. C.; Chang-Chien, G. P.; Fang, K.; and Lin, M. *Journal of Hazardous Material* 163(2-3): 1185-1193. (Apr. 2009)

NAL Call #: T55.3.H3J6; ISSN: 0304-3894

Descriptors: ducks/ dibenzofurans/ dioxins/ China

Abstract: Since the "Toxic Egg Event" broke out in central Taiwan, the possible sources of the high content of polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs) in eggs have been a serious concern. In this study, the PCDD/F contents in different media (feed, soil and ambient air) were measured. Evaluation of the impact from electric arc furnace dust treatment plant (abbreviated as EAFDT plant), which is site-specific to the "Toxic Egg Event", on the duck total-PCDD/F daily intake was conducted by both Industrial Source Complex Short Term model (ISCST) and dry and wet deposition models. After different scenario simulations, the worst case was at farm A and at 200g feed and 5g soil for duck intake, and the highest PCDD/F contributions from the feed, original soil and stack flue gas were 44.92, 47.81, and 6.58%, respectively. Considering different uncertainty factors, such as the flow rate variation of stack flue gas and errors from modelling and measurement, the PCDD/F contribution fraction from the stack flue gas of EAFDT plant may increase up to twice as that for the worst case (6.58%) and become 13.2%, which was still much lower than that from the total contribution fraction (86.8%) of both feed and original soil. Fly ashes contained purposely in duck feed by the farmers was a potential major source for the duck daily intake. While the impact from EAFDT plant has been proven very minor, the PCDD/F content in the feed and soil, which was contaminated by illegal fly ash landfills, requires more attention.

This citation is from PubMed.

33. Assessment of soil disturbance using magnetic susceptibility and fly ash contents on a Mississippian mound in Illinois.

Olson, K. R.; Jones, R. L.; and Lang, J. M.

Soil Science 169(10): 737-744. (2004)

NAL Call #: 56.8 So3; ISSN: 0038-075X

Descriptors: alluvial soils/ archaeological material/ charcoal/ erosion/ fly ash/ horizons/ magnetic properties/ mounds/ organic matter/ palaeoecology/ Palaeosols/ radiocarbon dating/ soil formation / susceptibility/ tillage/ paleoecology/ paleosols/ soil cultivation/ soil genesis/ United States of America

Abstract: The Twenhafel Mound, a Middle Mississippian burial mound in Jackson County, Illinois, was most likely built between A.D. 500 and A.D. 900. The existence of the mound has been known since the French settled in the nearby town of Cahokia in 1699. Since the time of European settlement, the mound has not been legally protected from treasure hunters. The land was privately purchased and settled in the 1850s. Many similar and

adjacent mounds were excavated in a search for treasure or artifacts, leveled for farming, or hauled away. The primary objectives of this research are to determine the extent and time of mixing by excavation and/or tillage, the source of the mound materials, and the rate of diagnostic soil horizon formation. Fly ash was used as a time indicator. The depth of fly ash in the soil on the summit of the mound is consistent with the soil being tilled and mixed to a 40-cm depth. The sideslope of the mound has a similar significant depth of occurrence but has a higher amount of fly ash in the surface layer, suggesting that some tillage translocation and erosion of the summit soil has resulted in deposition on the sideslope. The soil developed in the alluvial fan adjacent to the mound has a similar texture and supports the theory that the mound was constructed from soil materials obtained from this alluvial fan rather than the theory that earth was carried from the adjacent bluffs formed in loess. Radiocarbon analysis of charcoal and organic matter found in the 80 to 130-cm layer suggests that 99% of the carbon is modern (<100 yrs old), which is consistent with the findings that trace amounts of fly ash in the layer were most likely moved into the layer by late historical human excavations and/or bioturbation. Reproduced with permission from the CAB Abstracts database.

34. Assessment of sugarcane crop applied with advanced engineering techniques using satellite remote sensing data.

Rao, V. V.; Rao, P. V. K.; and Venkataratnam, L.
In: Proceedings of the 61st Annual Convention of the Sugar Technologists' Association of India. New Delhi, India.; pp. a56-a64; 1999.

Descriptors: assessment/ composts/ fertilizers/ fly ash/ measurement/ monitoring/ remote sensing/ satellites/ sugarcane/ metrology/ surveillance systems

Abstract: In field studies in 1997-98 in Andhra Pradesh, sugarcane was remote sensed to analyse the effects of earth radiation nullifying diverters, bore well water diverters, oxygen diverters, sonic treatment, fly ash, biofertilisers and compost.

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35. Barley seedling growth in soils amended with fly ash or agricultural lime followed by acidification.

Renken, R. R.; McCallister, D. L.; Tarkalson, D. D.; Hergert, G. W.; and Marx, D. B.

Soil Science 171(5): 414-422. (2006)

NAL Call #: 56.8 So3; ISSN: 0038-075X

Descriptors: acid soils/ acidification/ aluminium/ application rates/ barley/ calcium/ Entisols/ exchangeable aluminium/ fly ash/ growth/ lime/ lime requirement/ liming materials/ Mollisols/ roots/ seedling growth/ seedlings/ shoots/ soil acidity/ soil amendments/ soil pH/ soil types/ aluminum/ exchangeable aluminum/ United States of America

Abstract: Calcium-rich coal combustion fly ash can be used as an amendment to neutralize soil acidity because of its oxides and carbonate content, but its aluminium content could inhibit plant growth if soil pH values fall below optimal agronomic levels. This study measured root and shoot growth of an acid-sensitive barley (*Hordeum vulgare* L. 'Kearney') grown in the greenhouse on three naturally acid soils. The soils were either untreated or amended with

various liming materials (dry fly ash, wet fly ash, and agricultural lime) at application rates of 0.5, 1, and 1.5 times the recommended lime requirement, then treated with dilute acid solutions to simulate management-induced acidification. Plant growth indexes were measured at 30 days after planting. Root mass per plant and root length per plant were greater for the limed treatments than in the acidified check (0.0 x rate). Root growth in the limed treatments did not differ from root growth in the original nonacidified soils. Top mass per plant in all limed soils was either larger than or not different from that in the original nonacidified soils. Based on top mass per plant, no liming material or application rate was clearly superior. Both fly ash and agricultural lime reduced the impact of subsequent acidification on young barley plants. Detrimental effects of aluminium release on plant growth were not observed. Calcium-rich fly ash at agronomic rates is an acceptable acid-neutralizing material with no apparent negative effects. Reproduced with permission from the CAB Abstracts database.

36. Beneficial land application uses of FGD products.

Dick, W. A.; Kost, D. A.; and Chen, L.

In: 23rd Annual International Pittsburgh Coal Conference, PCC - Coal-Energy, Environment and Sustainable Development. Pittsburgh, PA.; 2006. ISBN: 1890977233; 9781890977238

Descriptors: byproducts/ combustion/ concentration (process)/ fossil fuels/ sulfur/ sulfur dioxide/ energy production/ flue gas desulfurization (FGD) technologies/ flue gases

Abstract: Combustion of fossil fuels for energy production releases sulfur dioxide (SO₂) at a rate proportional to the S concentration in the fuel. Industrialized nations have adopted flue gas desulfurization (FGD) technologies to reduce SO₂ emissions. FGD technologies will generate increased amounts of product in the future as more utilities install scrubbers for SO₂ control. These FGD products raise economic and environmental issues for which satisfactory solutions still need to be found. The type of coal and desulfurization process used influences the chemical composition and properties of an FGD product. The properties of the FGD material have a direct impact on potential land application uses. FGD properties most commonly captured for beneficial purposes are (1) ability to neutralize acid, (2) high amounts of soluble calcium and sulfate, (3) source of plant nutrients, and (4) uniform particle size. Land application uses of FGD materials are identified by matching the properties of the FGD material with improvement in some ecosystem function (or functions). For beneficial use, the change in ecosystem function is assumed to be positive. FGD use must be considered in terms of recommended application rates, environmental impact and economic return. Beneficial land application implies the applied FGD material will improve the soil (primarily) and also the total environment. Often, the intended benefit relates to plant growth, but there may be other benefits to soil or water such as reduction of erosion, improved quality of runoff and/or leachate water, or improved internal drainage. The application rate must be sufficient to cause soil improvement, but not so great as to constitute disposal of the FGD material. Although there is recognition of the potential of using FGD materials in agriculture, there is also uncertainty whether this use is sustainable. Currently, there is a general lack of

acceptance in the agricultural community for using FGD materials. This barrier can only be overcome by research and sound knowledge that sometimes already exists in the scientific and technical literature. To promote use of FGD products, especially FGD gypsum, a national network of agricultural demonstration and research sites has been established. Network sites, strategically located in the United States, are available to producers, users and marketers of FGD products to provide places where observations can be made as to the benefits of FGD product use under regional agricultural conditions. In addition, data on crop yields, environmental impacts and economic benefits will aid in the marketing of the FGD products.

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37. Beneficial uses of clean coal combustion by-products; soil amendment and coal refuse treatment examples and case studies.

Dick, Warren A.; Chen, Liming; and Hao, Yueli.

In: Use and disposal of coal combustion by-products at coal mines: A technical interactive forum. Morgantown, WV, United States.) Vories, Kimery C. and Throgmorton, Dianne (eds.); 2000.

Notes: References: 35; illus. incl. 5 tables.

Descriptors: agriculture/ ash/ case studies/ characterization/ coal/ coal combustion byproducts/ coal mines/ combustion/ geochemistry/ land use/ mines/ nutrients/ pH/ sedimentary rocks/ soil treatment/ sulfates/ United States/ utilization/ waste disposal/ waste management/ Environmental geology

© American Geological Institute

38. Beneficial uses of flue gas desulfurization by-products: Examples and case studies of land application.

Dick, W. A.; Hao YueLi; Stehouwer, R. C.; Bigham, J. M.; Wolfe, W. E.; Adriano, D.; Beeghly, J. H.; and Haefner, R. J.

In: Land Application of Agricultural, Industrial, and Municipal By-Products/ Power, J. F; Dick, W. A.; Kashmanian, R. M.; Sims, J. T.; Wright, R. J.; Dawson, M. D.; and Bezdicek, D.; Series: Soil Science Society of America 6.

Madison, USA: Soil Science Society of America Inc. 2000; pp. 505-536.

Descriptors: application to land/ fly ash/ industrial wastes/ power stations/ scrubber sludge/ waste gases/ waste management/ waste utilization/ coal ash/ land application

Abstract: The properties of coal combustion wastes and their impacts on land application uses are summarized. Case studies of flue gas desulfurization waste use in agriculture, reclamation of coal-mined land and mining wastes, and as an engineering or construction material are also discussed.

Reproduced with permission from the CAB Abstracts database.

39. Benefits and constraints for use of FGD products on agricultural land.

Clark, R. B.; Ritchey, K. D.; and Baligar, V. C. 80(6): 821-828. (2001); ISSN: 00162361 [FUELA].

Notes: doi: 10.1016/S0016-2361(00)00162-9.

Descriptors: Agglomeration/ Aluminum/ Boron/ Coal combustion/ Compaction/ Desulfurization/ Flue gases/

Phosphorus/ Soil pollution/ Sulfur compounds/ Toxicity/ Trace elements/ Sulfite/ Coal byproducts

Abstract: Considerable amounts of coal combustion products (CCPs) are generated when coal is burned for generation of electricity. To meet Clean Air standards, large amounts of S must not be emitted into the atmosphere, which means considerable amounts of flue gas desulfurization products (FGDs) are and will be produced. Beneficial uses of FGDs are continually being sought to reduce waste, decrease cost of disposal, and provide value-added products. Beneficial agricultural uses of FGDs include application as amendment to acidic soil to mitigate low pH problems (Al and Mn toxicities); provide plant nutrients (i.e. Ca, S, and Mg); improve soil physical properties (e.g. water infiltration and soil aggregation); help alleviate soil compaction and improve aggregate stability of sodic soils; and inactivate P under high P-soil conditions to reduce P runoff. Co-utilization of FGDs with organic materials (manures, composts, biosolids) should also provide many benefits when used on land. Constraints for use of FGDs on agricultural land could be both insufficient or excessive amounts of CaCO₃, CaO, and/or Ca(OH)₂ in raising soil pH insufficiently or too much; excessive Ca to cause imbalanced Mg, P, and K in soils/plants; Ca displacement of Al from soil exchange sites to induce Al toxicity in plants; high B to induce B toxicity in plants; excessive sulfite which is toxic to plants; and excessive amounts of undesirable trace elements (e.g. As, Cd, Cr, Ni, Pb, and Se) which could potentially contaminate water and pose toxicity to plants/animals/microorganisms. Most constraints should not impose problems for FGD use on land.

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40. Bermudagrass sod growth and metal uptake in coal combustion by-product-amended media.

Schlossberg, M. J.; Vanags, C. P.; and Miller, W. P. *Journal of Environmental Quality* 33(2): 740-748. (2004) NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: application to land/ byproducts/ fly ash/ lawns and turf/ soil chemical properties/ soil physical properties/ uptake/ Bermuda grass/ chemical properties of soil/ Cynodon transvaalensis/ land application/ lawns and sports turf/ physical properties of soil/ United States of America

Abstract: Coal combustion by-products (CCB) include fly ash and bottom ash and are generated nationally at rates of 108 Mg yr⁻¹. Land applications of CCB have improved physicochemical properties of soil, yet inherent bulkiness and trace metal content of CCB often limit their use.

Likewise, utilization of biosolids and manure as fertilizer can be problematic due to unfavorable nutrient ratios. A 2-yr field study evaluated environmental and technical parameters associated with CCB-organic waste utilization as growth media in turfgrass sod production. Experimental growth media formulated with CCB and organic waste and a sand-compost control mixture were uniformly spread at rates from 200 to 400 m³ ha⁻¹ and sprigged with hybrid bermudagrass [*Cynodon dactylon* (L.) Pers. x *C. transvaalensis* Burt-Davy]. Leaf clippings were collected and analysed for total elemental content each year. In Year 2, growth media samples were collected during establishment 47 and 84 days after planting (DAP) and viable *Escherichia coli* organisms were quantified. At harvest (99 or 114 DAP), sod biomass and physicochemical properties of the growth media were

measured. During sod propagation, micronutrient and metal content in leaf clippings varied by growth media and time. After 47 d of typical sod field management, viable *E. coli* pathogens were detected in only one biosolids-amended plot. No viable *E. coli* were measured at 84 DAP. In both years, sod biomass was greatest in media containing biosolids and fly ash. Following installation of sod, evaluations did not reveal differences by media type or application volume. Using CCB-organic waste mixes at the rates described herein is a rapid and environmentally safe method of bermudagrass sod production. Reproduced with permission from the CAB Abstracts database.

41. Bio-efficacy of flyash-based herbal pesticides against pests of rice and vegetables.

Sankari, S. A. and Narayanasamy, P.
Current Science 92(6): 811-816. (2007); ISSN: 0011-3891
Descriptors: aubergines/ botanical insecticides/ fly ash/ insect pests/ neem seed extract/ non wood forest products/ okras/ plant extracts/ plant pests/ rice/ turmeric/ vegetables/ brinjal / eggplants/ minor forest products/ neem/ non timber forest products/ paddy/ vegetable crops
Abstract: The bio-efficacy of fly ash (FA)-based herbal pesticides on certain insect groups is reported. The eight FA-based herbal pesticides showed efficacy in thwarting various groups of pests infesting rice and vegetables, thus indicating them to be potential biopesticides. Among all the treatments, FA+10% turmeric dust and FA+10% neem seed kernel dust showed the highest efficacy against all the test insects, including *Epilachna vigintioctopunctata* on aubergine and *Spodoptera litura* on okra, followed by the FA+10% *Vitex negundo* dust and FA+10% *Eucalyptus globulus* dust and FA+10% *Ocimum sanctum* [*Ocimum tenuiflorum*] dust treatments. Reproduced with permission from the CAB Abstracts database.

42. Biochemical parameters and bacterial species richness in soils contaminated by sludge-borne metals and remediated with inorganic soil amendments.

Mench, M.; Renella, G.; Gelsomino, A.; Landi, L.; and Nannipieri, P.
Environmental Pollution 144(1): 24-31. (2006)
NAL Call #: QH545.A1E52; ISSN: 0269-7491
Descriptors: acid phosphatase/ alkaline phosphatase/ arylsulfatase/ beta glucosidase/ biological activity in soil/ cadmium/ enzyme activity/ fly ash / heavy metals/ hydrolases/ iron/ microbial flora/ nickel/ polluted soils/ pollution control/ proteinases/ soil amendments/ soil bacteria/ soil enzymes/ soil flora/ soil pollution/ soil types/ sorption/ species richness/ urease/ acid phosphomonoesterase/ alkaline phosphomonoesterase/ arylsulphatase/ beringite/ microbial biomass/ microbial communities/ microflora/ proteases/ remediation/ soil respiration
Abstract: The effectiveness of two amendments for the in situ remediation of a Cd- and Ni-contaminated soil in the Louis Fargue long-term field experiment was assessed. In April 1995, one replicate plot (S1) was amended with 5% w/w of beringite (B), a coal fly ash (treatment S1+B), and a second plot with 1% w/w zerovalent-Fe iron grit (SS) (treatment S1+SS), with the aim of increasing metal sorption and attenuating metal impacts. Long-term responses of daily respiration rates, microbial biomass,

bacterial species richness and the activities of key soil enzymes (acid and alkaline phosphatase, arylsulfatase, beta -glucosidase, urease and protease activities) were studied in relation to soil metal extractability. Seven years after initial amendments, the labile fractions of Cd and Ni in both the S1+B and S1+SS soils were reduced to various extents depending on the metal and fractions considered. The soil microbial biomass and respiration rate were not affected by metal contamination and amendments in the S1+B and S1+SS soils, whereas the activity of different soil enzymes was restored. The SS treatment was more effective in reducing labile pools of Cd and Ni and led to a greater recovery of soil enzyme activities than the B treatment. Bacterial species richness in the S1 soil did not alter with either treatment. It was concluded that monitoring of the composition and activity of the soil microbial community is important in evaluating the effectiveness of soil remediation practices. Reproduced with permission from the CAB Abstracts database.

43. Biochemical responses of *Cassia siamea* Lamk grown on coal combustion residue (fly ash).

Kumar, A.; Vajpayee, P.; Ali, M. B.; Tripathi, R. D.; Singh, N.; Rai, U. N.; and Singh, S. N.
Bulletin of Environmental Contamination and Toxicology 68(5): 675-683. (2002)
NAL Call #: RA1270.P35A1; ISSN: 0007-4861
Descriptors: animal manures/ cattle dung/ cattle manure/ cysteine/ enzyme activity/ enzymes/ fly ash/ heavy metals/ lipid peroxidation/ nitrate reductase/ phytotoxicity/ reclamation/ soil amendments/ superoxide dismutase/ thiols/ *Cassia siamea*/ mercaptans
Abstract: Experiments were conducted using *Cassia siamea* plants grown on fly ash (FA), FA+garden soil (GS), FA+cow dung manure (CM), and FA+press mud (PM) in 1:1 ratio to determine the effect of heavy metal accumulation on cysteine, non-protein thiol contents, lipid peroxidation (measured in terms of malondialdehyde (MDA) content), superoxide dismutase (SOD) (antioxidant enzyme) and nitrate reductase activities. Heavy metal uptake by *C. siamea* plants induced lipid peroxidation in leaves after 20 days exposure to raw FA and FA-amended by soil, CM and PM in 1:1 ratio. Maximum MDA content as observed in plants grown in FA. Stimulation of SOD activity was observed in plants grown in raw FA and all the 3 types of amendments. However, this antioxidant enzyme was most active in plants grown in FA+PM amendment. An increase in cysteine content of plants grown in raw FA, FA+GS, FA+CM and FA+PM was observed. However, it was maximum in leaves of plants grown on FA+PM for 20 days while its minimum concentration was recorded when plants were grown in GS for the same duration. Maximum increase in non-protein thiol content was recorded when plants were grown in FA-amended by PM for 20 days while minimum non-protein thiol content was observed when plants were grown in raw FA for 60 days. Nitrate reductase activity (NRA) was also found affected by toxicity of FA. Maximum inhibition in NRA was recorded in plants grown for 60 days in raw FA. However, it was minimum when plants were growing in FA-amended GS in 1:1 ratio. The highest concentration of each heavy metal (Cu, Zn, Fe and Ni) was recorded in plants grown in FA-amended with PM. It is concluded that *C. siamea* is a highly suitable species for plantation on FA landfills as it thrives well and has metal

detoxification potential. Among the different FA amendments, PM was found to be the most suitable amendment for amelioration of FA.
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44. Biomass yield and phosphorus availability to wheat grown on high phosphorus soils amended with phosphate inactivating residues. III. Fluidized bed coal combustion ash.

Codling, E. E.; Mulchi, C. L.; and Chaney, R. L.
Communications in Soil Science and Plant Analysis 33(7-8): 1085-1103. (2002)
NAL Call #: S590.C63; ISSN: 0010-3624 [CSOSA2]
Descriptors: coal/ soil amendments/ Triticum aestivum/ dry matter accumulation/ crop yield/ phosphorus/ nutrient availability/ soil fertility/ nutrient content/ manganese/ poultry manure/ fluidized bed wastes
Abstract: The high phosphorus (P) soils in the poultry producing areas of Maryland's Eastern Shore pose an environmental risk to surface and ground water. Amendments with calcium (Ca) salts and calcium-rich byproducts have been considered in management practices for reducing P solubility in soil solution. A growth chamber experiment was conducted using fluidized bed coal ash (BA) at increasing rates on Matapeake, Evesboro, and Woodstown soils that had received poultry litter for over 30 years which increased Mehlich 3-phosphorus (M3-P) to levels above 800 mg kg⁻¹. The objectives of the study were to 1) determine the effects of BA on plant dry biomass yield (BM), wheat tissue P and Mn levels, and 2) examine pH, extractable P and Mn concentrations in the BA treated soils following three cropping cycles. BA was incorporated into each soil at rates of 0, 10, 25, and 50 g kg⁻¹ soil followed by incubation for seven weeks. Three crops of "Grandin" wheat (*Triticum aestivum* L.) were grown in succession. Biomass yield (BM) was significantly reduced with BA additions for the three soils. Plant P concentrations were progressively lowered with increased rates of BA for all BA additions for all three soils. Plant Mn levels were substantially reduced with additions of BA in response to the large increase in pH for all soils. Soil pH values increased from 5.0 +/- 0.2 in the control soils to >10.2 at the 50 g kg⁻¹ rate, and decreased during cropping cycles. Both water soluble P (WSP) and M3-P concentrations were significantly decreased upon addition of BA in all soils. Although WSP concentrations showed higher correlations with plant P concentration than M3-P levels, in terms of P sequestration in soils, WSP amounts were reduced by an average of 27 mg kg⁻¹ and 33 mg kg⁻¹ at addition of 10 g kg⁻¹ and 50 g kg⁻¹ while M3-P quantities were reduced by approximately 130 mg kg⁻¹ and 500 mg kg⁻¹, respectively, when averaged over soil and cycles. The large increase in soil pH, which reduced P in wheat at the 10 g kg⁻¹ BA, would suggest that this material may not be suitable for field application to sequester P in high P soils. This citation is from AGRICOLA.

45. Boron accumulation by maize grown in acidic soil amended with coal combustion products.

Clark, R. B.; Zeto, S. K.; Ritchey, K. D.; and Baligar, V. C.
78(2): 179-185. (1999); ISSN: 00162361 [FUELA]
Descriptors: plant dry matter/ shoot boron concentrations/ soil pH and electrical conductivity/ acidity/ boron/ carbonates/ crops/ cultivation/ electric conductivity of solids/

fluidized bed combustion/ fly ash/ lime/ plants (botany)/ soils/ toxicity/ acidic soil/ coal combustion products (CCP)/ plant dry matter / coal combustion

Abstract: Coal combustion products (CCPs) have potential for use as soil amendments on acidic soils. One concern for plants grown on acidic soils amended with CCPs is boron (B) toxicity, since many CCPs contain considerable B. Maize (*Zea mays* L.) was grown (greenhouse) on acidic soil [Umbric Dystrochept, pH 3.9 (1 soil:1 10 mM CaCl₂)] amended with 15 CCPs [two fly ashes (FAs), three fluidized bed combustion products (FBCs), one calcium (Ca) oxide (CaO) material, six high Ca sulfite (CaSO₃) flue gas desulfurization products (FGDs), and three high Ca sulfate (CaSO₄) FGDs] at different levels to determine accumulation of B in shoots. Plants were also grown in soil amended with Ca carbonate (CaCO₃, lime) and chemical grade CaSO₄ and CaSO₃ as controls. Among the CCPs tested, FAs contained the highest B levels. Shoot B concentrations were as high as 500 mg kg⁻¹ without reductions in dry matter (DM) for plants grown on soil amended with one FA. Plants grown with one FBC had sufficient B to suspect potential B toxicity, and plant DM was greatly reduced or died when grown with 0.5% of this material. Relatively high shoot B concentrations were noted in plants grown with the highest levels of high CaSO₃ FGDs. High shoot B concentrations (~300 mg kg⁻¹) were noted for plants grown with 5% levels of one high CaSO₄ FGD, and DM declined after reaching these levels. Plants grown on soil amended with CaO had low shoot B. Some of the CCPs used in this study contained sufficient B to potentially induce B toxicity in plants grown on the acidic soil amended with the various CCPs. Maize growth was generally enhanced when grown on soil amended with the CCPs at appropriate levels. _ 1998 Elsevier Science Ltd. © 2009 Elsevier B.V. All rights reserved.

46. Calcium co-amendments modify extractable orthophosphate levels in fresh and composted cattle manure.

Whalen, J. K.
Water, Air and Soil Pollution 141(1-4): 105-124. (Nov. 2002)
NAL Call #: TD172 .W36; ISSN: 0049-6979 [WAPLAC]
Descriptors: cattle manure/ composts/ land application/ soil fertility/ nutrient availability/ phosphorus/ calcium oxide/ calcium hydroxide/ fly ash/ nutrient uptake/ *Hordeum vulgare*/ barley/ sandy loam soils/ nutrient content/ crop yield/ seeds/ barley straw/ nitrogen/ soil pH/ phosphates/ cement dust/ lime/ Internet resource
This citation is from AGRICOLA.

47. CBR and DCP correlation for Class C fly ash-stabilized soil.

Misra, A.; Upadhyaya, S.; Horn, C.; Kondagari, S.; and Gustin, F.
Geotechnical Testing Journal 29(1): 30-36. (2006); ISSN: 0149-6115
Descriptors: bearing characteristics/ clay soils/ fly ash/ penetrometers/ soil stabilization/ soil types/ bearing capacity
Abstract: The dynamic cone penetrometer (DCP) test is being increasingly used for assessing the California bearing ratio (CBR) values of sub-grade soil in the field. The purpose of this laboratory investigation was to establish a correlation between CBR and DCP for soils stabilized with

Class C fly ash. In this laboratory study, natural soil (Type CL-lean clay) mixed with Class C fly ash was used to establish the correlation at different percentages of Class C fly ash and moisture. It was found that a good correlation exists between CBR and DCP for Class C fly ash-stabilized soils and that the correlations are similar to those developed by other researchers. The correlations developed here may be used for rapid field determination of CBR values of clay soils stabilized with Class C fly ash. Reproduced with permission from the CAB Abstracts database.

48. Changes in amino acid profile and metal content in seeds of *Cicer arietinum* L. (chickpea) grown under various fly-ash amendments .

Gupta, D. K.; Tripathi, R. D.; Rai, U. N.; Dwivedi, S.; Mishra, S.; Srivastava, S.; and Inouhe, M.
Chemosphere 65(6): 939-945. (Nov. 2006)
NAL Call #: TD172 .C54; ISSN: 0045-6535.

Notes: [Erratum: 2007 Jan, v 66, issue 7, p 1382].

Descriptors: *Cicer arietinum*/ chickpeas/ plant proteins/ amino acid composition/ protein content/ chemical concentration/ bioaccumulation/ iron/ copper/ zinc/ cadmium/ chromium/ metals/ fly ash/ sawdust/ soil amendments/ press mud

This citation is from AGRICOLA.

49. Changes in physical and chemical properties of three soil types in India as a result of amendment with fly ash and sewage sludge.

Veeresh, H.; Tripathy, S.; Chaudhuri, D.; Ghosh, B. C.; Hart, B. R.; and Powell, M. A.

Environmental Geology 43(5): 513-520. (Feb. 2003)

NAL Call #: QE1.E5; ISSN: 1073-9106 [ENGOE9]

Descriptors: agricultural soils/ Oxisols/ Alfisols/ Vertisols/ soil amendments/ physicochemical properties/ India

Abstract: The use of coal fly ash and domestic sewage sludge in agriculture is being considered as one of the methods for recycling of these wastes in an environmental beneficial manner. Mixtures with soil were prepared at different proportions of fly ash and sludge, either alone or in combination at a maximum application rate of 52 t ha⁻¹. The changes in the selected properties and heavy metal contents of three soil types in India were studied after incubating the respective mixtures for 90 days at near field capacity moisture level. Sewage sludge, due to its acidic and saline nature, high organic matter and heavy metals content, had more impact on soil properties than the fly ash. Sludge application produced several changes including an increase in available nitrogen, organic carbon, salinity and water-holding capacity of the soils. The concentrations of major cations and heavy metals also increased because of the sludge application and the pH was decreased. However, the levels of individual metal concentrations in all the mixture types were below the allowable limits prescribed by several environmental agencies. Using fly ash either alone or in equal quantity with sewage sludge had little influence on soil properties and heavy metal content. The relative availability (RA) of heavy metals in three soils amended with 52 t ha⁻¹ of sewage sludge was observed to be highest in oxisol, followed by alfisol and vertisol.

This citation is from AGRICOLA.

50. Changes in the properties of sandy soil fertilized with different doses of ashes from "Dolna Odra" power station .

Meller, E.

Folia Universitatis Agriculturae Stetinensis, Agricultura 78: 189-201. (1999).

Notes: Original title: Zmiany we wasciwosciach gleby piaszczystej nawozonej zroznicowanymi dawkami popioow z elektrowni "Dolna Odra".

Descriptors: application rates/ biological activity in soil/ cadmium/ cobalt/ fertilizers/ fly ash/ magnesium/ phosphorus/ physical properties/ power stations/ properties/ sandy soils/ soil/ soil properties/ soil resources/ soil texture/ trace elements/ zinc/ microelements

Abstract: The effect of applications of 15, 30, 60 and 120 t fly ash/ha on physical, chemical and biological soil properties was studied on a sandy soil in a one-factor field experiment in Poland. The results show that the applied amounts of fly ash did not significantly affect the soil texture and other physical properties. There was no positive influence of ashes on biological activity in the arable-humic soil horizon (Ap) either. Ash fertilization contributed to clear but short soil deacidification. The soil resources, mainly of available magnesium and phosphorus, also improved. Although the concentration of some trace elements (Zn, Co, Cd) increased, their content was always lower than the permissible amount for agricultural soils.

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51. Characteristics of ash (coal, wood and rice hull) and its potential use as an additive in poultry manure for protecting the environment.

Nahm, K. H.

Korean Journal of Poultry Science 33(1): 65-80. (2006); ISSN: 1225-6625

Descriptors: acidity/ agricultural soils/ alkalinity/ biomass/ coal/ fly ash/ odour abatement/ organic carbon/ pH/ phosphorus/ poultry manure/ reviews/ rice husks/ silica/ soil amendments/ soil types/ solubility/ wood ash/ hydrogen ion concentration/ odor abatement/ potential of hydrogen/ poultry litter/ rice hulls

Abstract: This review focuses on the literature published about ash characteristics and their environmental uses. There is no uniform physico-chemical definition of the selected ashes (coal fly ash-CFA, wood ash-WA, and rice hull ash-RHA) used in various studies. These ashes vary greatly in their acidity (pH< 6.0) or alkalinity (pH>12.5) based on the conditions at which they were farmed and the composition of the ash source. CFA amendment to manure reduced manure-P solubility and application of CFA amended manure to agricultural soils is a method to improve water quality WA may prove to be a valuable manure odour control amendment since it contains a high level of carbon. A major biomass source is rice hull (husk) which provides an ash source (RHA). The rice hull and RHA are sources of silica, comprising approximately 20 and 60%, respectively. So far research has been directed at the use of CFA, WA and RHA as soil amendments, but there is potential use of these materials as manure additives to sequester P and reduce odors.

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52. Characteristics of boron accumulation by fly ash application in paddy soil.

Lee SeulBi; Lee YongBok; Lee ChangHoon; Hong ChangOh; Kim PilJoo; and Yu Chan

Bioresource Technology 99(13): 5928-5932. (2008)

NAL Call #: TD930.A32 ; ISSN: 0960-8524

Descriptors: boron/ fly ash/ leaves/ paddy soils/ phytotoxicity/ rice / rice soils/ silicates/ soil amendments/ soil types/ paddy/ South Korea

Abstract: Fly ash has a high content of plant available silicate which is strongly needed for rice cultivation in Korea. One concern for plants grown on soils amended with fly ash is boron (B) toxicity because most of the fresh fly ash contains considerable B. This study was conducted in paddy soil to determine B uptake by rice and characteristics of B accumulation in soil after fly ash application (0, 40, 80, and 120 Mg fly ash ha⁻¹). In all fly ash treatments, B content in rice leaves and available B in soil at all growing stage were higher than those of control, but were not exceeded a toxicity levels. Boron occluded in amorphous Fe and Al oxides comprised ca. 20-39% of total B and was not affected by fly ash application. Most of the B was accumulated by fly ash application as a residual B which is plant-unavailable form, comprised >60% of the total B in soil. Thus, fly ash can be a good soil amendment for rice production without B toxicity.

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53. Characteristics of synthetic soil aggregates produced by mixing acidic "Kunigami Mahji" soil with coal fly ash and their utilization as a medium for crop growth.

Jayasinghe, G. Y.; Tokashiki, Y.; and Kitou, M.

Soil Science and Plant Nutrition 54(2): 264-276. (2008)

NAL Call #: 56.8 SO38 ; ISSN: 0038-0768

Descriptors: acid soils/ aggregates/ bulk density/ cation exchange capacity/ coal/ crop yield/ electrical conductivity/ exchangeable cations/ fly ash/ growing media/ growth/ particle density/ saturated hydraulic conductivity/ soil chemical properties/ soil pH/ soil physical properties/ soil types/ soyabeans/ starch/ Ultisols/ waste paper/ waste utilization/ water holding capacity/ Capparales/ chemical properties of soil/ physical properties of soil/ potting composts/ rooting media/ soybeans

Abstract: This study was carried out to examine the characteristics and potential utilization of synthetic soil aggregates (SSA) produced by mixing acidic "Kunigami Mahji" soil in Okinawa, Japan, with waste materials, such as coal fly ash, used paper and starch, as media for crop growth. A series of different SSA were produced by incorporating various percentages (i.e. 0, 20, 40, 60, 80 and 100%) of coal fly ash into the "Kunigami Mahji" soil with used paper and starch. The particle density and bulk density of the original "Kunigami Mahji" soil were 2.67 and 1.23 g cm⁻³, respectively. The increased percentages of added coal fly ash, used paper and starch significantly decreased the particle and bulk densities of SSA compared with the original "Kunigami Mahji" soil because of the low particle and bulk densities of the coal fly ash (2.10 and 0.96 g cm⁻³, respectively). The SSA particle density varied between 2.39 and 2.14 g cm⁻³, and bulk density varied between 0.72 and 0.81 g cm⁻³, depending on the additional percentages of coal ash from

20-100%. Maximum water-holding capacity and saturated hydraulic conductivity were increased with the formation of SSA with coal fly ash, used paper and starch binder compared with the original "Kunigami Mahji" soil. The saturated hydraulic conductivity values of the SSA increased because of their low bulk density compared with the original soil. The addition of coal fly ash, used paper and starch to the acidic (pH=4.62) "Kunigami Mahji" soil to form SSA increased the pH (6.70-9.96), electrical conductivity, exchangeable cation concentration and cation exchange capacity. The addition of coal fly ash up to 60% increased the aggregate strength. The growth and yield of komatsuna and soybean crops with SSA as a crop growth medium was assessed. Both crops showed the highest growth and yield when grown with SSA containing 20% of coal fly ash. Synthetic soil aggregates containing more than 20% of coal fly ash reduced plant growth and yield. Therefore, SSA produced from "Kunigami Mahji" soil with 20% of coal fly ash, used paper and starch can be successfully used as a medium for crop growth. Reproduced with permission from the CAB Abstracts database.

54. Characterization of different coal fly ashes for their application in the synthesis of Zeolite X as cation exchanger for soil remediation.

Terzano, R.; Spagnuolo, M.; Medici, L.; Tateo, F.; and Ruggiero, P.

Fresenius Environmental Bulletin 14(4): 263-267. (2005);

ISSN: 1018-4619

Descriptors: arsenic/ cadmium/ cation exchange/ chemical composition/ chromium/ copper/ fly ash/ heavy metals/ lead/ nonclay minerals/ polluted soils/ soil amendments/ soil pollution/ soil types/ toxic substances/ trace elements/ X ray diffraction/ zeolites/ zinc/ microelements/ poisons/ remediation

Abstract: Four different coal fly ashes have been characterized for their potential application in the synthesis of Zeolite X for its use as cation exchanger for the remediation of heavy metal-polluted soils. Their chemical composition, with particular attention to the concentration of trace elements potentially toxic for the environment, has been determined by total dissolution and ICP-OES analysis. The relative amount of Zeolite X synthesized after 4 days of incubation at 60 degrees C starting from fly ash and the possible synthesis of other minerals has been investigated by means of X-ray diffraction. The fly ashes have been evaluated by their morphology (SEM analysis), granulometry (laser granulometry) and loss on ignition (LOI). Moreover, the fraction of potentially toxic elements, such as As, Cd, Cr, Cu, Pb and Zn, which can be released in solution during the synthetic process, has been quantified. Among the coal fly ash varieties analysed, one resulted to possess suitable properties for the synthesis of environmentally applicable Zeolite X, since it showed higher yield, no byproducts, lower mean particle size (useful for a quicker dissolution of the ash), and very low concentrations of potentially toxic elements. Finally, this coal fly ash has been fully characterized with regards to its chemical composition (major and minor constituents) by total dissolution and ICP-OES analysis, but also X-ray fluorescence of its fused powder.

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55. Characterization of thermal power station fly ash with relevant to plant nutrients availability.

Sanjay Bhojar

Annals of Plant Physiology 16(1): 29-35. (2002); ISSN: 0970-9924

Descriptors: calcium oxide/ cation exchange capacity/ chemical composition/ copper/ electrical conductivity / fly ash/ iron/ magnesium oxide/ manganese/ moisture content/ nitrogen/ nutrient availability/ particle density/ pH/ phosphate/ power stations/ soil amendments/ solubility/ zinc/ hydrogen ion concentration/ Mn/ potential of hydrogen

Abstract: This study was conducted to characterize the composition of fly ash from thermal power station in Korada District, Nagpur, Madhya Pradesh, India, to identify the available nutrients. The results showed that fly ash was near neutral in reaction (pH 7.5), free from soluble salts with EC 0.21 dSm-1, low in organic carbon content (0.32%) and very poor CEC (0.44 cmol (P+)/kg). Air dried fly ash showed insignificant moisture content (0.38%) and negligible water solubility (0.26%). Fly ash was found to have substantially maximum water holding capacity (37.71%) with particle density 1.40 g/cm³. Very low content of total N (0.056%) and P₂O₅ (0.087%) was observed, and the total K₂O (0.172%), CaO (1.6%) and MgO (0.96%) content were significant. Total micronutrient content was substantial and the availability of Fe, Zn, Mn and Cu was 3.81, 1.30, 3.98 and 3.60 ppm, respectively. Based on the characteristics of fly ash, it can be used as soil amendment to increase surface area and porosity of soil, and effectively act as cheap source of plant nutrients especially of micronutrients.

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56. Chemical and physical properties of dry flue gas desulfurization products.

Kost, D.; Bigham, J. M.; Stehouwer, R. C.; Beeghly, J. H.; Fowler, R.; Traina, S. J.; Wolfe, W. E.; and Dick, W. A. *Journal of Environmental Quality* 34(2): 676-686. (Mar. 2005-Apr. 2005)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: air pollution/ contaminants/ industrial byproducts/ coal/ fly ash/ chemical residues/ chemical analysis/ physicochemical properties/ dioxins/ sulfur dioxide/ soil amendments/ processing technology/ particle size distribution/ leachates

Abstract: Beneficial and environmentally safe recycling of flue gas desulfurization (FGD) products requires detailed knowledge of their chemical and physical properties. We analyzed 59 dry FGD samples collected from 13 locations representing four major FGD scrubbing technologies. The chemistry of all samples was dominated by Ca, S, Al, Fe, and Si and strong preferential partitioning into the acid insoluble residue (i.e., coal ash residue) was observed for Al, Ba, Be, Cr, Fe, Li, K, Pb, Si, and V. Sulfur, Ca, and Mg occurred primarily in water- or acid-soluble forms associated with the sorbents or scrubber reaction products. Deionized water leachates (American Society for Testing and Materials [ASTM] method) and dilute acetic acid leachates (toxicity characteristic leaching procedure [TCLP] method) had mean pH values of >11.2 and high mean concentrations of S (primarily as SO₄(2-)) and Ca.

Concentrations of Ag, As, Ba, Cd, Cr, Hg, Pb, and Se (except for ASTM Se in two samples) were below drinking water standards in both ASTM and TCLP leachates. Total toxicity equivalents (TEQ) of dioxins, for two FGD products used for mine reclamation, were 0.48 and 0.53 ng kg⁻¹. This was similar to the background level of the mine spoil (0.57 ng kg⁻¹). The FGD materials were mostly uniform in particle size. Specific surface area (m² g⁻¹) was related to particle size and varied from 1.3 for bed ash to 9.5 for spray dryer material. Many of the chemical and physical properties of these FGD samples were associated with the quality of the coal rather than the combustion and SO₂ scrubbing processes used.

This citation is from AGRICOLA.

57. Chemical characteristics and heavy metal solubility of fly ash remediation systems under clayey soil conditions.

Sagoe-Crentsil, K. K.

In: Challenges posed by urban and industrial contaminants; Contaminated site remediation conference. Fremantle, West. Aust., Australia.) Johnston, C. D. (eds.) Wembley, West Aust., Australia (AUS): CSIRO Land and Water, Centre for Groundwater Studies; 1999.

Notes: References: 7; illus. incl. 1 table.

Descriptors: ash/ base metals/ cement/ Clay soils/ Eh/ hydrochemistry/ metal ores/ pH/ pollution/ reclamation/ soils/ waste treatment/ Environmental geology

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58. Chemical characteristics of an acid sulphate soil from Kerala amended with lime and flyash.

Ramesh, V. and Chhonkar, P. K.

Journal of the Indian Society of Soil Science 49(4): 719-726. (2001)

NAL Call #: 56.9 IN2; ISSN: 0019-638X

Descriptors: acid sulfate soils/ calcium/ cation exchange capacity/ exchangeable calcium/ fly ash/ iron/ lettuce/ lime/ liming/ nutrient availability/ residual effects/ rice/ soil chemical properties / soil pH/ soil types/ zinc/ acid sulphate soils/ chemical properties of soil/ paddy/ thionic soils

Abstract: Effect of fly ash and lime applications on some chemical characteristics of Sulfaquept (kari) growing rice and its residual effect under lettuce crop was studied. Fly ash did not increase pH, EC and exchangeable calcium content of the soil under both the crops. The effect of liming as well as its interaction with fly ash was significant with respect to these parameters. The available sulfur content of the soil was increased with fly ash but declined with lime application. However, the residual effect of lime alone resulted in increased sulfur content. Fly ash application significantly increased the available iron and zinc content of soil while lime reduced both of them. However, fly ash amended soils under lettuce did not affect available zinc content while liming decreased it. Fly ash application increased the exchangeable aluminium content of the soil under both crops while the effect of lime was not noticeable. The residual fly ash and lime tended to reduce available cadmium.

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59. Chemical characterization of ash from gasification of alfalfa stems: Implications for ash management.

Mozaffari, M.; Rosen, C. J.; Russelle, M. P.; and Nater, E. A.

Journal of Environmental Quality 29(3): 963-972. (2000)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: aromatic hydrocarbons/ arsenic/ ash/ cadmium/ calcium/ carbon/ chemical composition/ chlorine/ cobalt/ crop residues/ electric power/ fly ash/ gasification/ lead/ lucerne/ naphthalene/ polycyclic hydrocarbons/ potassium/ selenium/ soil amendments/ waste management/ waste utilization/ alfalfa

Abstract: Electricity generation from biomass is an attractive option from an environmental perspective. Pilot studies have indicated that lucerne (*Medicago sativa*) stems are suitable feedstock for energy generation via gasification. Detailed information on chemical characteristics of the ash generated from gasification of lucerne stem is required to develop environmentally and economically sound ash management strategies. Lucerne fly and bottom ashes were characterized with respect to chemical properties that are important in developing ash management practices with emphasis on beneficial utilization as a soil amendment. Mean concentrations of total C, K, Ca, and Cl were 424, 120, 85, and 26 g kg⁻¹, respectively, in fly ash. In bottom ash, the mean concentrations of C, K, and Ca, were 63, 61, and 193 g kg⁻¹. Concentrations of total Pb, As, Cd, Co, and Se were below detection limits in both ash types. Naphthalene ranged from 6.2 to 74 mg kg⁻¹, but concentrations of many other polycyclic aromatic hydrocarbons were low or below mg kg⁻¹ detection limits. Available K and P in fly ash were 90 to 120 and 8 to 10 g kg⁻¹, respectively. Mean CaCO₃ equivalent value of fly ash was 400 g kg⁻¹, its electrical conductivity (EC) and pH were 127 dS m⁻¹ and 11.5, respectively. These results suggest that when managed properly, gasified lucerne ash could potentially be utilized as a beneficial soil amendment with few potential environmental concerns.

Reproduced with permission from the CAB Abstracts database.

60. Chemical characterization of synthetic soil from composting coal combustion and pharmaceutical by-products.

Guest, C. A.; Johnston, C. T.; King, J. J.; Alleman, J. E.; Tishmack, J. K.; and Norton, L. D.

Journal of Environmental Quality 30(1): 246-253. (2001)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: byproducts/ chemical composition/ coal/ composting/ fly ash/ growing media/ organic wastes/ sewage sludge/ potting composts/ rooting media

Abstract: Land application of coal combustion byproducts (CCBs) mixed with solid organic wastes (SOWs), such as municipal sewage sludge, has become increasingly popular as a means of productively using what were once considered waste products. Although bulk chemical and physical properties of several of these CCB-SOW materials have been reported, detailed information about their synthesis and mineralogy of the CCB-SOW materials has not been reported. In this paper, chemical and mineralogical properties of a soil-like material obtained from composting a mixture of CCBs with a pharmaceutical fermentation byproduct (FB) were investigated at the laboratory and field scale. All starting materials and

products were characterized by X-ray diffraction (XRD), fourier transform infrared (FTIR) spectroscopy, and elemental analyses. The results showed that the FB was strongly bound to the CCBs and could not be removed by washing. Within 2 weeks of the start of a composting study, there was a rapid drop in pH from 12 to 8, an increase in temperature to 70 degrees C, and a reduction in the dissolved oxygen content, attributed to the rapid establishment of a highly active microbial population. Composting produced a soil-like material with high levels of plant nutrients, a high nutrient retention capacity, and metal contents similar to median levels of those metals reported for soils. The levels of boron and soluble salts are such that sensitive plants may initially show toxicity symptoms. However, with adequate rainfall, leaching should rapidly remove most of the B and soluble salts. With care, the material produced is safe for use as a synthetic topsoil. Reproduced with permission from the CAB Abstracts database.

61. Chemical composition of leachate of dairy manure mixed with fluidized bed combustion residue.

Elrashidi, M. A.; Baligar, V. C.; Korcak, R. F.; Persaud, N.; and Ritchey, K. D.

Journal of Environmental Quality 28(4): 1243-1251. (Aug. 1999)

NAL Call #: QH540.J6; ISSN: 0047-2425.

Notes: References: 41; illus. incl. 2 tables.

Descriptors: agricultural waste/ aluminum/ animal waste/ boron / cadmium/ chlorine/ chromium/ copper/ fluidized bed combustion residue/ halogens/ heavy metals/ iron/ leachate/ lead/ manganese/ metals/ nickel/ pollutants/ pollution/ soils/ sulfur/ waste disposal/ water quality/ zinc/ environmental geology

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62. Chemical evaluation of nutrient supply from fly ash-biosolids mixtures.

Schumann, A. W. and Sumner, M. E.

Soil Science Society of America Journal 64(1): 419-426. (Jan. 2000-Feb. 2000)

NAL Call #: 56.9 So3; ISSN: 0361-5995 [SSSJD4]

Descriptors: organic fertilizers/ fertilizer analysis/ fly ash/ sewage sludge/ poultry manure/ mixtures/ nutrient availability/ extraction/ dris

Abstract: Prediction of plant nutrient supply from fly ash and biosolids (sewage sludge and poultry manure) may enhance their agricultural use as crop fertilizer. Two mild extraction methods (42-d equilibration with ion-exchange resins, 2-d equilibration with pH 4.8 buffered nutrient solution) and analysis of nutrient data by the Diagnosis and Recommendation Integrated System (DRIS) were tested with 29 fly ash samples, four biosolids samples, and their mixtures. The resin method was useful for major nutrient (N, P, K, Ca, Mg, S) extraction from fly ashes and organic materials, particularly where mineralizable fractions of N and P under aerobic conditions are required. However, resins were inefficient in extracting P from high-Fe sewage sludges because organic waste samples caused premature failure of semipermeable membranes and fouling of resins. Extraction of fly ash with dilute buffered nutrient solution was more successful because micro-nutrient recovery was improved, major nutrients were correlated to the resin method, both addition and removal of nutrients were recorded, DRIS analysis was possible, and equilibration

was rapid (2 d). The overall nutrient supply from these extremely variable fly ashes was: Cu = Fe approximately equal to B approximately equal to Mo > Ca > S > Zn > > Mn > N > Mg > P > K (high micronutrient, low major nutrient supply). For biosolids, the major nutrients ranked: P N approximately equal to Ca > S > Mg > K (sewage sludges), and N > Ca approximately equal to K > P > Mg > S (poultry manures). In mixtures of fly ash with 26% sewage sludge the order was: Ca > S > N > Mg > P > K, while in mixtures of fly ash and 13% poultry manure, the nutrients ranked: Ca > K approximately equal to N approximately equal to S > Mg > P. Optimal plant nutrition (especially N-P-K balancing) should be possible by mixing these three waste materials. This citation is from AGRICOLA.

63. Chemical properties of lateritic soil and yield of rice as influenced by addition of fly ash.

Subramoniam, S. R. and Chandrasekaran, A.
International Rice Research Notes 30(1): 35-37. (2005)
NAL Call #: SB191.R5I6; ISSN: 0117-4185

Descriptors: acid soils/ application rates/ calcium/ cation exchange capacity/ coir/ crop yield/ electrical conductivity/ exchangeable calcium/ exchangeable magnesium/ fly ash/ iron/ irrigated conditions/ lateritic soils/ lime/ liming/ magnesium/ nitrogen/ nutrient availability/ nutrient content/ organic carbon/ phosphorus/ potassium/ red soils/ rice/ rice husks/ rice soils/ soil chemical properties/ soil organic matter/ soil pH/ soil types/ waste utilization/ zinc/ chemical properties of soil/ coconut fibre/ Madras/ organic matter in soil/ paddy/ red earths/ rice hulls

Abstract: A field experiment was conducted to assess the use of fly ash, coir pith and rice husk ash in improving the lateritic soils of Kanyakumari District in Tamil Nadu, India under irrigated rice cultivation. Different combinations of fly ash (10 and 15 tonnes/ha) with different doses of lime, rice risk ash (12.5 tonnes/ha), raw coir pith (12.5 tonnes/ha), and coir pith compost (12 tonnes/ha). Grain yield was maximum in the treatment with 15 tonnes fly ash/ha and 12 tonnes lime/ha. Application of fly ash, lime and other industrial wastes had a positive effect on grain and straw yield. The pH, electrical conductivity and cation exchange capacity of the red lateritic acid soil increased with fly ash addition. Organic carbon content increased from 0.22-0.36% due to the organic compounds released from coir pith compost. Available NPK and exchangeable Ca and Mg likewise increased with fly ash application. Exchangeable Ca and Mg content was maximized with the application of fly ash with lime, but available Fe content of the soil decreased. Zn content of the soil was not affected. Fly ash contained a negligible amount of Fe but the lime addition decreased Fe availability in the soil. Reproduced with permission from the CAB Abstracts database.

64. Chemical speciation and phytoavailability of Zn, Cu, Ni and Cd in soil amended with fly ash-stabilized sewage sludge.

Su, D. C. and Wong, J. W.
Environment International 29(7): 895-900. (Jan. 2004)
NAL Call #: TD169 .E54; ISSN: 0160-4120
Descriptors: Biodegradation, Environmental/ Biological Availability/ Carbon: chemistry/ Coal/ Environmental Monitoring/ Industrial Waste/ Metals, Heavy: chemistry: pharmacokinetics/ Particulate Matter/ Refuse Disposal: methods/ Sewage: chemistry/ Zea mays: chemistry: growth

& development

Abstract: A sequential extraction method was used to determine chemical forms of Cu, Zn, Ni and Cd in fly ash-stabilized sludge. A loamy acid soil amended with fly ash-stabilized sludge was used to grow corn under greenhouse conditions. Sewage sludge amended with coal fly ash can reduce the availability of Cu, Zn, Ni and Cd in the sludge. Increasing fly ash amendment rate significantly reduced DTPA-extractable Cu, Zn, Ni and Cd concentrations. Percentages of Cu, Zn and Ni in residual fraction increased with an increase in fly ash amendment rates. Majority of Cu was associated with organic form, but Zn and Ni were associated with Fe-Mn oxide and residual forms. Addition of ash-amended sludge to soil significantly increased dry mass of corn. With coal fly ash amendment rate increasing, concentrations of Zn and Cu in shoot tissues of corn decreased significantly, but concentrations of Cd and Ni did not change significantly. Significant correlations were found between concentrations of Cu and Zn in corn shoot and oxide and total Cu fractions, and all chemical fractions of Zn in fly ash-stabilized sludge, respectively. Hence, ash amendment significantly reduced the availability of heavy metals by chemical modification of their chemical speciation into less available forms.

This citation is from PubMed.

65. Chlorophyll production in Acacia nilotica seedlings grown in flyash.

Kashyap, M. K.; Manjhi, R. B.; Avinash Jain; and Banerjee, S. K.
Indian Journal of Forestry 23(1): 41-45. (2000); ISSN: 0971-9431

Descriptors: chlorophyll/ chlorosis/ fly ash/ nitrogen phosphorus fertilizers/ nutrient deficiencies/ phosphorus fertilizers/ plant nutrition/ power stations/ sand/ seedlings/ superphosphate/ urea fertilizers/ phosphate fertilizers

Abstract: The chlorophyll content was studied of *Acacia nilotica* seedlings grown from seed on fly ash from the coal fired thermal power plant at Korba, Madhya Pradesh (India), mixed with sand, N (200 or 200 ppm N as urea) and P (25 ppm P as SSP [single superphosphate]) in different combinations. The chlorophyll content differed significantly the treatments at 1, 3 and 5 months old. The amount of chlorophyll A, chlorophyll B and total chlorophyll decreased gradually during the study period for all the treatments. The chlorotic nature of nutrient deficient plants was attributed to impaired photosynthesis resulting from the direct effect of the fly ash medium on the protein level and the chlorophyll content of the chloroplast. The best treatment for increasing the chlorophyll content of the leaves of *Acacia nilotica* was fly ash + sand + N(2000 ppm) + P (25 ppm). Reproduced with permission from the CAB Abstracts database.

66. Chromium leaching and immobilization in treated soils.

Dermatas, D. and Moon, D. H.
Environmental Engineering Science 23(1): 77-87. (2006)
NAL Call #: TD811.5.H39; ISSN: 1092-8758
Descriptors: chromium / clay minerals/ fly ash/ immobilization/ kaolinite/ leaching/ lime/ liming/ montmorillonite/ polluted soils/ quartz/ soil pollution/ soil types

Abstract: The purpose of this study is to investigate the effectiveness of a quicklime-based stabilization/solidification (s/s) technique to reduce the leachability of Cr(III) and Cr(VI) in laboratory-prepared soil. The soils were prepared by mixing kaolinite or montmorillonite with fine quartz sand and then subjecting the samples to s/s treatment. Treatment included quicklime, fly ash, and quicklime-fly ash additions. The effectiveness of the treatment was evaluated using the Toxicity Characteristic Leaching Procedure (TCLP) test. To elucidate the controlling Cr(VI) immobilization mechanisms, slurry mixtures were prepared with potassium chromate (K_2CrO_4), quicklime, and fly ash. X-ray diffraction (XRD) analyses were performed to investigate the reaction products responsible for Cr(VI) immobilization. Experimental results indicate very low Cr(III) leachability upon quicklime treatment. All samples treated with quicklime and quicklime-fly ash show TCLP Cr(III) concentrations below the U.S. EPA TCLP limit of 5 ppm. However, neither quicklime nor fly ash treatment alone was effective in reducing Cr(VI) leachability. An effective reduction in Cr(VI) leachability was achieved only when both quicklime and fly ash were added to the laboratory-prepared soils. Previous research has attributed this reduction in Cr(VI) leachability to the fly ash-induced chemical reduction of Cr(VI) to Cr(III). However, in this study, fly ash was found to be an ineffective reducing agent. XRD analyses results for quicklime-fly ash slurries do not indicate the formation of $CaCrO_4$ or $CaCrO_4 \cdot 2H_2O$, which were identified in previous research as the reaction products responsible for Cr(VI) immobilization. A hypothesis is presented in this paper to explain these results and the effectiveness of quicklime-fly ash mixtures in reducing the leachability of Cr(VI). XRD analyses have also identified the pozzolanic compound $3CaO \cdot Al_2O_3 \cdot 0.5CaCrO_4 \cdot 0.5CaSO_4 \cdot nH_2O$ as the precipitate most likely responsible for Cr(VI) immobilization. Reproduced with permission from the CAB Abstracts database.

67. Circulating fluidized bed combustion product addition to acid soil: Alfalfa (*Medicago sativa* L.) composition and environmental quality.

Chen, L.; Dick, W. A.; and Kost, D.

Journal of agricultural and food chemistry 54(13): 4758-65. (June 2006)

NAL Call #: 381 J8223 ; ISSN: 0021-8561

Descriptors: agrochemicals: chemistry/ calcium carbonate: chemistry/ chemistry, physical/ coke: analysis/ environment/ hydrogen ion concentration/ medicago sativa: chemistry/ soil: analysis/ sulfur: chemistry/ trace elements: analysis/ water: chemistry

Abstract: To reduce S emissions, petroleum coke with a high concentration of S was combusted with limestone in a circulating fluidized bed (CFB) boiler. The combustion process creates a bed product that has potential for agricultural uses. This CFB product is often alkaline and enriched in S and other essential plant nutrients, but also contains high concentrations of Ni and V. Agricultural land application of CFB product is encouraged, but little information is available related to plant responses and environmental impacts. CFB product and agricultural lime

(ag-lime) were applied at rates of 0, 0.5, 1.0, and 2.0 times the soil's lime requirement (LR) to an acidic soil (Wooster silt loam). The 2.0x LR application rate of CFB product was equivalent to 67.2 Mg ha⁻¹. Alfalfa yield was increased 4.6 times by CFB product and 3.8 times by ag-lime compared to untreated control. Application of CFB product increased the concentration of V in soil and alfalfa tissue, but not in soil water, and increased the concentration of Ni in soil and soil water, but not in alfalfa tissue. However, these concentrations did not reach levels that might cause environmental problems.

This citation is from PubMed.

68. Clean technology for bulk utilisation of coal ash in agriculture.

Saxena, M.; Murali, S.; Asokan, P.; Mishra, C. R.; and Pal, H. K.

In: REWAS'04 - Global Symposium on Recycling, Waste Treatment and Clean Technology. Gaballah I.; Mishra B.; Solozabal R.; and Tanaka M. (eds.)

Madrid; pp. 655-664; 2005. ISBN: 8495520044

Descriptors: Agriculture/ Crops/ Power plants/ Radioisotopes/ Soils/ Trace elements/ Captive Power Plant (CPP) / Clean technology/ National Aluminium Company Limited (CO)/ Regional Research Laboratory (RRL)/ Coal ash/ Agriculture/ Ash/ Coal/ Farm Crops/ Power Plants/ Radioisotopes/ Soil/ Trace Elements

Abstract: With the primary objective of development and demonstration of clean technology for bulk utilisation of Coal ash generated by Captive Power Plant (CPP) of National Aluminium Company Limited (NALCO), Angul, Orissa, India, studies on "Long term effect of Coal ash / Pond ash on agriculture system" have been carried out by Regional Research Laboratory (RRL), Bhopal, India. Characterization of Pond ash and soil for optimization of the dose for agriculture, have been carried out for physical and chemical properties as well as trace elements and radionuclides. Randomized Block Design experiments have been conducted on wasteland plots by admixing Pond ash at the rate of 10% (280 T ha⁻¹) and 20% (560 T ha⁻¹) in 1999. Maize (*Zea mays* L.) and paddy (*Oriza sativa* L.) in kharif and onion (*Allium cepa* L.) and sunflower (*Helianthus annuus* L.) crops in rabi seasons were raised on rotation basis in two separate experimental plots during 1999-2002. The effect of trace elements like Cu, Zn, Fe, Mn, Ni, Cr, Co, Cd etc present in the soil admixed with Pond ash application were tested. No adverse effect on the soil system has been observed. The radioactivity levels like ²²⁶Ra, ²²⁸Ac and ⁴⁰K in the ash admixed soil have been analysed. Due to the Pond ash admixing in soil, no toxicity symptoms have been noticed on the crop physiology during the crop growth stages. The presence of the above trace elements and radioactivity levels in the food (grains/seeds/bulbs) grown on the ash admixed plots are within the permissible limits. In addition, this clean technology of bulk utilisation of Pond ash in agriculture has been paying dividends to the farming community in the form of 20 - 25% increased crop yields due to the favourable soil modification and micro-nutrients like Cu, Zn, Fe, Mn and Co supplied by the Pond ash to the plants.

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69. CO₂ evolution and enzyme activities (dehydrogenase, protease and amylase) of fly ash amended soil in the presence and absence of earthworms (Drawida willsi Michaelsen) under laboratory conditions.

Pati, S S and Sahu, S K

Geoderma 118(3/4): 289-301. (2004)

NAL Call #: S590 .G4; ISSN: 0016-7061

Descriptors: amylases / biological activity in soil/ carbon dioxide/ enzyme activity/ fly ash/ microbial activities/ oxidoreductases/ proteinases/ respiration/ soil amendments/ soil enzymes/ Drawida willsi/ proteases/ redox enzymes

Abstract: The CO₂ evolution and dehydrogenase, protease and amylase activities of fly ash amended soil (Orissa, India) in the presence and absence of earthworms were investigated under laboratory conditions for 2 months at 50% water-holding capacity (WHC) and 25±2 degrees C temperature. A toxicity test of different age groups (juvenile, immature and adult) of *Drawida willsi* earthworms, dominant (>80% both in number and biomass) in crop fields of India, was conducted for 14 days at different concentrations of fly ash amended soil. On the basis of the results of the toxicity test, seven concentrations of fly ash amended soil were chosen (0, 2.5, 5, 10, 15, 25 and 50%; w/w) to study the CO₂ evolution and enzyme activities in the presence and absence of *D. willsi*. The results demonstrated little or no inhibition of soil respiration and enzyme activities up to 2.5% fly ash amendment. With further addition of fly ash, all the above activities were significantly decreased. On the other hand, significant stimulation of soil respiration and microbial activities were observed up to 5% fly ash amendment when the soils contained earthworms. This may be due to increased microbial activity induced by substrates that are produced by the earthworms. Co-application of fly ash and earthworms at lower doses can thus be considered to stimulate soil biological activity and thereby improve nutrient cycling in acidic soil.

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70. Coal combustion residues: Environmental implications and recycling potentials.

Asokan, P.; Saxena, M.; and Asolekar, S. R. 43(3): 239-262. (2005); ISSN: 09213449 [RCREE].

Notes: doi: 10.1016/j.resconrec.2004.06.003.

Descriptors: building materials/ characterisation/ coal combustion residues/ conservation/ disposal/ engineering applications/ recycling/ resources/ utilisation and safe-management/ calorific value/ coal ash/ electric power generation/ environmental impact/ fossil fuels/ substitution reactions/ ash ponds/ coal combustion residues (CCR)/ electric power requirement/ environmental sound management/ coal combustion/ asbestos/ cement/ coal/ concrete/ fossil fuel/ heavy metal/ lignite/ paint/ radioactive element/ sulfur/ coal-fired power plant/ electricity generation/ recycling/ waste management/ agriculture/ ash/ chemical composition/ chemical structure/ combustion/ construction work/ ecology/ electricity/ environmental factor/ environmental reclamation/ extraction/ India/ mineralogy/ mining/ physical chemistry/ pollution/ radioactivity/ recycling/ review/ solid waste/ waste management/ Asia/ Eastern Hemisphere/ Eurasia/ India/ South Asia/ World/ Fraxinus

Abstract: To meet the electric power requirement, the world population is greatly dependent on fossil fuel. Presently in India, about 75% of the total electrical energy (i.e. ~100,000 MW) is generated from fossil fuel and about 105 million tons of coal combustion residues (CCRs) as solid waste/by-product is being released annually during combustion of pulverised bituminous, sub bituminous, and lignite coal. Indian coal typically has ash content of 30-60%, which results in low calorific value however low in sulphur, radioactive elements and heavy metals content. Mostly, the CCRs is being disposed to the ash pond as thin slurry, and more than 65,000 acres of land is occupied in India for storage of this huge quantity of ash which leads ecological and environmental problems. Presently about 27% of the total CCRs produced in India is being recycled and used in various applications. The major utilisation is in cement, concrete, bricks, wood substitute products, soil stabilisation, road base/embankment, and consolidation of ground, land reclamation and for agriculture. In this paper, an attempt has been made to assess the global generation of CCRs, present utilisation and acceptability in Indian context, implications and future potentials to achieve environmental sound management. _ 2004 Elsevier B.V. All rights reserved.

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71. Coal fly ash and lime stabilized biosolids as an ameliorant for boron deficient acidic soils.

Jiang, R. F.; Yang, C. G.; Su, D. C.; and Wong, J. W. C.

Environmental Technology 20(6): 645-649. (1999)

NAL Call #: TD1.E59; ISSN: 0959-3330

Descriptors: acid soils/ application rates/ cucumbers/ fly ash/ lime/ loam soils/ maize/ plant tissues/ soil amendments/ soil types/ toxicity/ trace element deficiencies/ trace element fertilizers/ yields/ corn/ gherkins/ micronutrient fertilizers

Abstract: Previous studies have shown that a combination of coal fly ash (10% w/w) and lime (1% w/w) amendment was effective in stabilizing biosolids (ACS) by killing the pathogens and reducing heavy metal availability, and the product contained a high B content. The suitability of ACS as a B fertilizer for a degraded B deficient acid soil (from South China) was evaluated. An acid and B deficient loamy soil was amended with the ACS at application rates of 6.4, 12.7, 25.5, 63.7 and 127.4 mg/ha, which were then compared to the same soil receiving an equivalent B fertilizer application rates of 0.9, 1.4, 2.2, 4.5 and 8.4 kg/ha, respectively. Soil hot water soluble B content and pH increased significantly with an increase in the amendment rate of the ACS mixture. Soil amended with the ACS mixture had a significantly higher dry weight yield for both cucumber and maize than the control and its counterparts of soil with B fertilizer. The highest yield was obtained in the treatment with 5% ACS mixture amendment. Boron concentrations in plant tissues increased according to the application rates of the ACS mixture and B fertilizer. Cucumber was more sensitive than maize to both B deficiency and toxicity as indicated by the insignificant effect of B fertilizer application on dry weight yields of maize. The experimental results demonstrated that the ACS mixture at an application rate of ≤63.7 mg/ha could act as a B fertilizer supplement for the acid loamy soil. Reproduced with permission from the CAB Abstracts database.

72. Coal fly ash and phospho-gypsum mixture as an amendment to improve rice paddy soil fertility.

Lee, Y. B.; Ha, H. S.; Lee, C. H.; and Kim, P. J.
Communications in Soil Science and Plant Analysis 39(7-8): 1041-1055. (Apr. 2008)

NAL Call #: S590.C63; ISSN: 0010-3624

Descriptors: coal fly ash/ phospho-gypsum/ soil amendment/ rice paddy/ soil fertility

Abstract: Rice is a plant that requires high levels of silica (Si). As a silicate (SiO₂) source to rice, coal fly ash (hereafter, fly ash), which has an alkaline pH and high available silicate and boron (B) contents, was mixed with phosphor-gypsum (hereafter, gypsum, 50%, wt wt⁻¹), a by-product from the production of phosphate fertilizer, to improve the fly ash limitation. Field experiments were carried out to evaluate the effect of the mixture on soil properties and rice (*Oryza sativa*) productivity in silt loam (SiL) and loamy sand (LS) soils to which 0 (FG 0), 20 (FG 20), 40 (FG 40), and 60 (FG 60) Mg ha⁻¹ were added. The mixture increased the amount of available silicate and exchangeable calcium (Ca) contents in the soils and the uptake of silicate by rice plant. The mixture did not result in accumulation of heavy metals in soil and an excessive uptake of heavy metals by the rice grain. The available boron content in soil increased with the mixture application levels up to 1.42 mg kg⁻¹ following the application of 60 Mg ha⁻¹ but did not show toxicity. The mixture increased significantly rice yield and showed the highest yields following the addition of 30-40 Mg ha⁻¹ in two soils. It is concluded that the fly ash and gypsum mixture could be a good source of inorganic soil amendments to restore the soil nutrient balance in rice paddy soil.

This citation is from AGRICOLA.

73. Coal fly ash as a soil conditioner for field crops in southern Ontario.

Cline, J. A.; Bijl, M.; and Torrenueva, A.
Journal of Environmental Quality 29(6): 1982-1989. (2000)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: application rates/ boron/ crop yield/ field crops/ fly ash/ lime/ maize/ nutrients/ plant composition/ seedling emergence/ selenium/ soil/ soil conditioners/ soil pH/ soil types/ soybeans/ chemical constituents of plants/ corn/ soybeans

Abstract: Sixty-eight per cent of the 957 000 t of fly ash (FA) from coal-fired generating stations in Ontario, Canada, was landfilled in 1998. Current restrictions by government regulators prevent its use for agricultural purposes. Greenhouse and field experiments were therefore initiated to assess the effects of FA on plant growth. The objective of the greenhouse study was to evaluate various rates of FA (0-80 t ha⁻¹ equivalent) on soil pH, soil and plant nutrient levels, and plant growth using representative acidic clay and sandy soils from Southern Ontario. After 90 d of soil incubation, the highest rates of FA increased soil pH, but had no significant effect on hot-water extractable B. Dry weights of plants grown in the same soil types were unaffected by FA rates. In a 3-yr field study, FA was applied to acidic clay and sandy loam soils at rates ranging from 0 to 50 t ha⁻¹ (dry wt. basis). Lime control treatments were also included. In Year 1, maize plant emergence, grain yield, percentage moisture, and harvest index were not significantly influenced by FA applications. However, soybean yields treated with 50 t FA ha⁻¹ increased by as much as 35 and 31% in comparison with untreated and

lime control treatments, respectively. Selenium and boron, while presently the rate-limiting elements for maximum permissible loading rates of FA for soil amendments in the province, did not accumulate in plants in quantities that would be of concern for plant health or animal and human consumption.

Reproduced with permission from the CAB Abstracts database.

74. Coal fly ash as an acid-reducing soil amendment and its side effects.

McCallister, D. L.; Frank, K. D.; Stevens, W. B. ; Hergert, G. W.; Renken, R. R.; and Marx, D. B.

Soil Science 167(12): 811-820. (2002)

NAL Call #: 56.8 So3; ISSN: 0038-075X

Descriptors: acid soils/ acidification/ aluminium/ application rates/ chemical composition/ coal/ combustion/ fly ash/ lime/ lime requirement/ liming materials/ loam soils/ sandy loam soils/ soil acidity/ soil amendments/ soil pH/ soil toxicity/ soil types/ aluminum/ toxic soils

Abstract: Coal combustion by-products may offer significant benefits if used properly to neutralize soil acidity, but unintended release of trace components must be considered. A study was conducted with two objectives: (i) To compare the efficacy of two different preparations of fly ash with that of conventional ag lime for their ability to raise soil pH and reduce exchangeable Al; and (ii) to determine if the Al applied in fly ash produces detrimental changes in soil properties following subsequent acidification. Either fly ash in one of two forms, or conventional ag lime, was applied to three acid soils (Anselmo loam, Valentine sandy loam, and Holdrege sandy loam) in a pot study at rates equal to 0.5, 1.0, and 1.5 times the soils' lime requirements. Soils were equilibrated in triplicate at approximately 33 kPa water potential in the greenhouse for 315 days (liming phase), during which pH and exchangeable aluminium (Al) were measured. The soils were then acidified under similar conditions for 439 days (acidification phase) by adding dilute acid solution to simulate management-induced acidification, and pH and exchangeable Al were then measured again. Both fly ashes and ag lime were effective in raising soil pH by up to 1.2 units and in reducing exchangeable Al by up to 5.6 mg kg⁻¹. Two-way interactions involving soil, liming material, and rate of application produced different results for combinations of these factors. All amendments helped the soils resist subsequent acidification compared with zero-rate treatments but differed based on the 3-way combinations of soil, liming material, and rate of application. We concluded that overliming (as indicated by exceeding the target pH of 6.5) is a problem with all liming materials on the coarsest soils, suggesting that lime calibration should be re-examined. The fly ash materials seem to contribute to soil exchangeable Al after acidification, but this contribution is inconsequential if soil pH values are maintained at agronomic optima.

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75. Coal fly ash as an amendment to container substrate for *Spathiphyllum* production.

Chen, J. J. and Li, Y.

Bioresource Technology 97(15): 1920-1926. (2006)

NAL Call #: TD930.A32 ; ISSN: 0960-8524

Descriptors: arsenic/ cadmium/ calcium/ canopy/ chemical

composition/ chemical properties/ chromium/ coal/ copper/ dolomite/ electrical conductivity/ fly ash/ growing media/ iron/ lead/ leaves/ magnesium/ manganese/ mercury/ molybdenum / nickel/ nonclay minerals/ nutrient content/ ornamental plants/ pH/ phosphorus/ physical properties/ physicochemical properties/ plant composition/ plant diseases/ plant tissues/ potassium/ selenium/ shoot apices/ soil amendments/ substrates/ waste utilization/ weight/ zinc/ chemical constituents of plants/ dry weight/ hydrogen ion concentration/ leaf canopy/ Mn/ Mo/ ornamentals/ potential of hydrogen/ potting composts/ rooting media/ United States of America

Abstract: Coal fly ash, possessing alkalinity and containing some essential mineral elements, could be an alternative to lime amendment and a nutrient source of container substrates for ornamental plant growth. This study examined physicochemical properties of three fly ashes collected from Florida, Michigan, and North Carolina and container substrates formulated by incorporating commercial dolomite and the three fly ashes, respectively into a soilless basal substrate. The basal, dolomite- and fly ash-amended substrates were used to grow peace lily (*Spathiphyllum Schott 'Ty's Pride'*), a popular ornamental foliage plant, in 15-cm diameter containers in a shaded greenhouse. Electrical conductivities and pH of the substrates were monitored monthly. Plant canopy heights and widths, shoot fresh and dry weights were recorded five months after transplanting, and tissue nutrient contents were measured. Three fly ashes and the commercial dolomite were able to raise pH of the basal substrate from 3.8 to about 6.8. Canopy heights and widths as well as shoot fresh and dry weights of plants produced from fly ash-amended substrates were comparable to those produced from dolomite-amended substrate but significantly different from those produced from the basal substrate. On an average, five necrotic leaves appeared from plants produced in the basal substrate; however, less than one necrotic leaf occurred on plants produced in either dolomite- or fly ash-amended substrates. As a result, the quality grade of plants grown in the basal substrate was low, and plants were not marketable. Additionally, electrical conductivities of fly ash-amended substrates were consistently higher during the course of plant growth, suggesting that, in addition to neutralizing pH, the amended fly ashes provide nutrients for peace lily growth, which was confirmed by high nutrient contents in plant shoots. This study demonstrates that the three fly ashes can be alternatives to commercial dolomites used as amendments to soilless substrates for ornamental plant production. Utilization of fly ashes as container substrate amendments should represent a new market for the beneficial use of coal combustion byproducts.

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76. Coal fly ash as modifier of physico-chemical and biological properties of soil.

Yeledhalli, N. A.; Prakash, S. S.; Gurumurthy, S. B.; and Ravi, M. V.

Karnataka Journal of Agricultural Sciences 20(3): 531-534. (2007)

NAL Call #: S471.I42K37; ISSN: 0972-1061

Descriptors: Alfisols / alkaline phosphatase/ application rates/ application to land/ bacterial count/ base saturation/ calcium/ cation exchange capacity/ coal/ copper/ crop yield/

electrical conductivity/ enzyme activity/ exchangeable calcium/ exchangeable magnesium/ fly ash/ iron/ magnesium/ manganese/ nitrogen / NPK fertilizers/ nutrient availability/ organic carbon/ oxidoreductases/ phosphorus/ physicochemical properties/ potassium/ red soils/ soil amendments/ soil bacteria/ soil chemical properties/ soil enzymes/ soil fertility/ soil flora/ soil organic matter/ soil pH/ soil types/ sulfur/ sunflowers/ urease/ waste disposal/ waste management/ waste utilization/ yield components/ zinc/ alkaline phosphomonoesterase/ chemical properties of soil/ elemental sulphur/ land application/ Mn/ Mysore/ organic matter in soil/ red earths/ redox enzymes/ sulphur

Abstract: A field experiment was conducted to study the effect of levels of fly ash (0, 25, 50, 75 and 100 tones/ha) on physicochemical, biochemical and biological properties of alfisols, the yield parameters of sunflower, soil bacterial count and activity of soil enzymes; dehydrogenase, urease and alkaline phosphatase. Two levels of fertilizers were applied; No NPK and Recommended dose of NPK fertilizers. Physio-chemical and microbiological analysis was conducted after the harvest of sunflower. A study of graded level of coal fly ash amended alfisols revealed an increase in the content of N, P, K, Ca, Mg, S, Fe, Mn, Zn and Cu and disturbed the microbiological balance and soil enzyme activity.

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77. Coamendments to modify phosphorus extractability and nitrogen/phosphorus ratio in feedlot manure and composted manure.

Dao, T. H.

Journal of Environmental Quality 28(4): 1114-1121. (1999)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: aluminium sulfate/ amendments/ application rates/ calcrete/ cattle manure/ clay loam soils/ composting/ fly ash/ nitrogen/ phosphorus/ pollution/ sandy loam soils/ soil amendments/ soil types/ water quality/ aluminium sulphate/ aluminum sulfate/ calcareous crusts/ environmental pollution/ water composition and quality

Abstract: The effects of alum, caliche, and Class C fly ash on extractable P concentrations were examined in stockpiled and composted cattle manure at rates of 0, 0.10, 0.25, and 0.50 kg manure/kg. The mixtures were added to Amarillo fine sandy loam (Aridic Paleustalf) and Pullman clay loam (Torreptic Paleustoll) at the rate of 22 t/ha. Caliche, alum, and fly ash reduced water-extractable P (WP) in stockpiled manure by 21, 60, and 85% and by 50, 83, and 93% in composted manure at the 0.1 kg/kg rate. Alum and fly ash significantly reduced Bray-I P (BP) concentrations by 75 and 90% in stockpiled and composted manure, respectively, and >90% at higher rates. Fly ash decreased Mehlich III-P (MP) concentrations, and ranged from 50 to 98%. Mixing these amendments with feedlot manure widened the effective manure N:P ratio by a factor ranging from 1.5 to 18. Applying fly ash-treated stockpiled or composted manure reduced all extractable P fractions from amended soils. Alum and caliche consistently reduced the WP fraction only. Co-applications of mineral and animal byproducts stabilized manure P where uncovered storage was unavoidable or widened its effective N:P ratio, and allowed land application rates needed to fulfil plant N requirements without causing water quality impairments. Reproduced with permission from the CAB Abstracts database.

78. Comparative study on the growth of mulberry (Morus alba) plant at different levels of fly-ash amended soil.

Singh, V. K.; Behal, K. K.; and Rai, U. N.

Biological Memoirs 26(1): 1-5. (2000); ISSN: 0379-8097

Descriptors: Horticulture/ Agriculture/ Waste Management: Sanitation/ Soil Science/ Moraceae: Angiosperms, Dicots, Plants, Spermatophytes, Vascular Plants

Abstract: Study was undertaken on rehabilitating fly-ash contaminated waste land and a series of experiments were carried out by growing mulberry (*Morus alba* L.) plants in 25 earthen pots in five different sets of fly-ash/soil composition including control. Various characters of the soil amended with different percentage of fly-ash (i.e., fly-ash/soil-25:75, 35:65, 50:50 and 75:25) were monitored during the experimental study. The data obtained for the various growth parameters in the mulberry plants were comparatively assessed and analyzed employing randomized block design method. The 25:75 composition of fly-ash/soil was found viable for sustaining the growth of *M. alba* plants.

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79. Comparison of biomass and metal uptake between two populations of *Phragmites australis* grown in flooded and dry conditions.

Ye, Z. H.; Wong, M. H.; Baker, A. J. M.; and Willis, A. J.

Annals of Botany 82(1): 83-87. (July 1998); ISSN: 0305-7364 [ANBOA4]

Descriptors: *Phragmites australis*/ biomass/ mine spoil/ fly ash / soil pollution/ provenance/ adaptation/ seedlings/ roots/ shoots/ water stress/ drought/ growing media/ zinc/ lead/ cadmium/ copper/ nickel/ nitrogen/ potassium/ phosphorus/ soil ph / redox potential/ metal ions/ sediments/ China/ Belgium/ flooding/ dry matter/ growth/ uptake

Abstract: The biomass and metal concentrations of two populations of *Phragmites australis* were studied by growth in a glasshouse in three ameliorated substrata [Mai Po (MP) sediment, fly ash (FA) and lead/zinc mine tailings (TL)] under flooded and dry conditions for 90 d. Plants were raised from seeds from 'clean' (Mai Po, Hong Kong) and metal-contaminated (Plombieres, Belgium) sites. Seedling growth was best in fly ash, root dry weights being higher in flooded than dry conditions, and growth poorest in tailings, in which shoot and root dry weights were higher under dry conditions for both populations. However, in the MP substratum conditions did not significantly affect shoot and root dry weights of either population. In the fly ash and tailings, more metals were generally taken up in both roots and shoots in flooded than dry conditions, but there was little difference in the MP substratum. Metal uptake was mostly similar in both populations in seedlings grown in the same substratum, there being no clear evidence of ecotypic differentiation.

This citation is from AGRICOLA.

80. Comparison of different amendments for alleviating iron toxicity in rice.

Nayak, S. C.; Sahu, S. K.; Mishra, G. C.; and Sandha, B.

International Rice Research Notes 29(1): 51-53. (2004)

NAL Call #: SB191.R5I6; ISSN: 0117-4185

Descriptors: antagonism/ chemical composition/ crop yield/ fly ash/ iron/ leaves/ lime/ phytotoxicity/ plant composition/ potassium/ rice/ rice straw/ soil amendments/

straw/ toxicity/ varieties/ zinc/ chemical constituents of plants/ paddy

Abstract: Field experiments were during 1999, 2000 and 2001 wet seasons in Orissa, India, to study the efficacy of various amendments for Fe toxicity amelioration. The treatments include application of lime (0.5 and 0.25 lime requirement), fly ash (20 and 10 tonnes/ha), K (66 kg/ha), Zn (10 and 5 kg/ha) and foliar spray of $MnSO_4$ (0.6%). Two rice varieties, Mahsuri (tolerant of Fe toxicity) and Jajati (susceptible to Fe toxicity), were used. Symptoms of Fe toxicity such as reddish brown spots at the tips of the lower leaves with bronzing spreading over the entire leaf, appeared in the control treatment 25 days after planting the susceptible variety. Bronzing symptoms were recorded at 40 DAT. These symptoms decreased upon application of the different amendments. The application of Zn and lime at higher doses resulted in minimum toxicity. Jajati gave higher toxicity values than Mahsuri. Grain and straw yield of both varieties increased with application of the different amendments. Application of Zn showed the highest yield because of antagonism between Zn and Fe. Except for straw yield in 2001, Mahsuri produced higher yield than Jajati. Fe concentration in leaves was higher in the control treatment. A minimum concentration of Fe in leaves was observed in the Zn treatment, followed by the lime treatment. Jajati showed a higher Fe concentration in leaves than Mahsuri.

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81. Comparison of heavy metal contents between different reclaimed soils and the control soil.

Dong, J. H.; Bian, Z. F.; and Wang, H. F. 36(4): 531-536. (2007); ISSN: 10001964 [ZKDXE].

Notes: Language of Original Document: Chinese.

Descriptors: coal mining waste/ fly ash/ heavy metal pollution/ reclaimed soil/ accident prevention/ coal ash/ fly ash/ heavy metals/ pollution control/ soil pollution/ soil pollution control/ coal mining waste/ heavy metal pollution/ mining wastes/ reclaimed soil/ land reclamation

Abstract: To keep the ecological safety of the reclaimed lands filled with mining wastes and fly ash used as agricultural purpose, the contents of heavy metals As, Hg, Pb, Cu, Cd, Cr, Zn in different soils, including the reclaimed soils and control soil with different depths and the roots of wheat, were tested. The result shows that the contents of Pb and Cu in the fly ash and Cu and Zn in mining wastes are higher than that in the control soil, but only Zn in the covered soil with 20 cm depth and Zn and Cu in the covered soil with 20 cm and 40 cm depth on mining wastes filled sites are markedly higher than that in the control soil with the same depth. However, there are not remarkable differences for the contents of heavy metals in the roots of wheat on different reclaimed sites and the control site.

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82. Competitive adsorption behavior of selected heavy metals in three soil types of India amended with fly ash and sewage sludge.

Veeresh, H.; Tripathy, S.; Chaudhuri, D.; Hart, B. R.; and Powell, M. A.

Environmental Geology 44(3): 363-370. (June 2003)

NAL Call #: QE1.E5; ISSN: 1073-9106 [ENGOE9]

Descriptors: Alfisols / Vertisols/ genetic soil types/ soil amendments/ physicochemical properties/ soil properties/

India/ red alfisol/ black vertisol/ acid laterite

Abstract: Laboratory batch experiments were carried out to study the competitive sorption behavior of metals in three types of Indian soils, differing in their physicochemical properties: acid laterite (SL1), red alfisol (SL2) and black vertisol (SL3) treated with different proportions of fly ash and sewage sludge mixture. Representative samples were equilibrated with 10 to 200 micromolar L(-1) concentrations of metals simultaneously containing Cd, Cu, Ni, Pb and Zn in 5 mM of Ca(NO₃)₂ solution. In most of the cases the affinity sequence of metals was Pb>Cu>Zn>Ni>Cd based on their amount of sorption, which varied little with either metal equilibrating concentrations or the soil/mixture type. The observed metal affinity sequences in different soils amended with mixtures were compared to the predicted affinity sequences based on metal properties and a good match was found with those predicted by metal hydrolysis constants. This indicated that formation and subsequent sorption of metal hydrolysis products on soil surface is the predominant mechanism for sorption. In all the cases, Pb and Cu showed higher affinity followed by Zn, Ni or Cd. The increase in the metal additions further enhanced the competition among metals for exchange sites. Adsorption isotherms showed that metal sorption was linearly related to its concentration in the equilibrium solution. The distribution coefficients (K(D)) computed from the slopes of linear regression for different metals were higher in SL3 than in both SL2 and SL1. All the mixture amended soils produced higher K(D) values than their respective controls. Selectivity between metals resulted in the following affinities based on their K(D) values-Pb>Cu>Zn>Ni or Cd-which was in line with the value of the hydrolysis constant of the metals under study.

This citation is from AGRICOLA.

83. Competitive anion sorption effects on dairy wastewater dissolved phosphorus extraction with zeolite-based sorbents.

Dao, T. H.

Journal of Food, Agriculture and Environment 1(3/4): 263-269. (2003); ISSN: 1459-0255

Descriptors: anions/ dairy effluent/ dairy wastes/ desorption/ fly ash/ models/ nonclay minerals/ phosphates/ phosphorus/ sorption/ sorption isotherms/ waste water/ waste water treatment/ zeolites

Abstract: Dairy waste water is often used to irrigate field crops. Soluble and colloidal phosphorus (P) must be removed from the supernatant liquid to avoid further P loading of high-P fields. Information is needed on P sorption capacity of natural and synthetic zeolites and fly ash in a complex wastewater and on how the spent products release sorbed PO₄-P. Sorption isotherms were determined in single and multi-anion standard solutions and dairy waste water to quantify the sorption capacity of modified zeolites and fly ash and increase our understanding of underlying mechanisms of oxyanion retention. Solution anion concentrations were determined by high-performance ion chromatography. The results show that natural zeolites have negligible affinity for NO₃- or PO₄³⁻ anions. Surfactant-modified (SMZ) and synthetic (SZBP) zeolites and fly ash exhibit significant capacities to bind PO₄-P. Phosphate sorption on SMZ and SZBP was described by the Langmuir equation, with sorption maxima, S_{max},

averaging 0.71 and 0.31 mmol g⁻¹, respectively. Class C fly ash strongly sorbs and removes PO₄-P from solution. Sorption maxima increase by 4-fold and Langmuir K constants indicate a higher bonding energy than those of SMZ and SZBP. Competitive sorption is evident in PO₄-P sorption from mixed solutions of SO₄-S, NO₃-N, and PO₄-P. All sorbents removed dissolved PO₄-P from multi-ion dairy waste water suspensions containing 10 to 100 g solid litre⁻¹. The order of efficacy is fly ash >= SZBP > SMZ.

Although differences in affinity and desorption exist, the zeolite-based sorbents prove valuable as temporary sinks and offer promise in the development of reversible recovery treatments of P-laden animal waste water.

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84. Composition, biomass and activity of microflora, and leaf yields and foliar elemental concentrations of lettuce, after in situ stabilization of an arsenic-contaminated soil.

Ascher, J.; Ceccherini, M. T.; Landi, L.; Mench, M.; Pietramellara, G.; Nannipieri, P.; and Renella, G.

Applied Soil Ecology 41(3): 351-359. (2009)

NAL Call #: QH541.5.S6 A67; ISSN: 09291393 [ASECF].

Notes: doi: 10.1016/j.apsoil.2009.01.001.

Descriptors: coal fly ash/ soil biochemical activity/ soil microbial diversity/ soil remediation/ zerovalent iron grit

Abstract: Beringite (B) and zerovalent iron grit (Z), singly and in combination (BZ), were added to a loamy sand soil contaminated by trace elements (Reppel, Belgium), mainly by arsenic (As), to reduce As labile fractions and phytoavailability. An uncontaminated sandy soil was studied for comparison. Soils were placed in large lysimeters cultivated with maize and vegetables for 6 years. pH, organic C and total N content increased in amended soils. The Z and BZ treatments reduced the Ca(NO₃)₂-extractable soil As and As uptake by lettuce. The BZ lettuces had also the lowest foliar Pb, Cd, Zn, and Mn concentrations. All amendments had positive effects on the soil microbial biomass and reduced the qCO₂. Glucose mineralization was increased in Z and BZ amended soils. Acid phosphomonoesterase activity was higher in the untreated soil than in the other soils; the alkaline phosphomonoesterase, phosphodiesterase and protease activities were increased by Z and BZ treatments, whereas B amendment had less positive effects. Genetic fingerprinting using Denaturing Gradient Gel Electrophoresis (DGGE) revealed shifts in the composition of eubacterial and fungal communities of the amended soils. Microbial species richness decreased rather than increased in the treated soils, regardless of reduced trace element availability and increased soil microbial biomass and activity. © 2009 Elsevier B.V. All rights reserved. © 2009 Elsevier B.V. All rights reserved.

85. The composition of coal combustion by-products: Examples from a Kentucky power plant.

Kolker, Allan; Finkelman, Robert B.; Affolter, Ronald H.; and Brownfield, Michael E.

In: Use and disposal of coal combustion by-products at coal mines; A technical interactive forum.Morgantown, WV.)

Vories, Kimery C. and Throgmorton, Dianne (eds.); 2000.

Notes: References: 22; illus. incl. 1 table.

Descriptors: ash/ chemical composition/ coal/ coal combustion byproducts/ combustion/ environmental effects/ geochemistry/ heavy metals/ Kentucky/ leaching/ mass balance/ mineral composition/ pH/ pollutants/ pollution/ power plants/ sedimentary rocks/ sludge/ United States/ waste disposal/ Environmental geology/ Geochemistry of rocks, soils, and sediments
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86. Compressibility and hydraulic conductivity of a chemically treated expansive clay.

Nalbantoglu, Z. and Tuncer, E. R.

Canadian Geotechnical Journal 38(1): 154-160. (2001); ISSN: 0008-3674

Descriptors: cation exchange/ compressibility/ expansive soils/ permeability coefficient/ soil properties/ soil tests/ testing procedures/ Cyprus

Abstract: The paper presents a series of laboratory tests and evaluates the effect of lime and fly ash on the compressibility and hydraulic characteristics of an expansive soil in Cyprus. The tests were performed at different percentages of lime (0-7%) and fly ash (15 and 25%) by dry weight of soil, and additional tests were also performed on soils treated with 15% fly ash plus 3% lime. Previously published research reveals that few data are available concerning the compressibility and hydraulic conductivity of lime-treated soils. The results of this study indicate an increase in the vertical effective yield stress (apparent preconsolidation pressure) and a decrease in the compressibility characteristics of the treated soils.

Moreover, unlike some of the findings in the literature, higher hydraulic conductivity values were obtained with time. This finding has been substantiated by the reduced cation exchange capacity (CEC) values, which indicate that the pozzolanic reaction causes the soils to become more granular in nature, resulting in higher hydraulic conductivity. Original Abstract: L'article present une serie d'essais en laboratoire et evalue l'effet de la chaux et de la cendre volante sur la compressibilite et les caracteristiques hydrauliques d'un sol gonflant de Chypre. Les essais ont ete realises a differents pourcentages de chaux (0-7%) et de cendre volante (15% et 25%) par rapport au poids sec des sols, et des essais additionnels ont aussi ete realises sur des sols traites avec 15% de cendres volante et 3% de chaux. Des recherches publiees anterieurement revelent qu'il y a tres peu de donnees disponibles sur la compressibilite et la conductivite hydraulique de sols traites a la chaux. Les resultats de l'etude indiquent une augmentation de la contrainte verticale effective a la limite d'elasticite (pression apparente de preconsolidation) et une diminution des caracteristiques de compressibilite des sols traites. De plus, contrairement aux donnees disponibles dans la litterature, des valeurs plus elevees de la conductivite hydraulique ont ete obtenues en fonction du temps. Cette constatation a ete appuyee par les valeurs de capacite d'echange de cations (CEC) qui indiquent que la reaction pozzolanique a pour consequence que les sols evoluent vers une condition plus granulaire, resultant en une plus grande conductivite hydraulique.

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87. Concentration of heavy elements and radionuclides in crops grown on coal fly ash amended red and black soils.

Yeledhalli, N. A.; Prakash, S. S.; and Ravi, M. V.

Karnataka Journal of Agricultural Sciences 21(1): 125-127. (2008)

NAL Call #: S471.I42K37; ISSN: 0972-1061

Descriptors: Alfisols / arsenic/ black soils/ fly ash/ groundnuts/ heavy metals/ lead/ maize/ polluted soils/ pollution/ radionuclides/ red soils/ residual effects/ selenium/ soil types/ sunflowers/ uptake/ Vertisols/ corn/ environmental pollution/ Mysore/ peanuts/ radioactive isotopes/ radioactive nuclides/ radioisotopes/ red earths
Abstract: Field experiments were conducted during 2004 at Regional Agricultural Research Station, Raichur, University of Agricultural Sciences, Dharwad, Karnataka, India, to study the effect of fly ash application on heavy metal and radionuclides concentration in crops grown on an Alfisol Typic Chromustalf (red soil) and Vertisol Typic Pellusterfs (black soil). The concentration of heavy metals in sunflower seeds in red soils increased due to application of 40 tonnes fly ash/ha. The Se content of sunflower seed in control was 0.2 mg/kg, which increased to 0.21 mg/kg due to application of 40 tonnes fly ash/ha. Similarly, As content increased from 0.29 to 0.32 mg/kg and that of Pb from 0.73 to 0.78 mg/kg due to application of 40 tonnes fly ash/ha. The uptake of Se, As and Pb by sunflower seed was 0.11, 0.17 and 0.42 g/ha in control, respectively, which increased to 0.2, 0.32 and 0.74 g/ha due to application of 40 tonnes fly ash/ha. Similar trend of results were observed in black soil. The residual effect of fly ash on the concentration and uptake of toxic elements by groundnut in red soil and maize in black soil showed increasing trend with increasing rate of ash application. The alpha activity in sunflower seeds was below detectable limit in both red and black soils. The results of the study clearly indicated that the edible part of sunflower and groundnut contain heavy metals: Se, As and Pb and radionuclides are below the levels of human health concern.

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88. Concentration of some heavy metals in both oat varieties growing in the soil at different content of fly-ash.

Gregorczyk, A.

Folia Universitatis Agriculturae Stetinensis, Agricultura 88: 49-56. (2001); ISSN: 1506-1973.

Notes: Original title: Koncentracja wybranych metali ciezkich u dwu odmian owsa rosnacego na glebie o zroznicowanej zawartosci popiołu lotnego.

Descriptors: cadmium/ chemical composition/ copper/ cultivars/ fly ash/ heavy metals/ lead/ manganese/ nickel/ oats/ plant composition/ zinc/ chemical constituents of plants/ cultivated varieties/ Mn

Abstract: A pot experiment was conducted during 1999 in Roslin, Poland to evaluate heavy metal accumulation in naked (Akt) and hulled (Bajka) oat cultivars after application of 5% fly ash. The contents of Cu, Cd, Mn, Zn, Pb and Ni in the straw, root and grain were determined using the AAS method. Cu, Mn and Ni contents in the grains of ash-treated plants were within the natural limit for these metal

elements, while Cd, Zn and Pb contents in the grains of ash-treated plants exceeded the natural limit for these elements.

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89. Contaminant mobility in soils amended with fly ash and flue-gas gypsum: Intact soil cores and repacked columns.

Ishak, C. F.; Seaman, J. C.; Miller, W. P.; and Sumner, M. *Water, Air and Soil Pollution* 134(1/4): 287-305. (2002)

NAL Call #: TD172 .W36; ISSN: 0049-6979

Descriptors: application to land/ arsenic/ boron/ dispersion/ electrical conductivity/ environmental impact/ fly ash/ gypsum/ leaching/ saturated hydraulic conductivity/ soil amendments/ soil pH/ soil pollution/ turbidity/ Ultisols/ water holding capacity/ environmental effects/ land application/ United States of America

Abstract: The impact of the land application of coal combustion by-products, fly ash (FA) and flue-gas desulfurization gypsum (FDG), to coarse-textured soils of the southeastern USA was investigated using batch and dynamic column techniques. Two FA samples, one an alkaline FA (Alk-FA) and the other an acidic FA (Acid-FA), were evaluated alone and in combination with FDG as soil amendments to an Appling loamy sand (Typic Hapludults). The effects of these waste products on clay dispersion, soil hydraulic conductivity (K_{sat}) and the migration of contaminants such as Arsenic (As) and Boron (B) were studied using intact soil cores and repacked soil columns. FA or combinations of FA+FDG were applied to the surface of intact soil cores (10 t ha⁻¹) and repacked soil columns or incorporated within repacked soil columns. The columns were saturated and then leached for a prescribed number of pore volumes to simulate leaching conditions in the field. Effluent pH, electrical conductivity (EC), and turbidity were monitored and leachate fractions were collected for B, As, Ca, Mg, K and Na analysis. Both FA materials were ineffective at decreasing the inherent dispersibility of clay from the A_p horizon in batch tests. In fact, high application rates of the Alk-FA induced some clay dispersion in the well-flocculated B_t soil materials, and column results suggest that incorporating the Alk-FA within the surface soil may actually reduce K_{sat} . In contrast, treatments with FDG were highly effective at inducing rapid clay flocculation in batch tests and eliminating effluent turbidity for intact and repacked soil columns. Boron was readily mobile from both intact and repacked soil columns, a majority of which leached from the columns within the first three pore volumes. Boron leaching was greater for combined treatments (FA+FDG), possibly indicative of enhanced solubilization in the presence of FDG or sulfate (SO₄₂₋) competition for sorption sites. Arsenic levels present in the leachates from FA and FDG columns were generally lower than control columns and roughly correlated with effluent turbidity. Combined treatments (FA+FDG) enhanced Mg and K leaching due to the added competition of Ca for cation exchange sites. Following leaching, the intact soil cores were sectioned at 5 cm intervals and the pH and EC of the soil, as well as the vertical distribution of As and B, were determined. Levels of residual As were only slightly higher in the upper section of the FA-amended columns, showing little downward movement, but no clear trend in

residual B was observed due to its greater mobility. Reproduced with permission from the CAB Abstracts database.

90. Contamination and assessment of heavy metals in fly ash reclaimed soil.

Hu ZhenQi; Qi JiaZhong; and Si JiTao

Transactions of the Chinese Society of Agricultural Engineering 19(2): 214-218. (2003)

NAL Call #: S671.N8; ISSN: 1002-6819

Descriptors: arid lands/ arsenic/ assessment/ cadmium/ chromium/ copper/ dry farming/ fluorine/ fly ash/ heavy metals/ lead/ mercury/ nickel/ polluted soils/ reclaimed soils/ reclamation/ selenium/ soil pollution/ soil types/ tillage/ zinc/ dryland farming/ soil cultivation

Abstract: Soil samples were taken from fly ash reclaimed to soil to determine the contamination of 10 heavy metals, viz., As, Cd, Ch, Hg, Pb, Cu, Se, Zn, Ni and F. It was found that the soil reclaimed by fly ash was polluted by Cd, Se, Zn and F according to common soil assessment standards. Furthermore, the reclaimed soil was found to be suitable for dryland cultivation rather than wetland cultivations, and that the contamination of heavy metals on the soil surface was increased with cultivation time.

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91. Contamination character analysis of filling reclaimed soil with fly ash in subsided land.

Hu ZhenQi; Wei ZhongYi; and Qin Ping

China Environmental Science 24(3): 311-315. (2004);

ISSN: 1000-6923

Descriptors: absorption/ bioavailability/ fly ash/ heavy metals/ leaching/ nutrient content/ polluted soils/ reclaimed land/ reclaimed soils/ reclamation/ soil amendments/ soil analysis/ soil pollution/ soil types/ solubility/ uptake/ wheat

Abstract: The contamination potential of filling reclaimed soil with fly ash was revealed based on the analysis of fly ash pollution potential and through the analysis of reclaimed soil, leaching experiment and planting test. Solubility of heavy metals in fly ash was poor, and the crop absorption of heavy metals was restrained due to high pH value. The leaching test also showed poor leaching ability of heavy metal elements. The analysis of crop (wheat) seed sample cultivated in the fields and greenhouse pots showed that the contents of heavy metals coincided with the related national standard that the reclaimed land could be planted with certain crops, even when the soil was polluted with heavy metals.

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92. The content, uptake and utilization coefficient of sulphur by plants from waste activated sludges composted with CaO or brown coal ash.

Kalembasa, S.; Wysokinski, A.; and Cichuta, R.

Journal of Elementology 10(2): 325-332. (2005); ISSN: 1644-2296.

Notes: Original title: Zawartosc, pobranie i wspoczynniki wykorzystania siarki przez rosliny z osadow sciekowych kompostowanych z CaO lub popioem z wegla brunatnego.

Descriptors: activated sludge/ ash/ brown coal/ calcium oxide/ chemical composition/ composts/ farmyard manure / lime/ plant composition/ soil amendments/ sulfur/ uptake/

chemical constituents of plants/ elemental sulphur/ FYM/ sulphur

Abstract: The content, uptake and utilization coefficient of sulfur (S) by plants from waste activated sludges composted during 3 months with CaO or brown coal ash were investigated. Generally, a higher concentration of S was observed in plants fertilized with waste activated sludges and farmyard manure (FYM) without CaO and brown coal ash addition than with CaO and brown coal ash. The plants fertilized with mixtures of waste activated sludges with brown coal ash contained less S. The amount of S taken up by the plants in waste activated sludges and FYM with CaO and brown coal ash addition plots was lower than those in without CaO and brown coal ash addition. The plants took higher amount of S from the mixtures of waste activated sludges and FYM with brown coal ash addition than those with CaO. The values of utilization coefficient of S during the 3-year study period was higher in the mixtures of waste activated sludges and FYM with CaO addition than with brown coal ash. Reproduced with permission from the CAB Abstracts database.

93. The content variation of harmful elements in fly ash soil and vegetables and their environmental significance.

Tan Qulin; Zhai Jianping; Zhou Wei; and Qian Qin
Geological Journal of China Universities 5(3): 298-305. (Sept. 1999); ISSN: 1006-7493.

Notes: Original title: Gaoxiao Dizhi Xuebao. Language: Chinese. References: 7; illus. incl. 1 table.

Descriptors: agricultural waste/ ash/ Asia/ chemical elements/ China/ Far East/ geochemical indicators/ geochronology/ heavy metals/ Jiangsu China/ migration of elements/ Nanjing China/ pollutants/ pollution/ soils/ variations/ waste disposal/ yields/ environmental geology
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94. Copper stabilization by zeolite synthesis in polluted soils treated with coal fly ash.

Terzano, R.; Spagnuolo, M.; Medici, L.; Vekemans, B.; Vincze, L.; Janssens, K.; and Ruggiero, P.
Environmental Science and Technology 39(16): 6280-6287. (2005)

NAL Call #: TD420.A1E5; ISSN: 0013-936X

Descriptors: agricultural soils/ copper/ copper hydroxide/ fly ash / nonclay minerals/ polluted soils/ soil types / spatial distribution/ zeolites

Abstract: This study deals with the process of zeolite formation in an agricultural soil artificially polluted by high amounts of Cu (15 mg of Cu/g of soil dry weight) and treated with fused coal fly ash at 30 and 60 degrees C and how this process affects the mobility and availability of the metal. As a consequence of the treatment, the amount of dissolved Cu, and thus its mobility, was strongly reduced, and the percentage of the metal stabilized in the solid phase increased over time, reaching values of 30% at 30 degrees C and 40% at 60 degrees C. The physicochemical phenomena responsible for Cu stabilization in the solid phase have been evaluated by EDTA sequential extractions and synchrotron radiation based X-ray microanalytical techniques. These techniques were used for the visualization of the spatial distribution and the speciation of Cu in and/or on the neo-formed zeolite particles. In particular, micro XRF (X-ray fluorescence)

tomography showed direct evidence that Cu can be entrapped as clusters inside the porous zeolitic structures while μ -XANES (X-ray absorption near edge structure) spectroscopy determinations revealed Cu to be present mainly as Cu(II) hydroxide and Cu(II) oxide. The reported results could be useful as a basic knowledge for planning new technologies for the on site physicochemical stabilization of heavy metals in heavily polluted soils. Reproduced with permission from the CAB Abstracts database.

95. Corn and soil response to application of ash generated from gasified alfalfa stems.

Mozaffari, M.; Rosen, C. J.; Russelle, M. P.; and Nater, E. A.

Soil Science 165(11): 896-907. (Nov. 2000)

NAL Call #: 56.8 So3; ISSN: 0038-075X [SOSCAK]

Descriptors: Medicago sativa/ stems/ gasification/ fly ash/ soil amendments/ Zea mays/ dry matter accumulation/ nutrient uptake/ nutrient content/ potassium/ magnesium/ phosphorus/ nitrogen content/ mineral content/ sandy soils/ clay loam soils/ soil pH/ exchangeable cations/ trace elements/ application rate/ fuel crops

This citation is from AGRICOLA.

96. Creation of soil amendments containing Type A humic acid-like substances I. Creation of Type A humic acid-like substances by using rice straw and coal ashes.

Ikumi, Y.; Yahata, Y.; Suzuki, T.; Fujitake, N.; and Otsuka, H.

Japanese Journal of Soil Science and Plant Nutrition 75(6): 641-649. (2004); ISSN: 0029-0610

Descriptors: carbon/ coal/ fertilizer technology/ fixation/ fly ash/ humic acids/ humification/ production/ rice/ rice straw/ soil amendments/ straw/ paddy

Abstract: An attempt to create a soil amendment containing Type A humic acid-like substances was done by means of thermal incubation of a mixture of rice straw (RS) and coal fly ash (CFA). The specific objectives of the study are the following: (1) To make an effective use of CFA, a by-product of coal-fired power stations, and (2) To fix carbon in the soil for a long term period as Type A humic acids which are known to be hard to decompose. Optimal incubation conditions to create Type A humic acid-like substances were examined. Furthermore, the chemical properties of the created samples were analysed. The results obtained can be summarized as follows: (1) It was found that among the three temperature conditions imposed (60, 75 and 90 degrees C), 90 degrees C was the most suitable for the progress of humification, and that a water supply was very necessary; (2) Since the humic acid-like substances extracted from the incubated sample showed a high degree of humification at the pH range of 3-4, the increase in the degree of humification of the humic acid-like substances may be accelerated by maintaining a low pH condition during incubation; (3) The highest RF value was observed in the mixture with a dry weight ratio of 1:1 (CFA:RS) after 180 d incubation at 90 degrees C with water. The Delta logK and RF values of the humic acid-like substances extracted with the mixed solution (pH 7) of 0.1 mol L⁻¹ Na₄P₂O₇ and 0.1 mol L⁻¹ H₄P₂O₇ was 0.686 and 94.2 respectively, and these humic acid-like substances corresponded to Type A humic acids; (4) The yields of Type

A humic acid-like substances from the incubated mixture of CFA and RS (dry weight ratio of 1:1 and 1:2) were estimated to be at least 13.6% and 14.6% of the carbon contents of the samples at the start of the incubation, respectively, and (5) The contents of nutrients, such as nitrogen and phosphorus in the incubated sample were smaller than those reported for other soil amendments such as rice straw compost. Therefore, additional application of nitrogen and phosphate fertilizers would be needed in the actual scene for agronomical application of this soil amendment.
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97. Crop response to SLASH (mixture of sewage sludge and fly ash) and on soil properties of red and black soils as influenced by soil texture and fertility.

Yeledhalli, N. A.; Ravi, M. V.; and Prakash, S. S. *Environment and Ecology* 26(2A): 934-942. (2008)

NAL Call #: TD172.E5; ISSN: 0970-0420

Descriptors: black soils/ boron/ crop production/ crop yield/ fly ash/ groundnuts/ maize/ NPK fertilizers/ red soils/ sewage sludge/ soil amendments/ soil chemical properties/ soil fertility/ soil properties/ soil texture/ sulfur/ sunflowers/ trace elements/ chemical properties of soil/ corn/ elemental sulphur/ microelements/ Mysore/ peanuts/ red earths / sulphur

Abstract: Prime agricultural land is declining day after day and the cost of nutrients inputs escalating. It is therefore necessary to overcome the deficiency of nutrients and disturbed soil to feed the burgeoning population. Using conventional methods are costly and not sustainable. An attempt was made to mix the sewage sludge and fly ash in different proportion on wt/wt basis called SLASH material. Field experiments were conducted to determine the effect of SLASH on crop yields. Soil chemical properties of red and black soil were also monitored. SLASH treatments were compared with absolute and NPK control. The results illustrated the improvement in the crop yields. Sunflower, groundnut and maize yields on SLASH treatment were 28, 41 and 36% better than the NPK control. Soil chemical properties were also improved. The available NPK and S content in both the soils increased with increasing proportion of sewage sludge in SLASH. Similar trend was noticed in micronutrients. The higher level of hot water soluble boron was maintained up to 1:1 (wt/wt) ratio in SLASH, thereafter it decreased. The SLASH application was beneficial in minimizing the load of toxic heavy metals in the soil.

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98. Crop responses to SLASH (mixture of sewage sludge and fly ash) as influenced by soil texture and fertility.

Yeledhalli, N. A.; Ravi, M. V.; and Prakash, S. S. *Environment and Ecology* 26(3): 971-977. (2008)

NAL Call #: TD172.E5; ISSN: 0970-0420

Descriptors: clay loam soils/ crop yield/ fly ash/ heavy metals/ nutrient content/ nutrient uptake/ sandy loam soils/ sewage sludge/ soil amendments/ soil fertility/ soil texture/ soil types/ sunflowers/ Mysore

Abstract: The use of mixtures of sewage sludge and fly ash (SLASH) as a soil ameliorant has a tremendous potential, which has high quantities of waste materials. An attempt

was made to investigate the feasibility of converting waste disposal problems into a soil beneficiation strategy. Field experiments were conducted in Raichur, Karnataka, India, during kharif 2005 to determine the effect of SLASH under different conditions (sandy loam and clay loam soils, with optimal or sub-optimal fertilization) on sunflower yield as well as nutrient content and uptake. Sunflower yield differed in their response to soil texture and fertility. The augmentation with SLASH improved the sunflower yield. With SLASH at 3:1 ratio, the yield of sunflower was 28% higher than the NPK control. However, no evidence was found of heavy metal translocation from the soil to the biomass. The experiments showed the potential soil ameliorative properties of SLASH, which might benefit crop production.

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99. Cropping highbush blueberry in coal ash compost mixtures.

Black, Brent L. and Zimmerman, Richard H. In: 97th Annual International Conference of the American Society for Horticultural Science. Lake Buena Vista, Florida, USA.; Vol. 35(3); pp. 434; 2000.

NAL Call #: SB1.H6

Descriptors: Horticulture: Agriculture/ Waste Management: Sanitation/ Soil Science/ Ericaceae: Angiosperms, Dicots, Plants, Spermatophytes, Vascular Plants/ Coal Ash Compost Mixtures/ Meeting Abstract/ Meeting Poster

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100. Current pollution and odor control technologies for poultry production.

Nahm, K. H.

Avian and Poultry Biology Reviews 14(4): 151-174. (2003); ISSN: 1470-2061

Descriptors: air quality/ ammonia/ animal wastes/ chemicals/ diet/ dust/ enzymes/ filters/ fly ash/ heavy metals/ litter/ nitrogen/ odours/ ozone/ phosphorus/ pollution/ pollution control/ poultry farming/ reviews/ vitamin D/ water pollution/ environmental pollution/ livestock wastes/ odors/ smells

Abstract: Concentrated poultry production has resulted in pollution of water by nitrogen (N) and phosphorus (P), and air due to ammonia (NH₃), odors and dust within the poultry barns. Chemical additives containing calcium (Ca), aluminium (Al), or iron (Fe) reduce NH₃ emissions 35 to 99% and soluble P 31 to 95%, depending on the chemical and concentration used. Poultry feed manipulation methods for reducing N and P contents in poultry manure involve reducing protein contents and supplementing with synthetic amino acid to reduce N excretion up to 29.14%. Reducing soluble P contents in broiler diets (40% of NRC requirements) during the withdrawal period reduced soluble P contents in the manure. Enzyme supplements in poultry feed improve dry matter digestibility and phytic P utilization from grain diets, thereby reducing P content in manure. Litter materials increase carbon content of manure and sawdust has specifically been found to reduce the nitrogen in manure by 21%. Covers reduce odour production (impermeable covers by 70-85% and permeable covers by 45-85%) from manure storage areas. Filter systems reduce dust production and accompanying odors by 80% from poultry barns. Certain land application techniques of manure reduce odour and ammonia by 90%. Ozone lowers

NH₃ levels in poultry buildings up to 25% and also eliminates pathogens. Mixing fly ash with manure reduces soluble P contents in stockpiled manure up to 85% and composted manure up to 93%. Addition of vitamin D alone to poultry feed improves phytate P retention from 31 to 68%, while use with phytase improved retention to 79%. Using combinations of the methods would maximize their effectiveness.
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101. Dechlorination and sorption of TCE and PCE in soil amended with fly ash.

Uddin, M. Momin K.; Mills, Gary L.; and Seaman, John C. In: Abstracts with Programs: Geological Society of America. Denver, CO, United States.; Vol. 34 (6).; pp. 189; 2002. Notes: Geological Society of America, 2002 Annual Meeting.

Descriptors: ash/ chlorinated hydrocarbons/ dechlorination/ degradation/ dehalogenation/ effluents/ gas chromatograms/ halogenated hydrocarbons/ lime/ mass spectra/ organic compounds/ pollutants/ pollution/ sampling/ soils/ sorption/ spectra/ testing/ tetrachloroethylene/ textures/ trichloroethylene/ volatiles/ environmental geology

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102. Design fertilisers from coal waste.

Elliot, Alex

Australasian Science (Hawkesburn) 26(9): 24-26. (2005); ISSN: 1442-679X

Descriptors: agriculture/ ash/ cation exchange capacity/ coal/ combustion/ energy conservation/ fertilizers/ framework silicates/ nutrients/ sedimentary rocks/ silicates/ soil quality/ sustainable development/ utilization/ waste management/ water quality/ zeolite group/ environmental geology

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103. Determination of adsorption efficiency based on cation exchange capacity related to red earth, bone meal and pulverised fly ash as ameliorants to lead contaminated soils.

Gatima, E.; Mwinyihija, M.; and Killham, K.

International Journal of Environmental Science and Technology 3(3): 269-280. (2006); ISSN: 1735-1472

Descriptors: absorption/ adsorption/ agricultural soils/ bioavailability/ biosensors/ bone meal/ cation exchange capacity/ contamination/ determination/ fly ash/ leachates/ leaching/ lead/ metal ions/ polluted soils/ red soils/ soil amendments/ soil pollution/ soil toxicity/ soil types/ topsoil/ Britain/ red earths/ remediation/ toxic soils/ United Kingdom

Abstract: Efficient treatment strategies to reduce the toxicity of metal-contaminated soil using cost effective techniques such as naturally available ameliorants and industrial waste have emerged. The effect of 3 easily available soil amendments (bone meal, red earth/mud and pulverized fly ash) on the lability and bioavailability of lead, were determined. The soil used in the experiments were collected from an agricultural field on the Craibstone estate, located northwest of Aberdeen (UK). The application of ameliorants offered a possible alternative in situ remediation of contaminated sites without disruption to the ecosystem profile. In comparison to other ameliorants red earth/mud was found to be efficient in intercepting lead

leaching from soil amended with different lead compounds based on CEC (Cmol/g). This was associated with the heterogeneous adsorbency principle in red mud which is associated with its ability to bind metal ions (M²⁺) onto one or two types of surface sites at pH<6.0. However, areas that need to be studied and assessed (for public health concerns) critically for wide spread application of all the ameliorants include off-site effects of the ameliorants. Lux-based biosensor (*Escherichia coli* HB101 pUCD607) was used to assess Pb toxicity in soil samples due to its wide pH operating range and as an environmental-based organism.

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104. Development of formulations of *Trichoderma harzianum* strain M1 for control of damping-off of tomato caused by *Pythium aphanidermatum*.

Jayaraj, J.; Radhakrishnan, N. V.; and Velazhahan, R. *Archives of Phytopathology and Plant Protection* 39(1): 1-8. (2006); ISSN: 0323-5408

Descriptors: bentonite/ biological control/ biological control agents/ biomass/ fly ash/ formulations/ fungal antagonists/ fungal diseases/ gelatin/ glycerol/ lignite/ plant disease control/ plant diseases/ plant pathogenic fungi/ plant pathogens/ polyethylene glycol/ rhizosphere/ seed treatment/ seeds/ storage life / talc/ tomatoes/ wettable powders/ biocontrol agents/ biological control organisms/ Hyphomycetes/ Madras/ Peronosporomycetes/ phytopathogens/ polyoxyethylene/ Pythiaceae/ Straminipila
Abstract: A carbendazim-resistant *T. harzianum* strain M1, inhibitory to the growth of the damping-off pathogen *P. aphanidermatum*, was used for the development of new carrier formulations. Seven formulations (talc, lignite, lignite +fly-ash-based powder formulation, wettable powder, bentonite paste, polyethylene glycol-paste and gelatin-glycerin-gel) were developed for the treatment of the seeds of tomato (cv. PKM-1). The shelf life of the formulations was evaluated under storage at 24 degrees C up to 9 months. The population of propagules was optimum in all formulations up to 3 months of storage. Seed treatment with *T. harzianum* formulations reduced the incidence of damping-off disease of tomato by up to 74% and enhanced plant biomass under greenhouse and field (Tamil Nadu, India) conditions. Active colonization of *T. harzianum* in the rhizosphere of tomato plants was observed following seed treatment with the formulations.

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105. Development of hydroponic substrates using coal fly ash.

Kim IlSeop; Li XianRi; Yun HyungKweon; Kim YoungDo; Shin KunChul; and Yoo KeunChang

Journal of the Korean Society for Horticultural Science 42(2): 171-176. (2001)

NAL Call #: SB13.H28; ISSN: 0253-6498

Descriptors: chemical composition/ clay/ coal/ crop yield/ fly ash/ fruits/ growing media/ growth/ hydroponics/ nutrient solutions/ physicochemical properties/ porosity/ shale/ substrates/ tomatoes/ water uptake/ potting composts/ rooting media

Abstract: The possible replacement of imported

horticultural medium materials by home-made materials and the possible role of coal fly ash ball as a medium component for hydroponics were studied. The effects of mixing hard coal, soft coal, coal shale and coal fly ash on the physicochemical properties and growth of tomato plants were evaluated. Water absorption and apparent porosity of coal fly ash ball were controlled by the addition of hard coal, soft coal, coal shale and clay. Hard coal, soft coal and coal shale were used to make the pores in the medium. The surface of the medium was not good (showing, for example, surface cracks or fractures) when soft coal and coal shale were added. Clay was added to give the media plasticity. Greater amounts of clay in the mixture resulted in lower water absorption and apparent porosity. On the basis of water absorption and surface state after firing, the F80H15C5 (fly ash:hard coal:clay=80:15:5, w/w/w) medium was chosen for lab tests. For the pilot plant a new formula of F80H10C10 (fly ash:hard coal:clay=80:10:10, w/w/w) was used in the medium to overcome difficulties in shaping of the ball. No differences in tomato fruit yield were observed between media, but the ash ball medium recorded high soluble solids in the fruit. The yields were 200 g and 150 g per plant when the medium was supplied with a nutrient solution of 1.4 and 0.7 litres per plant, respectively. The soluble solid contents of tomato fruit were 5.5 degrees Brix and 8 degrees Brix in plants supplied with 1.4 and 0.7 litres of nutrient solution per plant, respectively. The stability of medium pH and EC was maintained throughout the experimental period, and no significant difference was observed in the mineral content of plants. Reproduced with permission from the CAB Abstracts database.

106. Development of synthetic light weight soil aggregates utilizing coal fly ash and mine clay as waste materials.

Jayasinghe, G. Y. and Tokashiki, Y.

Tropical Agricultural Research and Extension 8(1-12)(2005); ISSN: 1391-3646

Descriptors: aggregates/ bulk density/ clay/ coal/ fly ash/ mine spoil/ permeability/ soil density/ soil strength/ waste disposal/ waste management/ waste utilization/ water holding capacity/ mine wastes/ mining spoil/ mining wastes

Abstract: This paper presents an investigation of the development, evaluation and micro-morphological observations of synthetic light weight soil aggregates utilizing coal fly ash, Okinawa mine clay and used paper as waste materials. In this study, a series of aggregates were produced by using several fly ash application percentages from 0 to 100 with other waste materials as an alternative method of waste disposal. Relationship between applied coal ash percentage and different aggregate parameters such as bulk density, water holding capacity, permeability, aggregate strength, aggregate stability and mean weight diameter were determined. The results of the study showed that fly ash addition percentage had a correlation coefficient of 0.91 with the bulk density of the aggregates. Moreover coal ash addition percentage had correlation coefficients of 0.86, 0.95 and 0.96 with mean weight diameter difference, aggregate strength and loss percentage of finer fraction less than 1 mm respectively. Coal fly ash addition percentages below 40% showed low aggregate strength values. Highest aggregate strength was given with 100% of ash application. Bulk densities of all aggregates were in between 0.68-1.02 g/cm³ which is in the range of light

weight aggregates. Permeability of all aggregates showed an average value of 2.7x10⁻² cm/second. Water holding capacities of all treatments showed high values in between 0.69-0.74 litre/kg. pH values of aggregates were in the range of 5.85-8.25 and nitrogen percentages of all produced aggregates were in between 0.03-0.06%. Lowest loss percentage of finer fraction (less than 1 mm) was given at 100% of ash application after subjecting to mechanical shaking. Scanning electron microscopic (SEM) observations indicated that coal fly ash and mine clay particles are well enmeshed in the used paper matrix with starch as the binder to form stable light weight soil aggregates. Low application percentages of coal fly ash showed poor binding in SEM images. The study also revealed that aggregates produced by coal fly ash, mine clay and used paper with starch enhanced the aggregation while improving aggregate performances with increasing percentages of coal fly ash application. Reproduced with permission from the CAB Abstracts database.

107. Direct and residual effect of fertilization sources and time of application on equivalent yield of rice-potato cropping sequence and soil properties.

Rautray, S. K. and Swain, D. K.

Indian Journal of Hill Farming 16(1/2): 56-60. (2003); ISSN: 0970-6429

Descriptors: application date/ application rates/ application to land/ composts/ crop yield/ cropping systems/ farmyard manure/ fly ash/ green manures/ hyacinths/ nitrogen fertilizers/ NPK fertilizers/ nutrient content/ nutrient requirements/ organic amendments/ organic fertilizers/ phosphorus fertilizers/ potatoes / residual effects/ rice/ rice straw/ sandy loam soils/ soil fertility/ soil types/ straw/ superphosphates/ urea fertilizers/ dietary standards/ Filicopsida/ food requirements/ FYM/ land application/ nutritional requirements/ paddy/ phosphate fertilizers

Abstract: Field experiment was conducted at the experimental farm of Indian Institute of Technology, Kharagpur, West Bengal, India, during 1996-98 to investigate the direct effect of application of organic materials under integrated nutrient management with fly ash supplement on yield of rice and residual effects on yield of potato and properties of sandy loam soil. Paddy straw (PS), farmyard manure, water hyacinth compost (WH), green manure (*Sesbania rostrata*) and Azolla were the organic materials used. Equivalent nutrient level of 90:26:33 kg NPK/ha was supplied to rice crop through organic material and chemical fertilizer (CF, urea, single superphosphate and muriate of potash). However, in case of treatments involving PS, equivalent K level of 33 kg/ha could not be maintained because a higher dose (66.5 kg/ha) was added through 5 t PS. Organic materials and PA were incorporated into soil at 15 cm depth in three times of application, viz., 30 days before planting (DBP), 15 DBP and at planting. Direct effect of time of application on rice grain yield revealed that incorporation of organic materials at 15 DBP resulted in highest yield while application at planting resulted in lowest grain yield. Incorporation of organic materials in between 30 DBP of rice was equally beneficial on equivalent rice grain yield or rice-potato cropping sequence. Integrated nutrient management involving organic material and CF with fly ash at 10 t/ha as supplement applied to rice crop followed by recommended CF to potato crop was superior to continuous use of CF on

equivalent nutrient basis. Maximum equivalent rice yield of 12.6 t/ha was realized under integrated use of PS (5 t), complimentary CF (57.5 kg N and 18.5 kg P) and fly ash (10 t) for rice followed by 125:46:104 kg NPK through CF for potato.
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108. Direct and residual effect of flyash application to soil on crop yields and soil properties.

Grewal, K. S.; Yadav, P. S.; Mehta, S. C.; and Oswal, M. C. *Crop Research Hisar* 21(1): 60-65. (2001)

NAL Call #: SB4.C66 ; ISSN: 0970-4884

Descriptors: fertilizers/ fly ash/ residual effects/ soil properties/ soil temperature/ soil water/ wheat/ soil moisture

Abstract: The direct and residual effect of fly ash application/mixing on crop yields and soil properties was studied on a sandy loam soil at the Soil Research Farm of CCSHAU, Hisar. Fly ash collected from Thermal Power Plant, Faridabad in Haryana, was mixed @ 0, 5, 10 and 20% (w/w basis) in the plough layer (0-15 cm) of the soil. Also a 2.5 cm fly ash layer (equivalent to 10.6% w/w basis) was applied on the soil surface as a separate treatment. Pearl millet was grown in the kharif [monsoon] season and the residual effect was determined in wheat in rabi [winter]. Application of fly ash to soil increased both grain and straw yields of pearl millet (direct) and subsequent wheat (residual) crops significantly at all application rates. The maximum increase (32.9% in grain and 39.5% in straw of pearl millet and 32.4% in grain and 43.9% in straw of wheat over their respective controls) was observed with 20% fly ash mixed into the soil. Addition of fly ash to soil increased both the mean daily minimum and maximum soil temperatures during the emergence period of both the crops; however, these effects were more pronounced and beneficial during the winter (wheat) season. Fly ash application also resulted in greater moisture storage in the plough layer of soil at all the stages of crop growth. The uptake of N, P and K, both in grain and straw of pearl millet and wheat crops, was higher in fly ash treated plots than in controls.

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109. Direct and residual effects of agro-industrial wastes on a rocket salad (*Eruca sativa* Mill.) sorghum [*Sorghum bicolor* (L.) Moench] sequence.

Sharma, D. K.; Rana, D. S.; Kaushik, R.; Kumar, S.; and Joshi, H. C.

Acta Agronomica Hungarica 56(1): 99-106. (2008); ISSN: 0238-0161

Descriptors: composts / crop residues/ crop yield/ distillery effluent/ filter cake/ fly ash/ industrial wastes / leaves/ mineral uptake/ nitrogen content/ nitrogen fertilizers/ NPK fertilizers/ nutrient availability/ nutrient uptake/ phosphorus/ phosphorus fertilizers/ plant nutrition/ potassium/ potassium fertilizers/ residual effects/ seeds/ soil fertility/ sulfur/ sulfur fertilizers/ Capparales/ clarification mud/ elemental sulphur/ New Delhi/ phosphate fertilizers/ potash fertilizers/ sulphur/ sulphur fertilizers

Abstract: A field study was conducted during 2002-04 in New Delhi, India, to determine the effect of agro-based industrial wastes on rocket salad (*E. sativa*) and soil

properties, and how they can best be integrated with chemical fertilizers. The seed yield (1.80 t ha⁻¹) of rocket salad obtained by applying 5 t pressmud compost ha⁻¹ based on distillery effluent+half the recommended dose of NPKS (recommended dose: 60 kg N, 13 kg P 25 kg K and 20 kg S ha⁻¹) was on par with the seed yield (1.69 t ha⁻¹) recorded with the recommended dose of NPKS. However, the seed yield recorded with the former treatment significantly exceeded that obtained with 5 t ha⁻¹ of a 1:1 mixture of fly ash and distillery effluent+half the recommended dose of NPKS (by 30.4%) or 5 t ha⁻¹ of dry *Jatropha curcas* leaves+1/2 NPKS (by 24.1%). On the average, the distillery effluent-based pressmud compost+1/2 NPKS induced a perceptible increase in the soil available N, P and K, after the harvest of rocket salad, compared to the initial fertility status. The uptake of N, P, K and S in the seed and stover of rocket salad was the highest after the application of pressmud compost, closely followed by the recommended dose of NPKS, and the lowest in the control. The residual effect of the treatments given to rocket salad was significant on the fodder yield of succeeding sorghum (*Sorghum bicolor*). The fodder yield recorded with pressmud compost+1/2 NPKS was significantly higher than the other treatments. The application of pressmud compost alone was also significantly superior to the same rate of fly ash+effluent mixture or dry *J. curcas* leaves with respect to the seed yield of rocket salad, residual fertility after the harvest of rocket salad, and the fodder yield of succeeding sorghum.
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110. Direct and residual effects of fly ash integrated with FYM and chemical fertilizers on growth, yield and nutrient (major) uptake by crops on rice-groundnut cropping system in acid soils of Orissa.

Pradhan, K. C. and Sahu, S. K.

Environment and Ecology 22(2): 332-336. (2004)

NAL Call #: TD172.E5; ISSN: 0970-0420

Descriptors: acid soils/ crop yield/ farmyard manure/ fly ash/ groundnuts/ growth/ nitrogen fertilizers/ nutrient uptake/ phosphorus fertilizers/ potassium fertilizers/ residual effects/ rice/ soil types/ yield components/ FYM/ paddy/ peanuts/ phosphate fertilizers/ potash fertilizers

Abstract: A field investigation was undertaken to evaluate the direct and residual effects of fly ash on the growth, yield and uptake of some nutrients in a rice (cv. Lalat)-groundnut (cv. AK-12-24) cropping system in Orissa, India. Treatments comprised: T1, control; T2, 100% NPK at 80:40:40 kg/ha; T3, 10 t farmyard manure (FYM)/ha; T4, 20 t fly ash/ha; T5, 40 t fly ash/ha; T6, 20 t fly ash/ha + 50% NPK (40:20:20 kg/ha); T7, 40 t fly ash/ha + 50% NPK; T8, 20 t fly ash/ha + 50% NPK + 5 t FYM/ha; T9, 40 t fly ash/ha + 50% NPK + 5 t FYM/ha. Positive and significant direct and residual effects of fly ash applied alone or in combination with FYM or 50% recommended NPK were observed on the growth, yield and uptake of NPK by rice, followed by groundnut. T9 recorded the maximum grain yield, yield attributes and NPK uptake by rice. T9 was at par with T8. Similar results on groundnut were obtained in terms of the residual effects of these two treatments.
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111. Direct and residual supply of available sulphur and its balance sheet in rice-rice cropping sequence.

Sriramachandrasekharan, M. V.; Bhuvaneshwari, R.; and Ravichandran, M.

Advances in Plant Sciences 18(2): 699-703. (2005)

NAL Call #: QK1.A38; ISSN: 0970-3586

Descriptors: application rates/ clay loam soils/ crop yield/ dry matter accumulation/ farmyard manure/ filter cake/ fly ash/ green manures/ lignite/ nutrient availability/ organic amendments/ rice/ sequential cropping/ soil amendments/ soil fertility/ soil types/ sulfur/ Vertisols/ clarification mud/ elemental sulphur/ FYM/ Madras/ paddy/ sulphur

Abstract: A field experiment was conducted during kharif 2001 in an S-deficient clay loam soil (Typic Haplusterts) in Tamil Nadu, India, to investigate the direct and residual supply of S from different sources and its effect on rice-rice sequence. Treatments comprised 4 levels of S (0, 20, 40 and 60 kg/ha) with or without *Sesbania aculeata*, farmyard manure, sulfitation pressmud and lignite fly ash each applied at 12.5 t/ha. Results indicated that the organic amendments improved S availability and dry matter production of rice. To maintain sulfur fertility and higher dry matter production, application of 40 kg S/ha alone is needed. However, in combination with organic amendments, it is sufficient to apply 20 kg S/ha through gypsum.

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112. Distribution of exchangeable cations and trace elements in the profiles of soils amended with coal combustion by-products.

Kukier, U.; Sumner, M. E.; and Miller, W. P.

Soil Science 166(9): 585-597. (2001)

NAL Call #: 56.8 So3; ISSN: 0038-075X

Descriptors: Alfisols / arsenic/ boron/ calcium/ clay fraction/ coal / desulfurization/ exchangeable aluminium/ exchangeable calcium/ exchangeable cations/ exchangeable magnesium/ exchangeable potassium/ fly ash/ gypsum/ leaching/ lead/ magnesium/ nutrient availability/ nutrient deficiencies/ potassium/ sandy soils/ soil amendments/ soil fertility/ soil profiles/ soil types/ subsoil/ trace elements/ Ultisols/ desulphurization/ exchangeable aluminum/ microelements/ United States of America

Abstract: The flue gas desulfurization process employing forced oxidation technology generates an almost pure gypsum (FGD), which may substitute for mined gypsum used as a soil amendment in the southeastern USA. Under specific conditions, a mixture of FGD and fly ash (FA) may be produced by an electric power plant. A field experiment was conducted to study the effect of FGD applied both singly and as a 1:1 mixture with fly ash (AFGD) on the distribution of the exchangeable cations Ca, Mg, K, and Al and the trace elements B, As, and Pb in the profiles of soils having various textures. Lime was not applied in this study. The experiment was conducted in Tifton, Watkinsville, and Calhoun, Georgia, USA, on Pelham (loamy, siliceous, thermic Arenic Paleaquult), Cecil (clayey, kaolinitic, thermic Typic Kanhapludult), and Tupelo (fine mixed, thermic Vertic Paleudalf) highly weathered soils. The total amount of rainfall plus irrigation at these locations during the experimental period was 1385, 1418, and 1406 mm, respectively. Soil cores were collected to a depth of 70 or 80 cm ~13 months after by-product application. FGD

application increased exchangeable Ca levels in the subsoil. Exchangeable K levels were significantly decreased by FGD application only in a sandy soil. FGD promoted release of Mg from the soil sorptive complex and increased leaching of this element. Cations were transported most effectively in the profiles of a sandy soil. FA application increased plant available As in the surface layer of a sandy soil and plant available B in the zone of incorporation in the soils containing more clay, but it only partially alleviated deficiencies of this element. FA did not sufficiently supplement K and Mg losses induced by FGD application. The results of this study demonstrate that the FGD material had greater agronomic value than the mixed AFGD by-product.

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113. [Distributions and environmental impacts of selenium in wastes of coal from a power plant].

Xu, W. D.; Zeng, R. S.; Ye, D. N.; and Quero, X.

Huan Jing Ke Xue 26(2): 64-8. (Mar. 2005); ISSN: 0250-3301 .

Notes: Original language of article: Chinese.

Descriptors: air: analysis/ air pollutants: analysis/ carbon/ coal: analysis/ particle size/ particulate matter/ power plants/ selenium: analysis

Abstract: Samples of coals, fly ashes, slags and tiny fly ashes with different sizes, collected from a large power plant, were studied. It shows that Se tends not to be enriched in coarse fly ash and slag, but to be enriched in fine fly ashes especially in fine fly ash with size > 19.0 microm. This kind of distribution is shaped by: 1) volatility and organic-occurrence of Se in coal; 2) residence time in flue gases; 3) morphology of particles [holes on the surface of particles (> 19.0 microm) may adsorb more Se]. Sequence leaching test shows that Se is mainly organic-bonded (69.7%) in coal. Mass balance calculation of burned coal indicates that 16.5% of Se in coal may be disposed into air directly. The environmental impacts of Se in fine fly ashes can be ignored because of its small proportion and distributional character (mainly in particles with sizes > 19.0 microm). Se in slag may cause little environmental impacts. Se in coarse fly ash is partially mobile and may be used to benefit the soil which is lack of Se.

This citation is from PubMed.

114. Ecotoxicological hazard and risk assessment of heavy metal contents in agricultural soils of central Germany.

Manz, M.; Weissflog, L.; Kuhne, R.; and Schurmann, G.

Ecotoxicology and Environmental Safety 42(2): 191-201.

(Feb. 1999); ISSN: 0147-6513 .

10051370

Descriptors: Acid Rain/ Agriculture/ Germany/ Hydrogen-Ion Concentration/ Metals, Heavy: toxicity/ Models, Statistical/ Risk Assessment/ Safety Management/ Soil: analysis/ Soil Pollutants: toxicity/ Triticum: chemistry

Abstract: Heavy metal content of agricultural topsoils has been experimentally determined at 14 areas in the German Leipzig-Halle-Bitterfeld region covering ca. 3700 km². For most of the locations and elements, the contamination levels are comparable to those of other agricultural sites in Germany and Europe. Application of a sequential extraction technique revealed relatively low contamination levels in

the mobile fractions, which indicates a correspondingly low degree of bioavailability of the heavy metals under the current milieu conditions. In contrast, acidification of the soil due to a drastic decrease in the deposition of calciferous fly ash would lead to a significantly increased ecotoxicological hazard potential, as is analyzed by a probabilistic distribution method that quantifies the overlap of normalized exposure and effect data. The discussion includes recommendations for further improvement of risk assessment schemes addressing soil contamination. This citation is from PubMed.

115. Effect of a fly ash and gypsum mixture on rice cultivation.

Lee YongBok; Ha HoSung; Park BumKi; Cho JuSik; and Kim PilJoo

Soil Science and Plant Nutrition 48(2): 171-178. (2002)

NAL Call #: 56.8 SO38 ; ISSN: 0038-0768

Descriptors: boron/ calcium/ crop yield/ exchangeable calcium/ fly ash/ gypsum/ liming/ liming materials/ nutrient availability/ nutrient balance/ nutrient uptake/ paddy soils/ phosphate/ plant nutrition/ rice/ silicates/ silt loam soils/ soil amendments/ soil fertility/ soil types/ paddy/ South Korea

Abstract: Paddy soil in Korea generally required the addition of silicate to enhance rice productivity. Even though a silicate fertilizer has been applied at 4-year intervals by the Korean government, the quantity has not been sufficient, due to financial constraints, and an alternative source of cheaper silicate is required. Fly ash, which has a high silicate content, was selected as an alternative in the present study. To improve fly ash, which is highly alkaline and has a high boron content, the material was mixed with a by-product of gypsum (hereafter, described as gypsum) and the pH changes were monitored in water using an incubation test. The initial pH of the water suspension was compatible with the optimum range (~6.5-7.0) for rice using a mixture of 75% fly ash and 25% gypsum. A field experiment was carried out to evaluate the productivity of rice (*Oryza sativa*) on silt loamy soil to which 0 (FG 0), 20 (FG 20), 40 (FG 40), or 60 (FG 60) t ha⁻¹ of the mixture were added. Silicate and lime treatments were selected as a control. The highest rice yield was achieved following the addition of 40 t ha⁻¹ of the mixture to the soil. The mixture of fly ash and gypsum increased the uptake of silicate and phosphate and the amount of exchangeable calcium in the soil. The plant elemental uptake revealed that the application of the fly ash and gypsum mixture did not result in an excessive uptake of heavy metals by the rice in the submerged paddy soil. The amount of available boron increased with the increase in the amount of fly ash up to 0.62 mg kg⁻¹ following the application of 60 t ha⁻¹ of the mixture, but did not reach toxicity levels for rice, probably due to the dilution and leaching effects under the submerged growing conditions. It is concluded that the fly ash and gypsum mixture could be a good alternative to inorganic soil amendments to restore the soil nutrient balance in paddy soil.

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116. The effect of alkaline-stabilized sludge application on the microbiological quality of soil and leachate.

Kocaer, F. O.; Alkan, U.; and Baskaya, H. S.

Journal of Plant Nutrition and Soil Science 167(6): 704-712. (2004)

NAL Call #: 384 Z343A ; ISSN: 1436-8730

Descriptors: application to land/ artificial precipitation/ coliform bacteria/ fly ash/ heterotrophic microorganisms/ leachates/ leaching/ microbial flora/ population density/ sewage sludge/ soil bacteria/ soil profiles/ solutes/ spatial distribution/ transport processes/ land application/ microflora/ soil transport processes/ transport processes in soil systems

Abstract: The influences of fly ash and fly-ash-quicklime-treated-sludge mixtures (with fly-ash doses of 40%, 80%, and 120% on dry-weight basis) on the microbial numbers in soil and leachate were investigated by using 60 cm soil columns. Heterotrophic bacteria and total coliform numbers were determined in soil and leachate samples following an artificial rainfall event. The results indicated that land application of untreated sludge and fly-ash-sludge mixtures appear to introduce large numbers of bacteria to leachates and soil. Although the numbers in leachates and soils were found to decrease with increasing ash ratios, they were still all significantly above the control levels. Application of alkaline-stabilized and pasteurized sludge did not increase bacterial numbers significantly in soil and leachate. Distribution of heterotrophic bacteria through soil profile clearly showed no increase in soils amended with alkaline-stabilized and pasteurized sludges. Additionally, no significant inhibitory effect of lignite fly ash on soil microbial population was observed.

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117. Effect of cellulose decomposing fungi, cowdung slurry and fly ash on the decomposition and mineralization of rice straw.

Saha, H. and Hajra, J. N.

Environment and Ecology 22(Spl 4): 714-718. (2004)

NAL Call #: TD172.E5; ISSN: 0970-0420

Descriptors: ammonium nitrogen/ carbon dioxide/ cattle manure/ cellulose/ citric acid/ composting/ decomposition/ fly ash/ mineralization/ phosphorus/ rice/ rice straw/ soil fungi/ straw/ Acrophialophora/ Acrophialophora fusicarpa / ammonia nitrogen/ Hyphomycetes/ paddy/ Trichuriella/ Trichurus/ Trichurus spiralis

Abstract: The effect of two cellulose decomposing fungi, cowdung slurry and fly ash on the decomposition and mineralization of rice straw was studied in two related incubation experiments. In the first incubation study, rice straw (RS) was inoculated with *Trichurus spiralis* (TS), *Paecilomyces fusicarpus* [*Acrophialophora fusicarpa*] (PF) as cellulose decomposing fungi and cowdung slurry (CDS) as natural harborer of different enzymes and microorganisms, alone and in different combinations. In the second incubation study, rice straw along with best inoculum combination (TS+PF+CDS), selected from the first experiment, was treated with different levels of fly ash, viz. 5, 10 and 25%. In the first incubation study, maximum amount of CO₂ was evolved in the inoculum combination of TS+PF+CDS (7144.6 mg) followed by TS+PF (6420.1 mg), IS (5008.9 mg), PF (4560.8 mg), CDS (4180 mg) and control, i. e., rice straw only (2987.0 mg). Though CO₂ values of TS+PF+CDS and TS+PF were found statistically at par, mineralization studies indicated significantly higher values of NH₄-N (40 ppm), NO₃-N (72 ppm), total P (0.71%) and citric acid soluble P (0.41%) in TS+PF+CDS treatment compared to those in TS+PF treatment. In the second incubation study, application of fly ash irrespective of levels

decreased significantly the decomposition of rice straw inoculated with TS+PF+CDS over control in terms of CO₂ evolution and weight loss as well as mineralization with respect to NH₄-N, NO₃-N, total P and citric acid soluble P. Highest CO₂ evolution was recorded in control i. e., rice straw without fly ash (6936.5 mg) followed by FA at 5% (6262.3 mg), 10% (5775.8 mg) and 15% (5259.4 mg). Considering both the parameters of decomposition and mineralization, *Trichurus spiralis*, *Paecilomyces fusicaporus* along with cowdung slurry can be used as inoculum in large scale composting. Further, fly ash should not be used in composting system as an additive. Reproduced with permission from the CAB Abstracts database.

118. Effect of certain cultural practices on nematode management in a small-scale farming system.

Berry, S.; Cadet, P.; and Spaul, V. W. Kwa Shukela, Mount Edgecombe, South Africa.; pp. 149-164; 2005.
Descriptors: aldicarb / bagasse/ chemical control/ crop production/ crop yield/ cropping systems/ cultural control / farming systems/ farmyard manure/ fly ash/ free living nematodes/ green manures/ groundnuts/ integrated control/ intercropping/ intercrops/ Lima beans/ manures/ nematicides/ nematode control/ organic amendments/ pest control/ plant parasitic nematodes / plant pests/ roots/ sets/ shoots/ sweet potatoes/ agricultural systems/ eelworms/ FYM/ integrated plant protection/ peanuts/ setts
Abstract: Field trials were conducted on a small-scale grower farm in Amatikulu (under rainfed conditions) and Boschfontein (under irrigation), South Africa. The treatments comprised: organic amendments (bagasse, kraal manure and fly ash) applied around the cane set at planting; and intercropping between the sugarcane rows with velvet beans (*Mucuna deeringiana*), sweet potatoes (*Ipomoea batatas*), sugarbeans (*Phaseolus limensis* [P. lunatus]) and groundnuts (*Arachis hypogaea*). These treatments were compared with the control and nematicide (aldicarb at 150 g/kg)-treated plots. In the plant crop, intercropping with velvet beans, sweet potatoes and groundnuts increased nematode infestation in the sett and shoot roots. Conversely, nematicide and bagasse treatments decreased sett, shoot and root infestations. Bagasse, kraal manure and fly ash increased the multiplication of free-living nematodes, which are important in improving overall soil health. The two treatments that resulted in increased yield, relative to the control, were applying nematicide at planting (average increase of 18 and 20% cane and ERC yields, respectively) and applying kraal manure below and above the sett at planting (average increase of 21 and 20% cane and ERC yields, respectively). Kraal manure is a particularly useful amendment for small-scale farmers as it can be produced on the farm by the grower and has been shown to improve sett root germination and provides nutrients through decomposition. These results show that there are alternative control methods (other than nematicides) available to small-scale farmers to improve their productivity on poor soils. Reproduced with permission from the CAB Abstracts database.

119. Effect of co-application of fly ash and sewage sludge on growth, yield of okra (*Abelmoschus esculentus* L.) and some soil properties.

Yeledhalli, N. A. and Ravi, M. V.
Asian Journal of Soil Science 3(1): 71-75. (2008); ISSN: 0973-4775

Descriptors: application to land/ biomass/ bulk density/ crop yield / fly ash/ growth/ nutrient availability/ nutrient uptake/ okras/ organic carbon/ sewage sludge/ soil amendments/ soil density/ soil organic matter/ soil physical properties/ solid wastes/ use efficiency/ waste utilization/ land application/ Mysore/ organic matter in soil/ physical properties of soil

Abstract: Field study was conducted in the new orchard of the Division of Horticulture, Raichur, Karnataka, India, with the objective of improving physical condition of soil, nutrient use efficiency and uptake by the okra (*Abelmoschus esculentus*) on addition of fly ash and sewage sludge. The study examined the nutrient solubility and availability resulting from land application of fly ash and sewage sludge. The nutrient uptake was monitored in different plant parts of the okra. The results of field experiments indicated that application of 52 tonnes ha⁻¹ fly ash or sewage sludge individually or together in 50:50 proportion increased the pod yield of okra by 18.48, 61.88 and 64.00% over no solid waste control. There was efficient use of nutrient during the early stage of crop up to 45 days after sowing, which contributed for higher pod yield and biomass. Further, incorporation of solid waste along with varied levels of recommended dose of fertilizers significantly increased the organic carbon content, nutrient availability and decreased the bulk density of the soil. The results support the use of solid waste as amendment and nutrient source for land application.

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120. Effect of co-application of organics with fly ash on productive parameters and nutrient uptake by cowpea (*Vigna unguiculata* L.).

Yeledhalli, N. A.; Prakash, S. S.; and Ravi, M. V.
Environment and Ecology 26(3): 996-1000. (2008)
NAL Call #: TD172.E5; ISSN: 0970-0420

Descriptors: biogas slurry/ cowpeas/ crop yield/ farmyard manure/ fly ash/ nitrogen fertilizers/ NPK fertilizers/ nutrient uptake/ organic amendments/ phosphorus fertilizers/ plant nutrition/ potassium fertilizers/ poultry manure/ sewage sludge/ soil amendments/ soil conditioners/ trace elements/ vermicompost/ black eyed peas/ FYM/ microelements/ Mysore/ phosphate fertilizers/ potash fertilizers/ poultry litter/ southern peas

Abstract: A pot culture study was conducted Raichur, Karnataka, India, in 2001 to evaluate the co-application of organics with fly ash on the productive parameters and nutrient uptake by cowpea. The seed yield of cowpea increased significantly due to co-application of fly ash at 30 t/ha with sewage sludge at 20 t/ha, poultry manure at 5 t/ha, vermicompost at 2.5 t/ha, biogas sludge at 5 t/ha and farmyard manure at 20 t/ha with or without the recommended dose (25:30:25 kg/ha) of N:P:K fertilizers (RDF). The seed yield of cowpea increased by 6-12% over the RDF and was maximum (16.02 g/pot) in the treatment

receiving poultry manure as a biosolid along with fly ash. The uptake of macro and micronutrients by cowpea plant parts at different growth stages increased significantly due to combined application of biosolids and fly ash. The mutual beneficial effect of the mixture compared to fly ash alone act as a good soil conditioner and show better fertilization value for agriculture utilization. Reproduced with permission from the CAB Abstracts database.

121. Effect of coal fly ash on pigeon pea (*Cajanus cajan* L.).

Das, R. K. and Jha, B.

Journal of Ecotoxicology and Environmental Monitoring 10(3/4): 253-257. (2000); ISSN: 0971-0965

Descriptors: chromosome aberrations/ fly ash/ mitosis/ phytotoxicity/ pigeon peas/ seed germination/ seedling growth/ soil amendments/ toxicity/ chromosome abnormalities

Abstract: Healthy pigeonpea seeds were germinated in experimental pots or Petri dishes and subjected to different concentrations (15-75%) of fly ash in water. Increasing concentration of fly ash (45% or greater) decreased percentage germination and seedling growth, while there was a slight stimulation of plant height and root length at 15-30% fly ash. High concentrations of fly ash decreased mitotic index and increased mitotic abnormalities. Reproduced with permission from the CAB Abstracts database.

122. Effect of different combinations of flyash and soil on growth attributes of forest and dryland fruit crops.

Malewar, G. U.; Adsul, P. B.; and Syed Ismail

Indian Journal of Forestry 21(2): 124-127. (1998); ISSN: 0250-524X

Descriptors: fertilizers/ fly ash/ forest trees/ fruit trees/ growing media/ multipurpose trees/ pot experimentation/ seedling growth/ trees/ waste utilization/ woody plants/ neem/ potting composts/ rooting media

Abstract: A pot experiment was conducted using 5 fly ash and soil levels (T_1 , fly ash alone; T_2 , 3:1 fly ash and soil; T_3 , 1:1 fly ash and soil; T_4 , 1:3 fly ash and soil; and T_5 , soil alone) to grow nilgiri (*Eucalyptus globulus*), neem (*Azadirachta indica*), custard apple (*Annona squamosa*) and jamun (*Syzygium cumini*) at Marathwada Agricultural University, Parbhani, Maharashtra (India) during 1995-96. All the treatments were given NPK fertilizer at the time of transplanting to the pots. Growth measurements were made over 6 months. Plant height, number of leaves, number of branches, root weight and shoot weight of the plants were affected significantly by the different fly ash and soil combinations. Overall, soil alone was the best growing medium, but some of the fly ash treatments performed better for some growth parameters for some species. Reproduced with permission from the CAB Abstracts database.

123. Effect of fertilizer application on development of potato gangrene II. Effect of boron and calcium fertilizer application.

Kondo, F.; Ushiki, J.; Fukuda, Y.; Ueda, M.; and Naito, S.

Japanese Journal of Soil Science and Plant Nutrition 72(2): 230-236. (2001); ISSN: 0029-0610

Descriptors: boron fertilizers/ calcium fertilizers/ crop yield/ desulfurization/ fly ash/ fungal diseases/ industrial wastes/

necroses/ plant diseases/ plant pathogenic fungi/ plant pathogens/ postharvest decay/ potatoes/ Regosols/ sandy soils/ soil types/ tubers/ waste utilization/ Coelomycetes/ desulphurization/ phytopathogens/ rhegosols

Abstract: Previous study showed that spent flue gas desulfurization absorbent residue (SGDAR), which consists of gypsum and coal ash which contain a large amount of Ca and B, respectively, suppressed development of gangrene during storage of potatoes grown on sandy soil (Volcanic Regosols) in Hayakita-cho, Hokkaido, Japan. A field experiment was conducted in this area in 1998 which showed that application of Ca as gypsum (1.6 tonnes Ca/ha) suppressed development of gangrene. Application of B (1.6 kg B/ha) as coal ash or fitted trace element did not suppress it. The results indicated that Ca eluted from gypsum in SGDAR increased the resistance of the tuber from the infection of *Phoma exigua*, thus, SGDAR and gypsum promoted the growth of the tuber and increased the tuber yield, and coal ash and FTE increased the number of tubers.

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124. Effect of flue gas desulfurization residue on plant establishment and soil and leachate quality.

Punshon, T.; Adriano, D. C.; and Weber, J. T.

Journal of Environmental Quality 30(3): 1071-80. (May 2001-June 2001)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: Agriculture/ Air Pollution: prevention & control / Coal/ Gases/ Gossypium/ Hydrogen-Ion Concentration/ Incineration/ Plants: growth & development/ Power Plants/ Soil Pollutants/ Soybeans/ Sulfur: chemistry/ Sulfur Dioxide: chemistry/ Trace Elements: analysis: pharmacokinetics/ Zea mays

Abstract: Effects on soil quality and crop establishment after incorporation of flue gas desulfurization by-product (FGD) into soil as an amendment was assessed in a mesocosm study. Mesocosm units received applications equivalent to 0, 2.5, 5.0, 7.5, and 10% FGD residue [0, 25, 50, 75, and 100 tons acre⁻¹]. Germination, biomass production, and elemental composition of corn (*Zea mays* L. var. Dekalb DK-683), soybean [*Glycine max* (L.) Merr. var. Haskell Pupa 94], radish (*Raphanus sativus* L. var. Sparkler), and cotton (*Gossypium hirsutum* L. var. Deltapine 51) were determined. The quality of leachates and soil were also determined periodically. Flue gas desulfurization residue did not affect germination and all application rates stimulated aboveground biomass. Plants grown in FGD-amended soil contained significantly elevated tissue concentrations of As, B, Se, and Mo. The FGD residue elevated surface soil pH from 5.5 (Control) to 8.1 (at 10% FGD). Leachate pH was unaffected by FGD, but salinity rose sharply with increasing application rates of FGD. Leachates contained higher concentrations of B, with small increases in Se and As. Flue gas desulfurization residue application caused an increase in total B, As, Mo, Se, and extractable Ca in the soil, but decreased Mn and Zn. Using FGD residues could have beneficial effects on crop establishment without detrimental effects on soil or leachate quality, at an optimum rate of approximately 2.5%. This material could alleviate surface acidity, and B and Mo deficiencies in plants.

This citation is from PubMed.

125. Effect of fly ash alone or in combination with organic material and mineral fertiliser on crop yield and economics of rice-peanut cropping system.

Swain, D. K.; Mittra, B. N.; and Ghosh, B. C.

Fertiliser News 49(5): 51-55. (2004)

NAL Call #: 57.8 F4123; ISSN: 0015-0266

Descriptors: acid soils/ application date/ application methods/ application rates/ crop yield/ cropping systems/ economic analysis/ farmyard manure/ fly ash/ groundnuts/ lateritic soils/ NPK fertilizers/ organic amendments/ rice/ sandy loam soils/ soil types/ FYM/ paddy/ peanuts

Abstract: The field experiment with rice-groundnut cropping system was conducted in Research Farm of Agricultural and Food Engineering Department, Indian Institute of Technology, Kharagpur, West Bengal, India during 1997 to 1999 to investigate the effect of fly ash (FA) alone or in combination with organic material and mineral fertilizer on crop yield and economics of rice-groundnut cropping system. Rice (cv. IR 36) crop was grown during wet season (June-October) of 1997 (first season) and 1998 (third season) and groundnut (cv. AK 12-24) during dry seasons (January-May) of 1998 (second season) and 1999 (fourth season). The soil was acid lateritic and sandy loam in texture. FA was applied at 10, 20 and 40 t ha⁻¹ either in one season or in equal splits in two or four seasons. Besides, there was a control where no FA was applied. Seven modes of FA application were tried with recommended fertilizer level (F₁) and without fertilizer (F₀-control). The recommended fertilizer levels 90:26.2:33.3 and 30:26.2:33.3 kg ha⁻¹ of N:P:K for rice and groundnut respectively were maintained through integrated fertilizer application involving farmyard manure (FYM) and mineral fertilizer (CF). The quantity of FYM was decided at 30 kg N ha⁻¹ to rice and half of the dose to groundnut crop. Application of FA at 40 t ha⁻¹ in the first season and no application for the following three seasons (FA₄₀₋₀₋₀₋₀), 20 t ha⁻¹ in the first and third seasons (FA₂₀₋₀₋₂₀₋₀) and 10 t ha⁻¹ in all the four seasons (FA₁₀₋₁₀₋₁₀₋₁₀) were comparable for increasing the rice grain yield. For groundnut, in the absence of fertilizer, the application modes of FA at 40 t ha⁻¹ were at par whereas, in presence of fertilizer, split application modes (FA₂₀₋₀₋₂₀₋₀ and FA₁₀₋₁₀₋₁₀₋₁₀) were significantly better than single application (FA₄₀₋₀₋₀₋₀) in increasing pod yield during the fourth season. The trend remained the same in rice grain equivalent yield. Fly ash applied at lower level (FA₂₀) in single mode had higher agro-economic efficiency as compared to its split mode, whereas, at higher level (FA₄₀) split mode was better than single mode. The effect of FA was more discernible when this was applied in combination with FYM and CF as an integrated fertilizer application.

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126. Effect of fly ash amended soil on the development of root-knot nematode.

Tanweer Azam; Hisamuddin ; Niyaz, T.; and Robab, M. I.

Indian Journal of Nematology 37(2): 119-122. (2007)

NAL Call #: QL391.N4I5; ISSN: 0303-6960.

Notes: Original title: Meloidogyne incognita and growth of ivy gourd, Coccinea cordifolia.

Descriptors: chemical composition/ chlorophyll/ crop yield/ cultural control/ fly ash/ fruits/ medicinal plants/ nematode control/ pest control/ plant composition/ plant development/ plant nutrition/ plant parasitic nematodes/ protein content/

chemical constituents of plants/ drug plants/ eelworms/ medicinal herbs/ officinal plants/ Secernentea/ Tylenchida

Abstract: Coccinea cordifolia [Coccinia grandis], a wildly growing cucurbit plant having medicinal properties, was tested on plant growth, biochemical and pathological characteristics in fly ash (0, 10, 20, 30, 40 and 50%) amended soil infested with the root-knot nematode, M. incognita. The length, fresh weight and dry weight of the plants in comparison to control were significantly decreased in all the treatments except in treatment that received 30% fly ash. The number of flowers, fruits per plant, and the average leaf area exhibited the same pattern. Amount of chlorophyll and protein content of plants decreased significantly in all the treatments of 0 to 50% fly ash levels except 30% fly ash level. Number of gall and number of egg masses per plant decreased in 10 to 50% fly ash levels, when compared with 0% fly ash level amended plants. Reproduced with permission from the CAB Abstracts database.

127. Effect of fly-ash amended soil on the growth and yield of (chickpea), Cicer arietinum (L.).

Pandey, V. C.; Verma, S. C.; and Tewari, D. D.

Flora and Fauna Jhansi 11(1): 71-73. (2005); ISSN: 0971-6920

Descriptors: application rates/ biomass/ biomass production/ branches/ chickpeas/ crop yield/ fly ash/ growth/ plant development/ pods/ root nodules/ shoots

Abstract: A study was conducted to assess the growth performance of chickpea (Cicer arietinum) under the stress of fly ash (FA)-amended soil in Uttar Pradesh, India. The plants raised from certified seeds were treated with various concentrations of FA (25, 50 and 100%) and an untreated control (100% soil). Low concentrations FA showed better growth performance compared to high concentrations of FA. However, in some cases, low FA concentration promoted biomass only. FA inhibited shoot growth in dose- and time-dependent manner. Plants grown in 100% FA showed less number of branches compared to plants grown in the control. In case of the number of nodules, lower FA concentrations (25 and 50%) showed better performance than the control. Treatment with 50% FA recorded higher number of pods per plant than the other FA treatments, although the control treatment produced the highest number of pods per plant among all treatments.

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128. Effect of fly-ash amendment on germination behavior and seedling survival on certain cultivated legumes.

Prasad, B. K.; Banerjee, S. K.; and Roy, H.

Environment and Ecology 18(1): 210-216. (2000)

NAL Call #: TD172.E5; ISSN: 0970-0420

Descriptors: acid soils/ calcareous soils/ fly ash/ fruit vegetables/ green gram/ legumes/ loam soils / mung beans/ peas/ seed germination/ seedlings/ soil amendments/ survival/ vegetable legumes/ vegetables/ mung bean/ pea/ vegetable crops

Abstract: The effects of fly ash on seed germination and seedling survival of Vigna radiata cv. K-851 and peas cv. Azad P-1 in acid loam soil and calcareous soil were investigated. Germination percentage in V. radiata was highest with 20% fly ash (wt./wt.) in acid loam soil and 60% fly ash in calcareous soil. Germination of peas was highest

with 60% fly ash in both soil types. Seedling survival not generally affected even by the highest rates of fly ash. Reproduced with permission from the CAB Abstracts database.

129. Effect of fly ash and farmyard manure on soil enzyme activities and yield of rice grown on an inceptisol.

Reddy, T. P.; Devi, M. U.; Rao, P. C.; and Bhanumurthy, V. B.

Crop Research Hisar 34(1/3): 27-31. (2007)

NAL Call #: SB4.C66 ; ISSN: 0970-4884

Descriptors: acid phosphatase/ alkaline phosphatase/ ammonium/ application rates/ cellulase/ crop yield/ enzyme activity/ enzymes/ farmyard manure/ fly ash/ Inceptisols/ oxidoreductases/ rice/ urease/ acid phosphomonoesterase/ alkaline phosphomonoesterase/ FYM/ paddy/ redox enzymes

Abstract: A field experiment was conducted in a fine loamy mixed hyperthermic Typic Haplustep soil during rabi 2004-05 to study the effect of fly ash and FYM on rice yield and soil enzyme activities. The grain and straw yield of rice was significantly increased with fly ash, FYM and their interactions. The highest grain (5.84 t/ha) and straw yield (7.87 t/ha) was recorded by combined application of fly ash @ 10 t/ha and FYM @ 10 t/ha which was on par with fly ash @ 15 t/ha alongwith FYM @ 10 t/ha. Application of fly ash @ 15 t/ha alongwith FYM @ 10 t/ha has resulted in highest urease, dehydrogenase and cellulase activity at 30 DAT (4.48 micro g of NH_4^+ released/g soil/h, 5.37 mg of TPF produced/g soil/d and 3.50 mg of glucose released/g soil/d), 60 DAT (4.80 micro g of NH_4^+ released/g soil/h, 5.47 mg of TPF produced/g soil/d and 3.32 mg of glucose released/g soil/d) and at harvest (2.53 micro g of NH_4^+ released/g soil/h, 3.07 mg of TPF produced/g soil/d and 2.16 mg of glucose released/g soil/d), respectively, which was on par with application of fly ash @ 10 t/ha alongwith FYM @ 10 t/ha and significantly higher over control. The acid and alkaline phosphatase activity was not influenced by fly ash levels at all the stages viz., 30, 60 DAT and at harvest. However, it was significantly influenced by FYM application and their interactions. Reproduced with permission from the CAB Abstracts database.

130. Effect of fly ash and fertilizer levels on yield and trace metal uptake by soybean and wheat crops.

Arvind Kumar; Sarkar, A. K.; Singh, R P; and Sharma, V. N. *Journal of the Indian Society of Soil Science* 47(4): 744-748. (1999)

NAL Call #: 56.9 IN2; ISSN: 0019-638X

Descriptors: animal health/ application rates/ cereal grains/ cobalt/ fertilizers/ fly ash/ grain/ hazards/ incorporation/ lead/ metals/ nickel/ NPK fertilizers/ residual effects/ sequential cropping/ soyabeans/ toxicity/ trace elements/ uptake/ wheat/ yields/ microelements/ soybeans

Abstract: Field experiments were conducted in Bihar state, India, to study the effect of fly ash incorporation in soil on yield and quality of soyabean and wheat crops. Results indicate that fly ash incorporation in soil increased the grain yield of both soyabean and wheat crops. The percentage increase in grain yield with graded levels of fly ash (4 to

16%) ranged from 55 to 90 in soyabean and from 60 to 84 in wheat. Application of graded levels of fertilizers (50 and 100% NPK) showed similar results especially at higher levels of fly ash incorporation. A considerable residual effect of fly ash was apparent on yield of wheat, but levels of fly ash incorporation did not vary significantly in this regard. Content of trace metals in soyabean and wheat grain showed considerable increase when grown in fly ash incorporated soil. Trace metal uptake by crops was significantly increased by fly ash and fertilizer application in soil. Higher uptake of Pb (29 to 141 g ha⁻¹), Ni (18 to 86 g ha⁻¹) and Co (23 to 109 g ha⁻¹) by wheat grown in fly ash incorporated soil can cause plant and animal health hazards.

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131. Effect of fly ash and FYM on nutrient availability in soil and yield of sweet potato.

Birajdar, R. R.; Chalwade, P. B.; Badole, S. B.; Hangarge, D. S.; and Shelage, B. S.

Journal of Soils and Crops 10(2): 248-251. (2000); ISSN: 0971-2836

Descriptors: calcium/ fly ash/ magnesium/ manures/ soil amendments/ soil chemistry/ sweet potatoes/ yield

Abstract: The effects of fly ash (0,5,10 and 15 t/ha) and farmyard manure (FYM) (10 and 15 t/ha) on yield of sweet potatoes and available contents of nutrients in the soil after harvest were studied in a randomized block design trial on vertisol during the rabi season in 1996-97. Application of both fly ash and FYM increased tuber yield significantly, with FYM having the greater effect. Nutrient availability and exchangeable Ca and Mg were also found to be significantly greater in plots with FYM than with fly ash or the control.

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132. Effect of fly ash and FYM on nutrient uptake and yield of onion.

Patil, P. V.; Chalwade, P. B.; Solanke, A. S.; and Kulkarni, V. K.

Journal of Soils and Crops 15(1): 187-192. (2005); ISSN: 0971-2836

Descriptors: application rates/ crop yield/ farmyard manure/ fly ash/ nitrogen/ nutrient uptake/ onion harvesters/ onions/ phosphorus/ plant nutrition/ potassium/ FYM

Abstract: Studies were conducted at the Department of Horticulture, MAU, Parbhani, Maharashtra, India, during the cropping season of 1999 to investigate the effect of fly ash and farmyard manure (FYM) on nutrient uptake and yield of onion. The treatments include four levels each of fly ash and FYM (0, 5, 15 and 30 t ha⁻¹) with their sixteen combinations. Results indicated that with the increasing level of fly ash and FYM, there was a corresponding increase in the uptake of nitrogen, phosphorus and potassium. Onion yield was also increased by increasing levels of fly ash and FYM, later having more influence on yield of onion bulbs. Thus, fly ash can also be used at 30 tonnes ha⁻¹ without affecting the crop yield.

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133. Effect of fly ash and FYM on physico-chemical properties of Vertisols.

Patil, P. V.; Chalwade, P. B.; Solanke, A. S.; and Kulkarni, V. K.

Journal of Soils and Crops 13(1): 59-64. (2003); ISSN: 0971-2836

Descriptors: bulk density/ calcium carbonate/ electrical conductivity/ farmyard manure/ fly ash/ infiltration/ organic carbon/ physicochemical properties/ porosity/ soil chemical properties/ soil pH/ soil physical properties/ soil types/ Vertisols/ water holding capacity/ chemical properties of soil/ FYM/ physical properties of soil

Abstract: A field experiment was conducted in Parbhani, Maharashtra, India during summer season of 1998-99 to investigate the effect of fly ash and farmyard manure (FYM) on the physicochemical properties of Vertisols. The soil was clayey in texture dominated by montmorillonite clay with high coefficient of expansion and shrinkage. The fly ash treatments were: fly ash at 0 t/ha (F0); fly ash at 5 t/ha (F1); fly ash at 15 t/ha (F2); fly ash at 30 t/ha (F3) and FYM treatments at 0, 5, 15 and 30 t/ha designated as M0, M1, M2, and M3, respectively. Results showed that bulk density, porosity, infiltration rate and water holding capacity of soil were significantly affected due to application of different levels of fly ash and FYM. Fly ash at 30 t/ha showed reduction in bulk density and water holding capacity and increased in porosity and infiltration rate. Soil pH decreased with the increased of fly ash and FYM. Electrical conductivity increased with increasing level of fly ash and the similar effect of FYM was also observed. The amount of calcium carbonate decreased with the increasing levels of fly ash and FYM. Organic carbon was decreased with the increasing levels of fly ash and increased with the increasing levels of FYM.

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134. The effect of fly ash and the product left after purification of waste gases on yield and chemical composition of spring rape.

Gregorczyk, A.

Folia Universitatis Agriculturae Stetinensis, Agricultura 81(181-186)(2000).

Notes: Original title: Wpływ popiołu lotnego i produktu powstającego z oczyszczania gazów odlotowych na plon i skład chemiczny rzepaku jarego.

Descriptors: application rates/ chemical composition/ crop yield/ fertilizers/ fly ash/ gases/ heavy metals / industrial wastes/ nitrogen fertilizers/ purification/ rape/ swede rape/ canola/ Capparales/ oilseed rape

Abstract: A trial of the use of fly ash from Dolna Odra power station along with the product of removing SO₂ and NO_x from waste gas coming from power station Kaweczyn, Poland as a source of fertilizer for crops was undertaken. A pot experiment was conducted with spring rape cv. Evita grown in sandy soil. Fly ash was applied at 0.3 or 0.6 kg per 9-kg capacity Mitscherlich pot and N was applied at 0.5, 1.5 or 3.0 g per pot. No significant differences were found in the yield of the seeds in the different treatments. The application of 0.6 kg ash per pot reduced dry matter yield compared with the control. Heavy metal content was within the limits of concentrations found under normal growing conditions.

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135. Effect of fly ash application on forage productivity, nutrient content and physiology of sorghum-cowpea intercrops.

Das, S. K.; Bhatt, R. K.; Yadava, R. B.; Suresh, G.; Kareemulla, K.; Rai, A. K.; Mojumder, A. B.; Pathak, P. S.; Singh, D. K.; and Singh, M. K.

Range Management and Agroforestry 28(2B): 406-408. (2007); ISSN: 0971-2070

Descriptors: black soils/ clay loam soils/ cowpeas/ crop yield / forage/ nutrient content/ organic fertilizers/ photosynthesis/ plant physiology/ red soils/ sandy loam soils/ soil amendments/ soil types/ biofertilizers/ black eyed peas/ carbon assimilation/ carbon dioxide fixation/ red earths/ southern peas

Abstract: A field experiment was conducted during kharif 2006 at Jhansi, Uttar Pradesh, India, using fly ash at two sites having sandy clay loam red (pH 7.1, available N 110 kg/ha, available P 16.5 kg/ha, available K 118.4 kg/ha) and clay loam black soils (pH 7.2, available N 129.6 kg/ha, available P 12.1 kg/ha, available K 260.3 kg/ha) to determine its influence on forage productivity and nutrient content with special emphasis on physiological changes on sorghum + cowpea. Amendments applied were: T1 - no fly ash + sole organic fertilizer; T2 - no fly ash + 50:50 inorganic-organic fertilizer; T3 - no fly ash + 25% inorganic + 50% organic + biofertilizer; T4 - 50 tonnes/ha fly ash + sole inorganic fertilizer; T5 - 50 tonnes/ha fly ash + 50:50 inorganic:organic fertilizers; T6 - 50 tonnes/ha fly ash + 25% inorganic + 50% organic + biofertilizers; T7 - 100 tonnes/ha fly ash + sole inorganic fertilizers; T8 - 100 tonnes/ha fly ash + 50:50 inorganic:organic fertilizers; and T9 - 100 tonnes/ha fly ash + 25% inorganic + 50% organic + biofertilizers. Results showed significant effect of application of fly ash in combination with manure, fertilizer and biofertilizers on green forage yield (GFY). Fly ash applications at 50 tonnes/ha registered significantly higher forage yield than no fly ash counterpart in kharif 2006. In red soil, barring treatment T9, further increased in the fly ash dose was not much effective and the total GFY obtained were statistically at par with respective treatments receiving fly ash at 50 tonnes/ha. Among the different treatments, significant increase in the fodder yield was recorded in T5. There was an increase in the rate of photosynthesis in sorghum as grown in fly ash amended red and black soil. Similarly, the rate of transpiration significantly improved in sorghum and cowpea in fly ash amended red and black soils. It was evident that fly ash application had a beneficial effect on nutrient content of sorghum in both the soil types.

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136. Effect of fly ash application on growth and yield attributes and yield of groundnut genotypes.

Bonge, R. T.; Wayal, G. R.; Jadhav, G. S.; Dahiphale, R. S.; Shaikh, A. K.; and Thombre, R. F.

Journal of Soils and Crops 14(1): 108-111. (2004); ISSN: 0971-2836

Descriptors: application rates/ black soils/ branches/ clay soils/ crop yield/ cultivars/ dry matter accumulation/ fly ash/ genotypes/ groundnuts/ leaves/ plant height/ soil types/ Vertisols/ yield components/ cultivated varieties/ peanuts

Abstract: A field experiment was conducted on medium black (clayey) soil (Vertisol) during post-monsoon (rabi) season of the year 1998-99 at the Department of Agronomy

Farm, Marathwada Agricultural University, Parbhani (Maharashtra, India). The experiment was laid out in a split plot design with three replications, comprising 4 levels (0, 5, 10 and 15 t/ha) of fly ash in main plots and 4 genotypes of groundnut (ICGV 92004, ICGS 44, TAG 24 and LGN 1) in subplots. Growth parameters like plant height, number of branches per plant, number of leaves per plant, leaf area per plant, and total dry matter per plant were not significantly influenced by the application of fly ash. Application of fly ash at 5 t/ha improved the yield attributes and produced significantly higher dry pod yield (1872 kg hectare⁻¹). Genotype TAG-24 with favourable yield attributes recorded a significantly higher dry pod yield (2279 ha⁻¹).
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137. [Effect of fly ash-filtered mud mixture on soil properties and radish yield and quality].

Xing, S.; Zhao, Z.; Zhou, B.; and Wu, X.

Ying Yong Sheng Tai Xue Bao 12(1): 121-5. (Feb. 2001); ISSN: 1001-9332 .

Notes: Original language of article: Chinese.

Descriptors: agriculture/ brassicaceae: physiology/ carbon: chemistry/ metals, heavy: chemistry/ particulate matter/ soil: analysis/ soil microbiology

Abstract: Based on pot culture experiment, the effect of fly ash-filtered mud mixture on soil biochemical properties, radish yield and its quality, and heavy metal accumulation in both soil and radish was examined. The mixture was made by mixing fly ash and filtered mud in proportion 1:1(w/w) and adding small amount of inorganic fertilizer. Its Cd, Pb, Cr, As and Hg contents were much lower than those requested by state control criteria. After applying this mixture in a definite amount, no significant accumulation of heavy metals was found in both soil and radish, the pollution index of heavy metals was < 1, the quantities of soil bacteria increased notably, and the activities of soil urease, phosphates and cellulase also raised significantly. The application of the mixture promoted radish growth and its development and metabolism. The reducing sugar and vitamin C in radish also increased markedly. The results indicated that the use of adequate amounts of the mixture did not cause any obvious heavy metal pollution in both soil and radish, but could improve soil fertility, and raise radish yield and its quality remarkably.
This citation is from PubMed.

138. Effect of fly ash on clayey soil.

Mohini Saxena; Asokan, P; and Aparna Chauhan

Clay Research 17(2): 109-114. (1998); ISSN: 0255-7193

Descriptors: clay soils/ conductivity/ drainage/ fly ash/ heavy metals/ interactions/ nutrients/ porosity/ soil amendments/ soil chemical properties/ soil physical properties/ soil types/ sorption/ chemical properties of soil/ physical properties of soil

Abstract: The changes in the quality of clayey soil mixed with fly ash was studied by measuring the adsorptive and desorptive properties of the soil and fly ash and their interaction. The physical and chemical properties of soil, fly ash and the mixture of the two (in various ratios) were studied in order to understand the mobility of nutrients in the soil. The results indicated the possibility of the use of fly ash as a soil amendment due to the presence of essential plant nutrients, e.g. Ca²⁺, Mg²⁺, Cu²⁺, Zn²⁺, Mn²⁺, SO₄,

PO₃⁻⁴, Cl⁻ etc. Addition of fly ash to clayey soil improved the soil porosity and thus improved drainage. The conductivity of the soil decreased upon addition of fly ash. The heavy metal content of the ash, in terms of essential and non essential metals, was within the permissible limit. Reproduced with permission from the CAB Abstracts database.

139. Effect of fly ash on emergence of crops under artificial crusted soils.

Singh, C. B. and Oswal, M. C.

Indian Journal of Soil Conservation 31(2): 192-198. (2003); ISSN: 0970-3349

Descriptors: crusts/ emergence/ fly ash/ loam soils/ sandy loam soils/ seasonal variation/ soil amendments / soil strength/ soil temperature/ soil types/ wheat/ Argisols/ Capparales/ seasonal changes/ seasonal fluctuations

Reproduced with permission from the CAB Abstracts database.

140. The effect of fly ash on growth and yield in both oat varieties .

Gregorczyk, A.

Folia Universitatis Agriculturae Stetinensis, Agricultura 88: 39-47. (2001); ISSN: 1506-1973.

Notes: Original title: Wpyw popiou lotnego na wzrost i plon dwu odmian owsa.

Descriptors: crop yield/ cultivars/ fly ash/ growth/ growth rate/ leaf area/ leaves/ oats/ cultivated varieties

Abstract: The effect of fly ash (0 and 0.45 kg/pot) on the growth and yield of a naked (Akt) and hulled (Najka) oat cultivar was investigated in pot experiments conducted during 1999 in Roslin, Poland. Data were recorded for relative growth rate (RGR), unit leaf rate (ULR), leaf area ratio (LAR), leaf weight ratio (LWR) and specific leaf area (SLA). For Bajka, significantly higher yield was recorded in the control treatment (no fly ash) compared with the fly ash treatment. RGR values were influenced by changes in LAR, while LAR values were influenced by changes in LWR.
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141. Effect of fly ash on growth and yield of cauliflower.

Bharud, R. W.; Gavhane, V. N.; Rasal, P. N.; Kusalkar, D. V.; and Karanjikar, P. N.

Agricultural Science Digest 22(1): 30-32. (2002); ISSN: 0253-150X

Descriptors: cauliflowers/ chlorophyll/ crop yield/ fly ash/ leaf area/ leaves/ maturity/ trace element fertilizers/ Capparales/ heading broccoli/ micronutrient fertilizers

Abstract: Fly ash at 5, 10, 15, 25, 30, 35, 40, 45 and 50 g/m²/day was applied to cauliflower cv. Kuari No. 3 in a field experiment conducted during the kharif season of 1994, in Maharashtra, India. Fly ash did not affect the duration of physiological maturity. Leaf area per plant, number of leaves per plant, chlorophyll content and yield increased with increasing fly ash levels.

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142. Effect of fly ash on growth characteristics of chickpea.

Shazia Siddiqui; Era Upadhyay; and Shazia Alvi
Bionotes 2(2): 35-36. (2000); ISSN: 0972-1800

Descriptors: chickpeas/ fly ash/ plant development/ trace element fertilizers/ micronutrient fertilizers

Abstract: Chickpea cv. Pusa 408 seeds were sown in pots filled with 1000 g soil; 800 g soil+200 g fly ash; 600 g soil+400 g fly ash; and 400 g soil+600 g fly ash, to determine the effect of different levels of fly ash on the growth characteristics of chickpea. The growth of chickpea plants was significantly affected by fly ash amendments. The maximum response was induced by a 40% level (400 g) of fly ash, wherein an increase in all the parameters of growth was highest. Fly ash at 60% level (600 g) was harmful for plant growth. The study demonstrated that lower concentrations of fly ash were beneficial for the growth of chickpea plants which may ultimately increase crop yield. Reproduced with permission from the CAB Abstracts database.

143. Effect of fly-ash on metal composition and physiological responses in *Leucaena leucocephala* (Lamk.) de Wit.

Meetu Gupta; Avanish Kumar; and Yunus, M.
Environmental Monitoring and Assessment 61(3): 399-406. (2000)

NAL Call #: TD194 .E5 ; ISSN: 0167-6369

Descriptors: carotenoids/ chlorophyll/ copper/ enzyme activity/ fly ash/ foliage/ heavy metals/ iron/ leaves/ manganese/ nitrate reductase/ nodulation/ plant composition/ plant physiology/ protein content/ proteins/ reclamation/ root nodules/ roots/ seedling growth/ seedlings/ soil amendments/ zinc/ chemical constituents of plants/ Mn/ press mud/ tetraterpenoids

Abstract: Seedlings of *Leucaena leucocephala* were grown in pots in 100% soil (pH 7.6, as control), 100% fly ash (pH 9.6, obtained direct from the pipelines of Feroz Gandhi Unchahar Thermal Power Project in Raebareilly, Uttar Pradesh, India) and fly ash amended with 50% press mud (pH 7.2) for 80 days. They were analysed with respect to plant growth, nodulation, elemental composition of the roots and leaves, and physiological changes in the leaves. Plants grown in fly ash exhibited reduced growth and nodulation, reduced chlorophyll, carotenoid and protein contents, and reduced nitrate reductase activity. Amending the fly ash with press mud enhanced all these responses to near the levels found in control plants, with nodulation actually increased over the control value. The elements Fe, Zn, Cu and Mn (all found in high concentrations in fly ash) accumulated in large quantities in plants grown in 100% fly ash (in the order Fe > Zn > Cu > Mn, with greater accumulations in the roots than the leaves), and these accumulations were mostly reduced in the amended fly ash treatment. The results of this study indicate that ash amended with press mud may provide more favourable conditions for the growth of this tree species. Reproduced with permission from the CAB Abstracts database.

144. Effect of fly ash on physical properties of lateritic soil.

Sahoo, S. and Kar, S.
Journal of the Indian Society of Soil Science 46(2): 291-293. (1998)

NAL Call #: 56.9 IN2; ISSN: 0019-638X

Descriptors: fly ash/ lateritic soils/ soil/ soil physical properties/ physical properties of soil
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145. Effect of fly ash on physical properties of Ultisols from subtropical China.

Lu ShengGao and Zhu Lei
Communications in Soil Science and Plant Analysis 35(5/6): 703-717. (2004)

NAL Call #: S590.C63; ISSN: 0010-3624

Descriptors: acid soils/ application rates/ available water/ clay loam soils/ fly ash/ microaggregates/ particle size distribution/ soil amendments/ soil physical properties/ soil strength/ soil types/ soil water content/ soil water retention/ subtropical soils/ subtropics/ Ultisols/ Chekiang/ modulus of rupture/ physical properties of soil/ subtropical zones

Abstract: Fly ash from coal-fired power generating plant was mixed with two acid clay loams (Typic Plinthudult and Typic Hapludults) from Zhejiang Province, China, at rates of 0, 5, 10, 20, 30, and 50% by weight. The physical properties of fly ash-amended soils, including soil particle size distribution, microaggregate composition, water retention curve and modulus of rupture, were determined to evaluate the effect of fly ash application on soil physical properties. The application of fly ash affected the measured physical properties of soils. At the application rate of 50% fly ash, there was a significant increase in the percentage of 0.15-0.01 mm particles and decrease in clay content (<0.002 mm). Application of fly ash at high rates (30 and 50%) to the Typic Plinthudult caused a significant change in the microaggregate size distribution of soil, while non-significant differences were observed in the rates of 5, 10, and 20% fly ash. However, no apparent effect of fly ash application on soil microaggregate size distribution was noted for the Typic Hapludult with high organic matter and free iron oxide contents. Fly ash application not only increased the water content at tensions of 0-0.1 MPa but also increased plant available water held at tensions of 0-1.2 MPa. Tests on fly ash-amended soils exceeding 10% showed that it significantly reduced the values of modulus of rupture in the soils. The presence of spherical cenosphere in fly ash, which have larger specific surface and characteristic hollow structure, resulted in increased water-holding capacity and reduction of modulus of rupture in the fly ash-amended soils. All these results suggest that fly ash is useful in improving certain physical properties of Ultisols by changing soil structure, increasing the amount of plant available water and decreasing the cohesiveness of soil particles.

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146. Effect of fly ash on physico-chemical properties of vertisol and yield of green gram.

Bharti Bhaisare; Matte, D. B.; Badole, W. P.; Anjali Deshmukh; and Shalini Pillewan
Journal of Soils and Crops 9(2): 255-257. (1999); ISSN: 0971-2836

Descriptors: calcium/ cation exchange capacity/ crop yield/ fertilizers/ fly ash/ green gram/ magnesium/ nitrogen fertilizers/ NPK fertilizers/ phosphorus fertilizers/

physicochemical properties/ plant nutrition/ soil amendments/ soil types/ Vertisols/ mung bean/ phosphate fertilizers

Abstract: Summer green gram [*Vigna radiata*](K-851) was grown during 1993-94 on Vertisol with three levels of N and P fertilizers (0:0, 25:50 and 18.75:37.50 kg/ha) and four levels of fly ash (0, 5, 10 and 15 t/ha). Application of fly ash up to 10 t/ha was more effective in terms of yield and improved the physicochemical properties of soil. The cation exchange capacity, available NPK, exchangeable Ca²⁺, Mg²⁺ and availability of micronutrients increased with increasing levels of fly ash, while bulk density recorded the opposite trend. Green gram responded well to higher doses of N and P for yield while combination fertilizers and fly ash were non-significant.

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147. Effect of fly ash on release behaviour of potassium in soils of an arid region.

Grewal, K. S.; Mehta, S. C.; Oswal, M. C.; and Yadav, P. S. *Journal of the Indian Society of Soil Science* 46(2): 203-206. (1998)

NAL Call #: 56.9 IN2; ISSN: 0019-638X

Descriptors: amendments/ arid lands/ arid soils/ fly ash/ loam soils/ potassium/ release/ sandy soils/ soil

Abstract: The effects of fly ash on the release behaviour of exchangeable (1N NH₄OAc-K) and non-exchangeable (boiling 1N HNO₃-K) K⁺ were studied in laboratory in sandy and loamy soils by mixing fly ash at 0, 25, 50, 75 and 100% (w/w). A major portion (68 to 76%) of exchangeable K⁺ (NH₄OAc-K) was extracted in the first extraction from the sandy soil. The subsequent extractions decreased the K⁺ release. In the loamy soil, only 38 to 42% of exchangeable K⁺ was released in the first extraction. The magnitude of K⁺ release was slower in loamy soil than the sandy soil. The release of non-exchangeable K⁺ was almost similar in both the soils in the first extraction. Addition/mixing of successive levels of fly ash had little effect on the release pattern of K⁺ in these soils.

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148. Effect of fly ash on soil microbial population in groundnut crop.

Patil, C. P. and Patil, C. V.

Karnataka Journal of Agricultural Sciences 14(1): 164-167. (2001)

NAL Call #: S471.I42K37; ISSN: 0972-1061

Descriptors: farmyard manure/ fly ash/ groundnuts/ NPK fertilizers/ populations/ soil bacteria/ soil fungi/ FYM/ peanuts

Abstract: The effect of fly ash, a major solid waste of coal and steel industries, on microbial inoculants and soil microbial population in groundnut crop was studied. Recommended dose of NPK fertilizers was applied as basal dose. An increase in soil bacteria and fungi population at 30 and 60 days over control in all treatments with soil + fly ashes FYM was observed. On the other hand, a drastic reduction in soil actinomycetous population treated with fly ash was observed. Maximum stimulation of bacteria (52.86 x 10³ CFU/g) fungi (12.33x10³ CFU/g) at 30 days of planting was noticed in the treatments soil + WFA and soil + WFA + FYM, respectively. Weathered fly ash mixed with soil had maximum stimulatory effect on soil

rhizobial population at 30 and 60 days (2.93x10³ and 9.87x10³ CFU/g) followed by soil + WFA + FYM, and soil + DFA + FYM, respectively. The soil rhizobial population was drastically reduced over control at 30 days and however, it had increased by three to four times at 60 days when compared to the population at 30 days. The nodule number was slightly higher in the treatment soil + FYM (92.99 g/plant) compared to the treatments soil + DFA + FYM (89.44 g/plant) and soil + WFA + FYM (84.33 g/plant), weight of nodules was highest in treatment soil + DFA + FYM (0.663 g/plant) followed by soil + WFA + FYM (0.538 g/plant). It is concluded that fly ash with or without organic matter (FYM) promotes good microbial growth and increased soil fertility thus, increasing plant growth. Reproduced with permission from the CAB Abstracts database.

149. Effect of fly ash on the availability of Zn, Cu, Ni and Cd to chicory.

Scotti, I. A.; Silva, S.; and Botteschi, G.

Agriculture, Ecosystems and Environment 72(2): 159-163. (1999)

NAL Call #: S601.A34 ; ISSN: 0167-8809

Descriptors: acid soils/ availability/ cadmium/ chicory/ clay loam soils/ clay soils/ copper/ EDTA/ ethylene/ fly ash/ metals/ nickel/ plant composition/ salts/ silt loam soils/ soil amendments/ soil types/ variation/ zinc/ chemical constituents of plants/ edetic acid/ ethylenediaminetetraacetic acid

Abstract: Chicory (*Cichorium Intybus*) was grown in two soils, a silt loam at pH 5.7 and a silty clay loam at pH 7.0, augmented with fly-ash and/or metals as salts. In acid soil the ash addition caused a decrease of Zn, Cu, Cd and Ni concentration for all treatments; for neutral soil this was true for Zn, but for Cu and Cd, only for treatments with salts. The added metals are more available to plants than those naturally occurring in soils. Extractions carried out with ethylene diamine tetra acetate (EDTA) pH 4.65 or diethyltriaminepentaacetic (DTPA) pH 7.3 showed no variation in extractable metal concentration over time. Reproduced with permission from the CAB Abstracts database.

150. Effect of fly ash on the growth of sunflower (H annuus).

Jaya Dwivedi; Khan, S. A.; Jha, A. K.; and Alpna Ram Vaniki Sandesh 27(1): 3-7. (2003); ISSN: 0972-5598

Descriptors: acid soils/ aluminium/ branches/ chlorophyll/ crop yield/ fly ash/ growth/ leaf area/ leaves/ magnesium/ manganese/ microbial activities/ nitrogen/ nutrient availability/ phosphorus/ plant height/ seed germination/ seeds/ soil acidity/ soil amendments/ soil types/ sulfur/ sunflower oil/ sunflowers/ toxicity/ trace elements/ zinc/ aluminum/ Chattisgarh/ elemental sulphur/ microelements/ Mn/ sulphur

Abstract: Fly ash, the major industrial residue (waste) in Chhattisgarh (India) faces serious disposal problem. At the same time, it is found to be a rich source of micronutrients and salts and has high alkalinity as where soil of this region is normally acidic. Acidic soil causes metal toxicity, reduced microorganism activity, reduced N, P, S, Mg, Mn availability, and Al toxicity resulting in poor crop yield and oil quality of sunflower. This paper presents the results of the study conducted to improve soil condition by ameliorating acidic soil by the application of fly ash and to

investigate the effect on the growth of sunflower. Seed germination and other plant growth parameters (plant height, number of branches per plant, leaf area and chlorophyll content per leaf) were studied. Reproduced with permission from the CAB Abstracts database.

151. Effect of fly ash on the physico-chemical properties of the soil and seed germination, growth and metals uptake of barley and wheat plants.

Khan, S.; Khan, J. A.; and Jabin, S. 7(1): 41-46. (2001); ISSN: 0971765X [EECOF]

Descriptors: barley/ fly ash/ metals uptake/ wheat/ physicochemical property

Abstract: Pot experiments were conducted to evaluate the physiology and metals uptake of barley (*Hordeum vulgare* L.) and wheat (*Triticum aestivum* L.) plants grown on fly ash amended soil. The beneficial effect on physiological development were noticed at lower doses of fly ash (pH 6.72) upto 30 and 20 g kg⁻¹ soil in case of barley and wheat, respectively, thereafter a phytotoxic behaviour was observed. The results of plants analysis showed an increase in the concentration of K, Mg, Fe and Zn metals upto 30 to 20 g fly ash kg⁻¹ soil thereafter, they tend to decline on increasing doses of fly ash. On the other hand, the contents of Na, Cr, Mn, Co, Cu, Ni, Cd and Pb uptake were found to remain enhance throughout the entire range of fly ash

amendments in both plants. The variation in physico-chemical properties, due to the addition of fly ash in soil, have indicated a decrease in pH (from 8.5 to 7.95) and composition of sand and clay and increase in electrical conductivity and composition of silt and organic matter. © 2009 Elsevier B.V. All rights reserved.

152. Effect of fly ash on VAM formation and growth response of pulse crops infested with *Glomus aggregatum* in sterile soil.

Reddy, C. N. and Garampalli, H. R.

Frontiers in Microbial Biotechnology and Plant Pathology: 205-212. (2002)

Descriptors: adverse effects/ bioremediation/ chickpeas/ endomycorrhizas/ fly ash/ industrial wastes/ mycorrhizal fungi/ mycorrhizas/ pigeon peas/ pollutants/ vesicular arbuscular mycorrhizas/ adverse reactions/ Glomaceae

Abstract: The effect of fly ash amendment at 3 concentrations (10, 20 and 30%) on the infectivity and efficacy of *G. aggregatum* was studied by conducting a pot culture experiment with sterile low fertile soil using pigeon pea (*Cajanus cajan*) cv. Maruti and chickpea (*Cicer arietinum* [Cicer arietinum]) cv. Annigeri, the two major pulse crop cultivars of this region. It is evident from the present investigation that the percent VAM colonization in both the crops significantly decreased with the increase of fly ash content in the soil. The formation of VAM fungal structures (vesicles and arbuscules) inside the host root was also found completely suppressed at higher concentrations of fly ash. The effectiveness of *G. aggregatum* under the influence of fly ash was found significantly affected compared to the control, when judged by the growth response of pigeon pea. However, in chickpea, VAM association could slightly increase the growth over its control. Fly ash amendment alone also has shown positive influence on the growth of both the crops over their controls (without VAM association). This

influence of fly ash amendment together with the usefulness of VAM fungi, as bioremediation agents can be exploited suitably in the reclamation of waste lands and soils over burdened with fly ash.

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153. Effect of fly ash on yield and nutrient uptake in rice and its impact on soil properties.

Brahmachari, K.; Debnath, A.; and Mondal, S. S. *Journal of Interacademia* 3(3/4): 293-300. (1999)

Descriptors: application rates/ fly ash/ mineral uptake/ nitrogen fertilizers/ nutrient uptake/ phosphorus fertilizers/ potassium fertilizers/ rice/ soil pH/ soil water retention/ sulfur fertilizers/ trace element fertilizers/ micronutrient fertilizers/ paddy/ phosphate fertilizers/ potash fertilizers/ sulphur fertilizers

Abstract: In a field trial during kharif 1994 and 1995 on an Entisol in Kalyani, West Bengal, India, rice cv. IR 36 was given no fertilizer, fly ash, N, NP, NPK or NPKS. Grain yields were in the order: NPKS > NPK > NP > N = fly ash > control. N, P and K uptake followed the same pattern. Studies with different fly ash concentrations showed that soil pH and water-holding capacity increased with increase in concentration of fly ash.

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154. Effect of fly ash, organic wastes and chemical fertilizers on yield, nutrient uptake, heavy metal content and residual fertility in a rice-mustard cropping sequence under acid lateritic soils.

Rautaray, S. K.; Ghosh, B. C.; and Mittra, B. N.

Bioresource Technology 90(3): 275-283. (2003)

NAL Call #: TD930.A32; ISSN: 0960-8524

Descriptors: acid soils/ application rates/ cadmium/ chemical composition/ crop yield/ farmyard manure/ fertilizers/ fly ash/ food grains/ green manures/ heavy metals/ lateritic soils/ nickel/ nitrogen/ nutrient uptake/ nutrients/ organic wastes/ phosphorus/ plant composition/ plant nutrition/ potassium/ residual effects/ residues/ rice/ rice straw/ sandy loam soils/ soil chemical properties/ soil fertility/ soil organic matter/ soil pH/ soil types/ straw/ Capparales/ chemical constituents of plants/ chemical properties of soil/ FYM/ organic matter in soil/ paddy

Abstract: A field experiment was conducted for two years in sandy loam acid lateritic soil to study the direct effect of fly ash, organic wastes and chemical fertilizers on rice (*Oryza sativa*) and their residual effect on mustard (*Brassica napus* var *glauca*) grown in sequence. Rice yields were higher when fly ash, organic wastes and chemical fertilizers were used in an integrated manner as compared to sole application of chemical fertilizers. Yields of mustard were also higher under the residual effect of the former rather than the latter. However, this beneficial residual effect under integrated nutrient sources was inadequate for the mustard crop in the low fertility test soil. Hence, direct application of fertilizers was needed, in addition to residual fertility. The effect of fly ash on mean rice equivalent yield of the rice-mustard cropping sequence was highest (up to 14%) when it was used in combination with organic wastes and chemical fertilizers. While the yield increase was 10% when it was used in combination with only chemical fertilizers. The minimum yield advantage, 3%, occurred when fly ash was applied alone. The equivalent yield of the

rice-mustard cropping sequence was equally influenced by either of the organic wastes. Cadmium and Ni content in rice grain and straw were less under the direct effect of fly ash. The residual effect on mustard was similar for Ni content in seed and stover; however, Cd content was increased. Beneficial residual soil chemical properties in terms of pH, organic carbon and available N, P and K were noted for integrated nutrient treatments involved fly ash, organic wastes and chemical fertilizers as compared to continuous use of only chemical fertilizers. Application of fly ash alone was effective in raising soil available P. Thus, integrated use of fly ash, organic wastes and chemical fertilizers was beneficial in improving crop yield, soil pH, organic carbon and available N, P and K in sandy loam acid lateritic soil.

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155. Effect of fly ash, press mud cake and phosphorus solubilizing bacteria (PSB) on yield, growth and quality of sugarcane.

Saini, S. K.; Rajesh, A.; Vijender Singh; and Sinha, S. K. *Indian Sugar* 56(4): 25-28. (2006); ISSN: 0019-6428
Descriptors: application rates/ brix/ crop quality/ crop yield/ fly ash/ germination/ growth/ NPK fertilizers/ phosphate solubilizing bacteria/ shoots/ sucrose/ sugar content/ sugarcane/ yield components/ biofertilizers/ integrated crop management/ saccharose

Abstract: A field experiment was conducted during 2004-05, in Pantnagar, Uttar Pradesh, India, to evaluate the effect of integrated nutrient management on the growth, yield and quality of sugarcane. Fourteen treatment combinations were evaluated, including 100% of the recommended NPK dose as control as well as 50 and 100% of the recommended NPK dose supplemented with press mud cake (PMC), fly ash (FA) and/or phosphate solubilizing bacteria (PSB). Application of 75% of the recommended NPK dose along with PMC, FA and/or PSB gave significantly higher values for cane yield and its attributes (germination percentage, number of shoots, number of millable canes, cane weight, cane girth, cane length) as well as juice quality parameters (corrected brix, sucrose percentage, available sugar percentage and commercial cane sugar yield) compared with 100% NPK alone. Application of 75% NPK + 13.4 t FA/ha + 6.6 t PMC/ha and 75% NPK + 6.6 t FA/ha + 13.4 t PMC/ha were the best treatments in increasing the values of the growth and yield attributes. However, application of 75% NPK + 10 t FA/ha + 10 t PMC/ha + PSB recorded the highest values for the quality attributes.

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156. Effect of fly ash waste on some properties of an acid soil, elemental composition and yields of crops.

Khandkar, U. R.; Gangwar, M. S.; and Srivastava, P. C. 18(1): 101-107. (1999); ISSN: 02578050 [PORSO]
Descriptors: Acid soil/ Elemental composition of crops/ Fly ash/ acid soil/ crop yield/ fly ash/ soil amendment/ soil nutrient/ India

Abstract: The effect of soil application of a thermal power station fly ash (2 to 20 per cent of soil weight) was investigated on properties of an acid soil, elemental composition and yields of rice, soybean and blackgram crops. The application of fly ash altered the soil texture and

increased water holding capacity, pH and electrical conductivity and extractable amount of P, Ca, Mg, S, Fe, Mn, Zn, Cu, B and Al but decreased soil particle density and available soil N. Soil application of fly ash increased the concentration of all the nutrients, Na and Al in seed and straw of all the three crops except N in all the cases and P and K in rice. The application of fly ash increased the seed and straw yield of all the three crops with no adverse effect on yields even at 20 per cent level. Fly ash can be used to correct S and B deficiency in acid soils.

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157. Effect of flyash incorporation on soil properties of texturally variant soils.

Naveen Kalra; Harit, R. C.; and Sharma, S. K. *Bioresource Technology* 75(1): 91-93. (2000)
 NAL Call #: TD930.A32 ; ISSN: 0960-8524

Descriptors: clay loam soils/ clay soils/ electrical conductivity/ field capacity/ fly ash/ organic carbon/ sandy loam soils/ sandy soils/ soil amendments/ soil organic matter/ soil ph/ soil physical properties/ soil texture/ soil types/ soil water/ wilting point/ organic matter in soil/ physical properties of soil/ soil moisture

Abstract: Modifications in soil properties caused by flyash incorporation in clayey, sandy-clay-loam, sandy and sandy-loam soils were evaluated. Flyash was collected from the National Capital Power Project, Dadri, Ghaziabad, UP. Ash incorporation treatments were 10%, 20%, 30% and 40% ash by weight in the soil-ash mixtures. Moisture retained at field capacity increased with ash content in sandy-clay-loam, sandy and sandy-loam soils, whereas the reverse trend was noted for clayey soil. Moisture retained at wilting point increased with ash content for all the soils. The changes in moisture retention constants associated with ash incorporation were due to macro- and micro-particle size modifications. The pH of soil-ash mixtures decreased with ash content for clayey, sandy and sandy-loam soils, whereas the reverse trend was noted for sandy-clay-loam soil. Electrical conductivity of the mixtures increased with the ash content for all the soils. Organic carbon values increased with ash content for sandy and sandy-loam soils, whereas they decreased for clayey and sandy-clay-loam soils. Modifications to the soil environment with incorporation of flyash need to be investigated on a long-term basis.

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158. Effect of flyash on micronutrients uptake by plants grown on an acid soil.

Ajaya Srivastava and Chhonkar, P. K. *Journal of the Indian Society of Soil Science* 50(4): 484-488. (2002)

NAL Call #: 56.9 IN2; ISSN: 0019-638X
Descriptors: acid soils/ Alfisols/ application rates/ bioavailability/ fly ash/ lime/ liming/ liming materials/ nutrient availability/ nutrient uptake/ oats/ phytotoxicity/ plant nutrition/ pot experimentation/ soil acidity/ soil ph/ soil types/ trace elements/ microelements

Abstract: A pot culture study was conducted to evaluate the effect of fly ash (0, 33, 66 and 100 g kg⁻¹ soil) and lime (0, 0.33, 0.66 and 1.0 lime requirement) on micronutrient uptake by Sudan grass (*Sorghum sudanense*) and oats (*Avena sativa*) grown on an acid soil (Alfisols), and micronutrients availability in soil. All levels of flyash and

lime significantly increased the pH, decreased the availability of micronutrients in soil, and also significantly decreased the micronutrients' uptake by both the crops. Results indicate that fly ash is as effective as lime in reducing the micronutrients toxicity to the plants grown on an acid soil. It is also indicated that fly ash is a feasible alternative to lime for treating acid soils. Reproduced with permission from the CAB Abstracts database.

159. Effect of flyash on the performance of wheat on Ustochrepts of sub-humid plains of India.

Totawat, K. L.; Nagar, G. L.; Jat, S. L.; and Jangir, R. K. In: 17th World Congress of Soil Science. Bangkok, Thailand.; pp. 215; 2002.

Descriptors: application rates/ clay loam soils/ crop yield/ farmyard manure/ fly ash/ Inceptisols/ incorporation/ nutrients/ plains/ sandy loam soils/ soil chemical properties/ soil toxicity/ soil types/ uptake/ wheat/ chemical properties of soil/ FYM/ toxic soils
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160. Effect of flyash on uptake of phosphorus, potassium and sulphur by Sudan grass and oats grown on an acid soil.

Ajaya Srivastava and Chhonkar, P. K.
Journal of the Indian Society of Soil Science 48(4): 850-853. (2000)
NAL Call #: 56.9 IN2; ISSN: 0019-638X

Descriptors: acid soils/ biomass production/ fly ash/ lime/ nutrient uptake/ oats/ phosphorus/ plant composition/ potassium/ soil/ soil acidity/ soil types/ sulfur/ chemical constituents of plants/ elemental sulphur/ sulphur
Abstract: The effects of coal fly ash and lime in alleviating the acidity of acid soil, and the effects of fly ash on nutrient uptake by crops were investigated in a pot experiment conducted during kharif (monsoon) season with Sudan grass (*Sorghum sudanense*) and in rabi (winter) season with oats. The P, K and S contents of *S. sudanense* and oats increased with graded levels of fly ash incorporation in soil up to 100 g/kg. It was found out that fly ash was as effective as lime in acid soil. Fly ash application improves the pH, and the availability of P, K and S. These amendments result in a significantly larger biomass production. However, because of the variability in soils and fly ash characteristics, specific site conditions need to be considered before deciding on the quantity of fly ash to be applied.
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161. Effect of flyash on yield, uptake of nutrients and quality of green gram grown on Vertisol.

Bharti Bhaisare; Matte, D. B.; Badole, W. P.; and Anjali Deshmukh
Journal of Soils and Crops 10(1): 122-124. (2000); ISSN: 0971-2836

Descriptors: crop production/ crop yield/ fertilizers/ fly ash/ green gram/ nitrogen fertilizers/ nutrient content/ nutrient uptake/ nutrients/ phosphorus fertilizers/ plant nutrition/ seasonal variation/ soil amendments/ straw/ mung bean/ phosphate fertilizers/ seasonal changes/ seasonal fluctuations

Abstract: A field experiment was conducted in Nagpur, India, during the summer of 1993-94 on green grams (K-851) with three levels of N (0, 18.75, 25 kg/ha) and P (0, 37.50, 50 kg/ha) and four levels of fly ash (0, 5, 10 and 15 t/ha) on Vertisols. Results showed that the highest yield of grain and straw along with highest content and uptake of nutrients were recorded with the increasing levels of fly ash upto 10 t/ha. The highest content of crude protein and test weights were recorded by the same level of fly-ash. Amongst the fertilizers, green gram responded well to higher doses of N and P fertilizers for yield, quality and nutrient uptake and content. The combined effect of fly ash and fertilizers was not significant.
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162. Effect of flyash pollution on biomass, primary productivity and characteristics of grains of maize.

Pandey, D. D. and Madhu Sinha
Environment and Ecology 18(3): 738-741. (2000)
NAL Call #: TD172.E5; ISSN: 0970-0420

Descriptors: crop yield/ fly ash/ maize/ pollution/ power stations/ corn/ environmental pollution
Abstract: Maize was grown 100 m downwind of the Thermal Power Station, Patratu, Bihar, to assess the effect of fly ash pollution on biomass, primary productivity and grain characteristics. Pollution decreased primary productivity of maize. Number of grains per cob, weight and volume of 100 grains, moisture, protein, total ash, fat, crude fibre, iron, phosphorus, calcium and calorific value of polluted grains were lower than in controls.
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163. Effect of foliar application of lignite fly ash on the management of papaya leaf curl disease.

Eswaran, A. and Manivannan, K.
Acta Horticulturae 740: 271-275. (2007)
NAL Call #: 80 Ac82; ISSN: 0567-7572

Descriptors: application date/ application rates/ crop yield/ crude protein/ cultural control/ disease resistance/ disease vectors/ fly ash/ fruits/ induced resistance/ insect control/ insect pests/ leaves/ lignite/ nitrogen content/ pawpaws/ pest control/ phenols/ plant disease control/ plant diseases/ plant pathogens/ plant pests/ plant viruses/ sugar content/ Madras/ papayas/ phytopathogens/ resistance to disease
Abstract: Studies were conducted on the effect of foliar application of lignite fly ash (LFA) dust on papaya leaf curl virus disease and vector (*Bemisia tabaci*) population. The treatments include various concentrations of LFA administered at different days after planting (DAT). LFA is the by-product from the combustion of pulverized coal/lignite in thermal power plants of India and has high silica content. The study revealed that foliar application of LFA dust at 2 kg per plant at 90 and 120 DAT was very effective in controlling papaya leaf curl virus disease and its vector. Application of LFA two times at 90 and 120 DAT was more effective over single applications at 30, 60 and 90 and 120 DAT. The fly ash stuck to leaf surface for a period of 9 to 12 days. Further application of lignite fly ash reduces the population of vector, thereby resulting in relatively disease free papaya crop. Plants treated with LFA dust at 2 kg/plant on 90 and 120 DAT also increased phenol and crude protein contents but reduced sugar and

amino nitrogen contents of the leaves. It is evident from this study that the application of LFA dust profoundly increased the resistance mechanism of the plant and ultimately enhanced the fruit yield. Reproduced with permission from the CAB Abstracts database.

164. Effect of four sources of silicon on the resistance of sugarcane varieties to *Eldana saccharina* (Lepidoptera: Pyralidae).

Keeping, M. G. and Meyer, J. H.

Proceedings of the Annual Congress South African Sugar Technologists' Association 77: 99-103. (2003); ISSN: 1028-3781

Descriptors: application rates/ calcium silicate/ chemical composition/ crop damage/ cultivars/ fly ash/ insect pests/ internodes/ leaves/ nutrient content/ nutrient uptake/ plant composition/ plant nutrition/ plant pests/ silicon/ silicon fertilizers/ stems/ sugarcane/ varietal reactions/ varietal resistance/ varietal susceptibility/ chemical constituents of plants/ crop injury/ cultivated varieties

Abstract: The effects of USA calcium silicate, local calcium silicate, Slagment and fly ash on the resistance of sugarcane cultivars N 26 (susceptible), N 21 (susceptible), N21 (resistant) and N33 (resistant) to *E. saccharina* were studied under greenhouse conditions. Calcium silicates and Slagment were applied at 5000 or 10 000 kg/ha (62 or 124 g per pot, respectively), whereas fly ash was applied at 15 000 or 30 000 kg/ha (186 or 372 g per pot). The silicon fertilizers were incorporated into the sand medium before planting. Significant variation in leaf and stalk silicon uptake was observed. The greatest increase in plant silicon content (particularly in stalks) was recorded for plants treated with local calcium silicate. Silicon uptake did not significantly vary between the susceptible and resistant cultivars, although the resistant cultivars had inherently higher silicon content than the susceptible cultivars. Treatment with silicon, except with 30 000 kg fly ash/ha in N33, significantly reduced damage by *E. saccharina* in terms of stalk length and internodes bored. The reduction in damage was directly proportional to the amount of silicon applied. On average, the higher silicon rate reduced damage by 34.4% in the susceptible cultivars and by 25.7% in the resistant cultivars.

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165. Effect of freezing and thawing processes on some physical properties of saline-sodic soils mixed with sewage sludge or fly ash.

Sahin, Ustun; Angin, Ilker; and Kiziloglu, Fatih M.

Soil and Tillage Research 99(2): 254-260. (June 2008)

NAL Call #: S590.S48; ISSN: 0167-1987

Descriptors: freezing / thawing/ saline-sodic soils/ sewage sludge/ fly ash

Abstract: Dispersion of saline-sodic soils was rather difficult to leach. Therefore, negative effects of freeze-thaw on soil physical properties should be reduced by inexpensive and practical methods. This study investigates the effect of freeze-thaw cycles (3, 6, and 9) on wet aggregate stability, bulk density, and permeability coefficient in three soils with different electrical conductivity and exchangeable sodium percentage levels (soil I:

5.30dSmp#, 47.51%; soil II: 42.80dSmp#, 55.45%; soil III: 36.30dSmp#, 59.34%) which consist of different proportions of sewage sludge and fly ash by volume (10%, 20%, and 30%). The experiment was conducted under laboratory conditions using disturbed and non-cropped soil samples mixed with sewage sludge and fly ash. Soils mixed with sewage sludge produced higher aggregate stability and permeability coefficients and lower bulk density values as compared to the soils mixed with fly ash. Sewage sludge added with a rate of 30% eliminated the negative effects of freeze-thaw processes on wet aggregate stability. Freeze-thaw processes did not affect the bulk density of the soils II and III, which were mixed with sewage sludge. However, fly ash addition decreased the bulk density of these soils very significantly after nine freeze-thaw cycles. Addition of sewage sludge or fly ash with rates of 20% and 30% significantly increased the permeability coefficients in soil I after nine freeze-thaw cycles. Results indicated that addition of sewage sludge and/or fly ash to saline-sodic soils could be alternative way for reducing negative effects of freezing-thawing on soil wet aggregate stability, bulk density, and permeability coefficient. This citation is from AGRICOLA.

166. Effect of FYM and industrial wastes on productivity of *Phyllanthus amarus*.

Arumugam Shakila and Rajeswari, R.

Advances in Plant Sciences 19(2): 525-529. (2006)

NAL Call #: QK1.A38; ISSN: 0970-3586

Descriptors: application rates/ branches/ farmyard manure/ fly ash/ leaves/ plant height/ FYM/ Madras

Abstract: The effects of farmyard manure (FYM) pressmud and lignite fly ash (0, 5 or 10 t/ha each) on the yield of *P. amarus* [*P. niruri*] were studied in Annamalaiagar, Tamil Nadu, India. All treatments significantly enhanced plant height, number of branches and leaves, and herbage yield. The application of FYM + pressmud + lignite flyash at 10 t/ha each resulted in the greatest plant height (118.09 cm), number of branches per plant (45.04), number of leaves per plant (1165.87), and herbage yield per plant (39.69 g).

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167. Effect of graded levels of fly ash and NPK on soil properties and yield of wheat.

Deshmukh, A. S.; Matte, D. B.; and Kene, D. R.

Journal of Soils and Crops 10(2): 260-264. (2000); ISSN: 0971-2836

Descriptors: calcium/ carbon/ fertilizers/ fly ash/ magnesium/ nitrogen fertilizers/ NPK fertilizers/ phosphorus fertilizers/ potassium fertilizers/ soil amendments/ soil chemistry/ soil ph/ soil physics/ wheat/ phosphate fertilizers/ potash fertilizers/ soil bulk density/ yield

Abstract: Field trials were conducted in Nagpur, India, on wheat cv. AKW-381 during 1993-94 with 0, 5, 10 and 15 t fly ash/ha along with three levels of NPK (none, 100:50:50 and 75:37.5:37.5 kg/ha) to study the effects on soil physicochemical properties and wheat yield. Application of 10 t fly ash/ha alone and in combination with 100:50:50 NPK was produced highest dry matter production, grain yield and improvement of the nutrient status and physicochemical properties of the soil. Although the soil

amendments had some effects on soil bulk density, CEC, available micronutrients and slight improvement in exchangeable Ca and Mg, they did not have an effect on soil pH, soil EC, organic C content and available NPK status of the soil.
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168. Effect of gypsum and lignite fly ash as sources of sulphur on ragi.

Naveen Saviour, Raghupathy, B.; Poonkodi, P.; and Angayarkanni, A.
Agricultural Science Digest 21(1): 5-8. (2001); ISSN: 0253-150X

Descriptors: calcium/ crop yield/ dry matter accumulation/ fly ash/ gypsum/ magnesium/ mineral uptake/ nitrogen/ nutrient availability/ nutrient uptake/ phosphorus/ plant nutrition/ potassium/ soil fertility/ sulfur/ elemental sulphur/ Madras/ sulphur

Abstract: The effects of gypsum and lignite fly ash (LFA) on the yield and nutrient uptake of ragi [*Eleusine coracana*] cv. CO 12 were investigated in Annamalai, Tamil Nadu, India [date not given]. The treatments were: (T1) control; (T2) gypsum at 80 kg/ha; (T3) gypsum at 160 kg/ha; (T4) gypsum at 240 kg/ha; (T5) LFA at 2.1 t/ha; (T6) LFA at 4.2 t/ha; and (T7) LFA at 6.3 t/ha. T4 gave the highest values for total dry matter production (3569 kg/ha), grain yield (1231 kg/ha) and straw yield (2338 kg/ha). This treatment also resulted in the highest uptake of N (60.66 kg/ha), P (14.27 kg/ha), K (71.44 kg/ha), Ca (17.92 kg/ha), Mg (16.13 kg/ha) and S (14.54 kg/ha), and increased the available nutrients in the soil.

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169. Effect of gypsum and lignite fly ash as sources of sulphur on the synthesis of protein and oil in soybean.

Poonkodi, P.; Raghupathy, B.; Angayarkanni, A.; and Boobalan, G. S.
Mysore Journal of Agricultural Sciences 35(1): 32-36. (2001)

Descriptors: application rates/ chemical composition/ crop yield/ fly ash/ gypsum/ methionine/ mineral uptake/ nitrogen content/ nutrient availability/ nutrient uptake/ plant composition/ plant nutrition/ pods/ protein content/ soybeans/ sulfur/ sulfur fertilizers/ Vertisols/ yield components/ chemical constituents of plants/ elemental sulphur/ soybeans/ sulphur/ sulphur fertilizers

Abstract: The effects of gypsum and lignite fly ash (LFA) on the performance of soybean cv. CO-1 were studied in a pot experiment using a clayey soil (Typic Chromustert). The treatments consisted of 250.0 kg gypsum/ha, 4.0 t LFA/ha, 187.5 kg gypsum + 1.0 t LFA/ha, 125.0 kg gypsum + 2.0 t LFA/ha and 62.5 kg gypsum + 3.0 t LFA/ha. The application of 125.0 kg gypsum + 2.0 t LFA/ha resulted in the highest number of pods per plant (28), grain yield per pot (8.80 g), oil content (21.80%), protein content (41.75%), methionine content (0.106%), total N content (6.68%), total S content (0.42%), N (1.28 g per pot) and S (0.080 g per pot) uptake, and soil available N (85.1 mg/kg) and S (9.8 mg/kg). The highest N:S ratio was recorded for the control (25.2).
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170. Effect of hard coal ash on the level of physiologically active compounds present in leaves of cultivated crops.

Zalewski, K and Login, A.

In: *Acta Physiologiae Plantarum. Fourth International Conference on Ecophysiological Aspects of Plant Responses to Stress Factors*. Cracow, Poland.; Vol. 23(3 Supplement); pp. 107; 2001. ISBN: 0137-5881

Descriptors: agronomy/ agriculture/ waste management: sanitation/ Gramineae: angiosperms, monocots, plants, spermatophytes, vascular plants/ Leguminosae: angiosperms, dicots, plants, spermatophytes, vascular plants/ hard coal ash: agricultural application
© Thomson Reuters

171. Effect of industrial and organic wastes on groundnut in typical ustifluvent soil.

Sriramachandrasekharan, M. V.

Annals of Agricultural Research 22(3): 436-438. (2001)
NAL Call #: S471.I4A56; ISSN: 0970-3179

Descriptors: chemical composition/ crop yield/ farmyard manure/ filter cake/ fly ash/ groundnut oil/ groundnuts/ gypsum/ haulms/ humic acids / kernels/ lignite/ mineral uptake/ nutrient uptake/ organic amendments/ plant composition/ plant nutrition/ pods/ protein content/ seed weight/ seeds/ yield components/ arachis oil/ chemical constituents of plants/ clarification mud/ FYM/ peanut oil/ peanuts

Abstract: The effects of lignite fly ash (LFA at 2.4 t/ha), gypsum (200 kg/ha), biodigested pressmud (BP at 7.5 t/ha), farmyard manure (FYM at 12.5 t/ha) and lignite humic acid (LHA at 40 kg/ha), applied singly or in combination, on groundnut cv. VRI 2 were investigated in Cuddalore, Uttar Pradesh, India in 1995. All treatments significantly enhanced the number of pods per plant, 100-kernel weight, seed and haulm yields, protein content and nutrient uptake compared to the control. The application of 7.5 t BP/ha+1.2 t LFA/ha+200 kg gypsum/ha recorded the highest number of pods per plant (26.1), 100-kernel weight (42.2 g), pod yield (2941 kg/ha), haulm yield (4756 kg/ha), oil (48.6%) and protein (24.2%) contents, and N (267.8 kg/ha), P (43.1 kg/ha) and K (281.5 kg/ha) uptake.

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172. Effect of industrial wastes as manure for rice.

Angayarkanni, A. and Poonkodi, P.

Journal of Ecobiology 16(4): 303-305. (2004)
NAL Call #: QH540.J56 ; ISSN: 0970-9037

Descriptors: crop yield/ filter cake/ fly ash/ grain/ industrial wastes/ nitrogen fertilizers/ nutrient uptake/ phosphorus fertilizers/ potassium fertilizers/ rice/ soil fertility/ soil pH/ straw/ waste utilization/ clarification mud/ Madras/ paddy/ phosphate fertilizers/ potash fertilizers

Abstract: A field experiment was conducted in Tamil Nadu, India during Rabi season to evaluate the effect of industrial wastes viz., pressmud and lignite fly ash (LFA) on the performance of rice (*Oryza sativa*) cv. ADT 43 and the residual soil fertility status. The treatments were control, pressmud (PM) at 6.25 tonnes/ha, LFA at 4 tonnes/ha, Recommended Dose of Fertilizers (150:50:50 kg N, P₂O₅ and K₂O/ha), 75% RDF + PM + LFA and 50% RDF + PM + LFA. The results showed that application of PM and LFA

along with 75% RDF recorded the highest grain and straw yield. LFA and PM when applied individually recorded relatively lesser grain and straw yield. A similar trend was observed with respect to nutrient uptake by grain. The soil fertility status at the post harvest stage revealed that 75% RDF + PM + LFA registered high N content in soil and was comparable with 100% RDF. However, application of 100% RDF recorded higher soil P_2O_5 and K_2O than other treatments. Application of LFA resulted in significantly high residual soil pH compared to other treatments. Reproduced with permission from the CAB Abstracts database.

173. Effect of integrated nutrient management on sabaigrass groundnut intercropping system under lateritic soils of South West Bengal.

Manisha Basu, Sanjib Das, and Mahapatra, S. C.
Environment and Ecology 24S(Special 1): 190-192. (2006)
NAL Call #: TD172.E5; ISSN: 0970-0420

Descriptors: application rates/ biomass production/ crop yield/ cropping systems/ dry matter accumulation / farmyard manure/ fibre plants/ fly ash/ groundnuts/ integrated systems/ intercropping/ intercrops/ lime/ NPK fertilizers/ organic amendments/ soil amendments/ tillers/ yield components/ fiber plants/ fibre crops/ FYM/ peanuts
Abstract: Sabaigrass (*Eulaliopsis binata*) is a commercial crop of marginal and submarginal rainfed upland areas. This crop is useful for its thin and long leaves containing high quality fibre, which is a good raw material for paper industries as well for marking rope and various rope-based utility items. A field experiment was conducted to evaluate the effect of integrated nutrient management on the growth and yield of sabaigrass-groundnut intercropping system for one year (2002-03) on the acid lateritic soils under the rainfed conditions of West Bengal, India. The treatments comprised three doses of chemical fertilizers (CF), i.e. 15:10:10 (CF_1), 30:20:20 (CF_2) and 60:40:40 kg of N: P_2O_5 : K_2O /ha (CF_3), along with farmyard manure (FYM), lime (L) and fly ash (FA). Thus, altogether 13 treatment combinations, viz. CF_1 , CF_1 +FYM, CF_1 +FYM+FA, CF_1 +FYM+L, CF_2 , CF_2 +FYM, CF_2 +FYM+FA, CF_2 +FYM+L, CF_3 , CF_3 +FYM, CF_3 +FYM+FA, CF_3 +FYM+L and untreated control, were tested under field condition. It revealed that all treatments increased leaf length (cm), number of tillers per plant, dry matter accumulation (g/m²) and yield of both crops. The integrated use of CF, FYM and FA resulted in higher yields for both crops compared with CF alone or other combinations. There was no significant difference between FA and L, also between CF_2 and CF_3 doses. Among all the treatment combinations, CF_3 +FYM+FA resulted in the best performance of both crops. Reproduced with permission from the CAB Abstracts database.

174. Effect of integration of fly ash with fertilizers and organic manures on nutrient availability, yield and nutrient uptake of rice in Alfisols.

Selvakumari, G.; Baskar, M.; Jayanthi, D.; and Mathan, K.

Journal of the Indian Society of Soil Science 48(2): 268-278. (2000)

NAL Call #: 56.9 IN2; ISSN: 0019-638X

Descriptors: alfisols / analysis/ application rates/ availability/ calcium/ composts/ crop production/ fertilizers/ fly ash/ heavy metals/ integration/ lignite/ magnesium/

manures/ nutrient availability/ nutrient uptake/ nutrients/ phosphorus/ physicochemical properties/ potassium/ properties/ rice/ seasons/ silica/ sodium/ soil/ soil pH/ sulfur/ summer/ treatment/ uptake/ yield increases/ yields/ elemental sulphur/ Madras/ paddy/ sulphur

Abstract: Field experiments were conducted for four seasons from summer 1997 to rainy season 1998 in Tamil Nadu, India, on Alfisols to study the effect of long-term application of fly ash alone and in combination with fertilizer, compost and Azospirillum on yield and uptake of rice and physicochemical properties and nutrient availability of the soil. The results of the pooled mean analysis for four seasons indicated that the treatments which received fly ash at 20 and 40 t ha⁻¹ recorded yield increases of 10.3 and 16.6%, respectively over the treatments without any fly ash addition. The treatments receiving N, P and K as fertilizers or fertilizers plus compost or fertilizers plus Azospirillum recorded 117, 125 and 131% increases in yield over the treatments without any manurial addition. The highest yield (6.90 t ha⁻¹) was recorded when fly ash applied was at 40 t ha⁻¹ in combination with fertilizer, compost and Azospirillum. The significant increase in the uptake indicated that fly ash could serve as a source of plant nutrients. Under integrated plant nutrient supply system with fly ash, its effect was pronounced. The continuous addition of lignite fly ash resulted in significant increase in pH, EC [electrical conductivity], exchangeable Na, available P, K, Ca, Mg, S and Si in the post-harvest soil after fourth crop of rice. The increase in pH was not significant. The results also confirmed that even after continuous addition of fly ash for three seasons, there was no hazardous level of heavy metal content. Reproduced with permission from the CAB Abstracts database.

175. Effect of lignite fly ash on growth, yield performance and quality attributes of blackgram.

Poonkodi, P. and Deepa, B.

Advances in Plant Sciences 15(2): 491-493. (2002)

NAL Call #: QK1.A38; ISSN: 0970-3586

Descriptors: application rates/ black gram/ chlorophyll/ crop quality/ crop yield/ fly ash/ growth/ haulms/ nitrogen/ nitrogen content/ plant height/ pods/ protein content/ seeds/ yield components

Abstract: A pot experiment was conducted on clay loam soil to study the effect of lignite fly ash (1, 2, 3, 4, and 5 t/ha applied as basal dressing) on the growth, yield, and quality of black gram cv. ADT3. At 60 days after sowing, lignite fly ash at 4 and 5 t/ha gave the tallest plants (25.23 and 25.34 cm) and the highest chlorophyll content (36.80 and 37.02 mg/g of tissue), number of pods per plant (21.70 and 22.11), pod length (4.78 and 4.81 cm), number of seeds per pod (5.46 and 5.52), haulm yield (6.17 and 6.18 g per pot), N content (3.68 and 3.70%), and protein content (23.00 and 23.15).

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176. Effect of mode of fly ash application with organic and chemical fertilizers on yield and nutrient uptake in crops under yellow sarson (Brassica rapa var glauca) rice (Oryza sativa) yellow sarson cropping sequence.

Rautaray, S. K.; Ghosh, B. C.; and Mittra, B. N.

Indian Journal of Agricultural Sciences 72(8): 480-483. (2002)

NAL Call #: 22 AG83I; ISSN: 0019-5022

Descriptors: application methods/ cadmium/ chemical composition/ crop yield/ fertilizers/ fly ash/ nickel/ nutrient availability/ nutrient uptake/ organic carbon/ organic fertilizers/ plant composition/ rice/ sequential cropping/ soil pH/ Capparales/ chemical constituents of plants/ paddy
Abstract: A field experiment was conducted during 1996-98 in West Bengal, India, to study the effect of mode of fly ash application, either as full- or split-doses, alone or in combination with organic or chemical fertilizers in a yellow sarson [*Brassica campestris* var. sarson]-rice-yellow sarson cropping sequence. Yellow sarson and rice were grown in 3 seasons in sequence, namely yellow sarson during the dry season (November to March 1996/97), rice during the wet season (June to October 1997) and yellow sarson during the dry season (November to March 1997/98). Data were obtained for yield, nutrient uptake, seed contents of cadmium and nickel, and pH, available nutrient and organic carbon in the soil. The results are discussed. Reproduced with permission from the CAB Abstracts database.

177. Effect of mode of pond and fly ash application on yield and nutrient content of crops under yellow sarson, *Brassica napus* var. *glauca* and rice, *Oryza sativa* in rotation.

Rautaray, S. K.

Journal of Oilseeds Research 22(1): 190-191. (2005); ISSN: 0970-2776

Descriptors: Alfisols / ash/ calcium/ crop yield/ farmyard manure/ fly ash/ magnesium/ mineral content/ nitrogen/ NPK fertilizers/ nutrient content/ phosphorus/ plant nutrition/ potassium/ returns/ rice/ sulfur/ zinc/ Capparales/ elemental sulphur/ FYM/ paddy/ sulphur
Abstract: A field experiment was conducted during 1996/98 on an acid lateritic (Haplustalf) soil in Assam, India. Yellow sarson (*B. napus* var. *glauca* [*B. campestris* var. sarson]) and rice (*O. sativa*) were grown in 3 seasons in sequence, i.e. yellow sarson during the dry season (November-March 1996/97), rice during the wet season (June-October 1997) and yellow sarson during the dry season (November-March 1997/98). Thirty tonnes of pond and fly ash was applied in 3 modes, i.e. 30-0-0 (first season yellow sarson received 30 tonnes/ha and no application to the following crops), 20-10-0 (first season yellow sarson received 20 tonnes/ha, rice received 10 tonnes/ha and no application to the second yellow sarson crop) and 10-10-10 (each crop received 10 tonnes/ha). A uniform NPK fertilizer dose of 90-26-33 kg/ha and 60-17-33 kg/ha was applied in rice and yellow sarson, respectively, through 5 tonnes of farmyard manure and complementary dose of chemical fertilizers or chemical fertilizers alone. Yellow sarson yield, rice equivalent yield and net returns were generally highest with the application of both ash at 20-10-0 and 30-0-0 tonnes/ha. Nutrient content in yellow sarson seed showed no variation due to mode of ash application. The contents of all nutrients (N, P, K, Ca, Mg, S and Zn) were higher with ash+farmyard manure+chemical fertilizer, followed by ash+chemical fertilizers and chemical fertilizers alone. Reproduced with permission from the CAB Abstracts database.

178. Effect of organic amendments on the oxygen uptake of *Pseudomonas putida* PAPs 1 in chromium-contaminated pond ash.

Sheela, A. M.; Shanmugasundaram, R.; and Sundaram, M. D.

Soil and Sediment Contamination 14(1): 71-84. (2005)

NAL Call #: TD878 .J68; ISSN: 1058-8337

Descriptors: artificial wetlands/ bioremediation/ chromium/ coir/ enzyme activity/ enzymes/ farmyard manure/ fly ash/ nitrogen/ nutrient content/ organic amendments/ oxidoreductases/ oxygen consumption/ phosphorus/ potassium/ rice/ rice straw/ soil amendments/ straw/ coconut fibre/ constructed wetlands/ FYM/ paddy/ redox enzymes

Abstract: In this study a Cr (VI) resistant bacterium *Pseudomonas putida* was isolated from pond ash and its oxygen consumption potential at different concentrations of Cr (VI) viz., 0, 100 and 200 mg kg⁻¹ was studied using Electrolytic Respirometry. Oxygen consumption by the bacterium was noticed up to 200 mg kg⁻¹ Cr (VI) concentration. To the pond ash (inoculated with and without *Pseudomonas*) 200 mg kg⁻¹ Cr (VI) was added and incorporated with different organic amendments such as farmyard manure (FYM), coir pith, paddy straw and press mud and the cumulative oxygen consumption was studied. The cumulative oxygen consumption by the bacterium was higher when the pond ash was incorporated with organic amendments. The highest oxygen consumption of 205 mg l⁻¹ was observed when press mud was used, which was followed by FYM (198 mg l⁻¹). Furthermore, the enrichment with press mud increased the nutrient content of N (57.28 mg kg⁻¹), P (5.5 mg kg⁻¹) and K (42.7 mg kg⁻¹) of the pond ash. The maximum dehydrogenase enzyme activity of 0.63 micro g TPF formed g⁻¹ sample h⁻¹ was measured when the pond ash was inoculated with *Pseudomonas* and enriched with press mud. The results also indicated that maximum reduction of Cr (VI) (42.5%) was observed when *Pseudomonas* and press mud were used. This study evaluated the possibilities of toxicity reduction and nutrient enrichment of the ash pond using a Cr (VI) resistant bacterium and organic amendments. Reproduced with permission from the CAB Abstracts database.

179. Effect of organic manures and flyash on nutrient uptake of sugarcane.

Venkatakrishnan, D. and Ravichandran, M.

Indian Sugar 56(11): 41-46. (2007); ISSN: 0019-6428

Descriptors: brix/ cane sugar/ composts/ farmyard manure/ fly ash/ humic acids/ juice quality/ leaves/ lignite/ manures/ mineral uptake/ nitrogen/ nitrogen fertilizers/ nutrient uptake/ phosphorus / phosphorus fertilizers/ potassium/ potassium fertilizers/ reducing sugars/ stems/ sugar content/ sugarcane/ FYM/ Madras/ phosphate fertilizers/ potash fertilizers

Abstract: The effects of organic manures and fly ash on the performance of sugarcane (cv. Co 86032) were studied at Mamangalam Chidambaram Taluk, Tamil nadu, India, from 2003 to 2004. The main plot treatments consisted of 25 t farmyard manure (FYM), 25 t seasoned pressmud and 5.0 t biocompost/ha, whereas the subplot treatments consisted of 100% of the recommended NPK rates (275:60:100

kg/ha; S1), S1 + 25 t lignite fly ash/ha, S1 + 50 kg humic acid/ha, and S1 + S2 + S3 (S4). All the treatments had significant effects on nutrient uptake and juice quality. Among the organic manures, seasoned pressmud resulted in the greatest uptake of N, P and K by stems (86.42, 47.84 and 204.35 kg/ha, on average), and by tops and trashes (86.45, 38.89 and 147.04 kg/ha). Farmyard manure and seasoned pressmud registered the highest average Brix (19.52 and 20.32%) and Pol (18.64 and 19.01%) values, and lowest reducing sugar contents (0.58 and 0.52%). The highest commercial cane sugar content (13.52%) was obtained with seasoned press mud (13.52%). Among the subplot treatments, Fe, Mn, Zn and Cu uptake by stems were most pronounced in plants under S4 (6.83, 2.27, 1.24 and 0.74 kg/ha). This treatment also gave the highest Brix (19.41%) and Pol (18.56%) values, and lowest reducing sugar content (0.56%). The combination between seasoned press mud and S4 was optimum for enhancing nutrient uptake and juice quality in sugarcane. Reproduced with permission from the CAB Abstracts database.

180. Effect of organics and graded levels of sulphur on rice yield and sulphur use efficiency.

Bhuvaneswari, R.; Sriramachandrasekharan, M. V.; and Ravichandran, M.

Journal of Interacademia 11(1): 51-54. (2007); ISSN: 0971-9016

Descriptors: application rates/ crop yield/ farmyard manure/ fly ash/ green manures/ lignite/ rice/ soil amendments/ sulfur fertilizers/ use efficiency/ FYM/ Madras/ paddy/ sulphur fertilizers

Abstract: Field experiments were conducted in Tamil Nadu, India, during the 2001 kharif season, to study the effect of sulfur (S) at varying rates, i.e. 0, 20, 40 and 60 kg/ha, with different organics, i.e. green manure, farmyard manure, sulfitation press mud and lignite fly ash, each applied at 12.5 t/ha, on yield, S use efficiency and S optimization of rice cv. ADT 43. The results revealed that rice responded significantly to the application of S and organics compared to the control. The highest grain (5065 kg/ha) and straw yields (7524 kg/ha) was obtained with 40 kg S/ha. Green manure addition caused 8.9% increase in grain yield and 10.6% increase in straw yield, closely followed by sulfitation press mud. S use efficiency was highest at 20 kg/ha and higher in the presence of organics. The physical optimum of S worked out through the Mitscherlich and Bray approach showed that 38.8 kg S/ha was needed to obtain 87.5% yield and in the presence of organics, it ranged from 14.4 to 32.3 kg S/ha, resulting in S savings of approximately 6.5-24.4 kg S/ha.

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181. The effect of pit coal fly ash from power plant "Dolna Odra" on growth and yielding of winter cereals.

Stankowski, S.; Stosio, M.; and Pacewicz, K.

Folia Universitatis Agriculturae Stetinensis, Agricultura 101: 309-318. (2006); ISSN: 1506-1973.

Notes: Original title: Wpływ stosowania popiołów lotnych z węgla kamiennego, pochodzących z elektrowni "Dolna Odra", na wzrost i plonowanie zbóż ozimych.

Descriptors: application rates/ coal/ crop yield/ fly ash/ photosynthesis/ rye/ seed weight/ triticale/ wheat/ winter

wheat/ yield components/ carbon assimilation/ carbon dioxide fixation

Abstract: A field experiment was conducted in the years 1995/96-1997/98 at Ostoja/Szczecin Agricultural Experimental Station in Poland. The treatments comprised 4 species of winter crops (rye cv. Warko, wheat cv. Almari, triticale cv. Bogo, and barley cv. Kroton in 1995/1996 and cv. Gil in 1996/97 and 1997/98), as well as 4 doses of ash (0 (control), 50, 100 and 150 t/ha). The grain yield, yield components and photosynthetic processes in plants were determined. The application of fly ash had a positive effect on the grain germination. In 1995 and 1997, the optimum dose of fly ash equalled 50 and 100 t/ha, whereas in 1996 when the conditions for the germination were unpropitious, the optimum dose equalled 150 t/ha. In either year, the plant germination was not worse on the plots with the applied ash as compared to the control object without ash. The effect of ash application on the yield of the investigated species varied. A regular increase of the yield with the growing ash dose was observed in barley (at ~40%). The yield of rye increased in two years after the application of the dose estimated on the regression line and not exceeding 55 and 88 t/ha. The increase of the triticale yield was noted only in one year. The yield of wheat was similarly independent of the ash dose. The increase of the grain yield in the investigated species due to the growing doses of ash was caused by the increase of the number of ears and the number of grains in an ear. The weight of 1000-grains varied insignificantly subject to this factor. No distinct differentiation of the chlorophyll content in the leaves nor the fluorescence induction coefficient Fv/Fm were observed.

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182. Effect of pyrite and fly ash on pH of sodic soil under submerged and field capacity conditions.

Bharat Singh and Anil Kumar

Farm Science Journal 12(2): 161. (2003); ISSN: 0972-8589

Descriptors: field capacity/ fly ash/ nonclay minerals/ pyrites/ reclamation/ saline sodic soils/ sodic soils/ soil pH/ soil types/ soil water regimes / waterlogging/ saline alkali soils

Abstract: A study was conducted to determine the effect of pyrite and fly ash on pH of sodic soil under submerged and field capacity conditions at different intervals. Seven treatments were employed, viz., waterlogged (T1); 0.50% fly ash, waterlogged (2); 1.00% fly ash, waterlogged (3); 0.75% pyrite, field capacity (T4); 0.75% pyrite, 15 days field capacity and then continuously waterlogged (T5); 0.75% pyrite, 30 days field capacity and the continuously waterlogged (T6); 0.375% pyrite + 0.50% fly ash, 15 days field capacity and then continuously waterlogged (T7). Two moisture regimes (i.e. field capacity and waterlogged conditions) were maintained up to 60 days of incubation period by addition of distilled water as and when required. The changes in pH were recorded at 0, 7, 15, 30 and 60 days on incubation. Results showed that pyrite was more efficient in decreasing the pH when it was surface broadcast and allowed to oxidize for 30 days at field capacity and then waterlogged. The addition of pyrite and fly ash in different combinations tended to decrease pH of sodic soil both under waterlogged and field capacity conditions. Fly ash was found good substitute for reclaiming

saline sodic soil when applied with pyrite under field capacity for 30 days and then waterlogged.
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183. Effect of resistant genotypes induced with organic nutrients on the feeding rate of rice brown plant hopper, Nilaparvata lugens (Stal.) (Delphacidae: Homoptera).

Rani, B. U. and Suresh, K.

Insect Environment 12(1): 42-44. (2006)

Descriptors: cultivars/ farmyard manure/ fly ash/ insect pests/ lignite/ neem seed cake/ non wood forest products/ phosphate solubilizing bacteria/ plant pests/ rice/ varietal resistance/ biofertilizers/ brown planthopper/ cultivated varieties/ FYM/ minor forest products/ neem seed oilmeal/ non timber forest products/ paddy/ rice brown planthopper
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184. [Effect of Shajiang black soil amended by coal fly ash on ecological factors and residue of heavy metal in wheat field].

Ma, X.; Wang, X.; Ding, J.; Gao, E.; and Yang, Q.

Ying Yong Sheng Tai Xue Bao 12(4): 610-4. (Aug. 2001); ISSN: 1001-9332 .

Notes: Original language of article: Chinese.

Descriptors: coal/ ecology/ metals, heavy: analysis/ soil: analysis / triticum: physiology/ water: analysis

Abstract: The effect of Shajiang black soil amended by coal fly ash on ecological factors in wheat field and residue of Cd, Cr, Pb, Hg and As were studied by pot experiment. The results showed that applying coal fly ash into Shajiang black soil could decrease soil density, soil proportion and clay content, but increase soil porosity, filtration coefficient and soil temperature. Moreover, it could promote water evaporating when soil moisture was high and keep soil water when lower than 10%. It also could facilitate activity of soil micro-organism and promote soil nutrient transforming. With (6-18) x 10(4) kg.hm-2 coal fly ash applied in Shajiang black soil, the accumulated quantity of Cd, Cr, Pb, Hg and As in soil and in wheat grain were lower than international standard index of pollution. Therefore, Shajiang black soil amended by coal fly ash was safe and reliable within the above range.

This citation is from PubMed.

185. Effect of soil amendments on sorption and mobility of metribuzin in soils.

Kaushik Majumdar and Neera Singh

Chemosphere 66(4): 630-637. (2007)

NAL Call #: TD172 .C54; ISSN: 0045-6535

Descriptors: animal manures/ downward movement/ fly ash/ herbicide residues/ herbicides/ leachates/ leaching/ metribuzin/ organic amendments/ polluted soils/ sandy loam soils/ soil amendments/ soil pollution/ soil types/ sorption/ weedicides/ weedkillers

Abstract: Metribuzin (4-amino-6-tert-butyl-4,5-dihydro-3-methylthio-1,2,4-triazin-5-one), is weakly sorbed to soil therefore, leaches easily to lower soil profiles. Soil amendments play a significant role in the management of leaching losses of pesticides. Therefore, present study reports the effect of organic manure and fly ash amendments on metribuzin downward mobility in sandy loam soil columns. Application of animal manure [T-1(OM)

and T-2(OM)] and fly ash [T-1(FA) and T-2(FA)] at 2.5% and 5.0% levels increased the metribuzin retention in the soil. Freundlich constant [$K_f(1/n)$] values of metribuzin for treatments T-1(OM) and T-2(OM) were 0.70 and 1.11, respectively, which were significantly higher than the value (0.27) in natural soil (T-0). The respective values for treatments T-1(FA) and T-2(FA) were 1.80 and 4.61.

Downward mobility of metribuzin

was studied in packed soil columns [300 mm (l) x 59 mm (i.d.)]. Both the amendments significantly reduced the downward mobility of metribuzin and affected breakthrough time and maximum concentration of metribuzin in the leachate. Leaching losses of metribuzin were decreased from 97% in natural soil (T-0) column to 64% [T-1(OM)] and 42% [T-2(OM)] for animal manure-amended columns and 26% [T-1(FA)] to 100% [T-2(FA)] for fly ash-amended columns, as metribuzin did not leach out of 5% fly ash-amended column. Study indicates that both animal manure and fly ash were quite effective in reducing the downward mobility of metribuzin in packed soil columns of a sandy loam soil.

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186. Effect of solid wastes and fertilizer levels on growth and yield of okra (Abelmoschus esculentus (L.) Moench).

Nagaraja, H.; Yeledhalli, N. A.; Patil, C. V.; Halepyati, A. S.; and Patil, M. G.

Karnataka Journal of Agricultural Sciences 16(1): 134-136. (2003)

NAL Call #: S471.I42K37; ISSN: 0972-1061

Descriptors: crop yield/ fly ash/ growth/ leaves/ okras/ organic amendments/ plant height/ pods/ sewage sludge/ trace element fertilizers/ micronutrient fertilizers

Abstract: A field experiment was conducted [date and location not given] to determine the effect of sewage sludge and fly ash fertilizer rates on the growth and yield of okra cv. Arka Anamika. The treatments were no solid waste application (control), 52 t 100% sewage sludge/ha, 52 t 100% fly ash/ha, and 50% fly ash+50% sewage sludge. At 45 days after sowing, the highest number of leaves (17.70) was obtained with 50:50 fly ash and sewage sludge treatment followed by sewage sludge (14.44), fly ash (12.93), and the control (9.77). The maximum plant height, number of pods per plant, and pod yield at all 3 stages was also obtained with 50:50 fly ash and sewage sludge treatments.

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187. Effect of vermicomposting on the transformation of some trace elements in fly ash.

Bhattacharya, S. S. and Chattopadhyay, G. N.

Nutrient Cycling in Agroecosystems 75(1/3): 223-231. (2006)

NAL Call #: S631 .F422; ISSN: 1385-1314

Descriptors: cadmium/ cattle dung/ chromium/ copper/ crop yield/ fly ash/ heavy metals/ iron/ lateritic soils/ lead/ manganese/ NPK fertilizers/ potatoes/ soil types/ trace elements/ vermicompost/ vermicomposting/ zinc/ microelements/ Mn

Abstract: One major constraint of the agricultural uses of fly ash (FA) is the low availability of different plant nutrients despite their high occurrence in the total amount. However,

degrading FA through increased microbial activity can improve the availability of these nutrients substantially. It has been found that intestines of epigeic earthworms contain a high concentration of different microorganisms. Therefore, in the present study we addressed the effects of vermicomposting technology on the solubility of some micronutrient cations (Fe, Mn, Cu, and Zn) and some heavy metals (Pb, Cd, and Cr) in different combinations of fly ash and organic matter, applied in the form of cow dung (CD). Various combinations of FA and CD were treated with and without an epigeic earthworm (*Eisenia fetida*) and the solubility of different trace elements in the treatments were estimated periodically. The results revealed that the inclusion of epigeic earthworm *Eisenia fetida* in different combinations of fly ash and cow dung converted a considerable amount of the micronutrients into bio-available forms. On the other hand, the solubility of heavy metals tended to be reduced by the microorganisms, presumably by formation of some organo-metallic complex. Application of these vermicomposted FA and CD combinations to a red lateritic soil was found to improve the soluble Fe, Mn, Cu, and Zn status of the soil. Furthermore, the use of vermicomposted FA and CD (1:1) in potato cultivation demonstrated that use of this mixture at 10 ton per hectare (t ha⁻¹; fresh weight) was able to compensate 80% of the recommended NPK fertiliser, along with farm yard manure application, without compromising the crop yield. Reproduced with permission from the CAB Abstracts database.

188. Effect on growth, tuber yield and quality of potato in fly ash amended soil.

Rajesh Kumar; Singh, R. P.; Arvind Kumar; Sarkar, A. K.; and Sharma, V. N.

In: Potato, Global Research and Development.

Proceedings of the Global Conference on Potato. New Delhi, India.; Vol. 2.; pp. 872-876; 2002.

Descriptors: application rates/ chemical composition/ cobalt/ copper/ crop quality/ crop yield/ dry matter/ fly ash/ growth/ industrial wastes/ lead/ leaves/ manganese/ nickel/ NPK fertilizers/ plant height/ potatoes/ soil amendments/ solid wastes/ weight/ zinc/ Mn

Abstract: The effects of 4, 8 or 16% of fly ash, an amorphous ferro-alumino silicate waste produced by steel and thermal power plants, alone or in combination with 50 or 100% recommended NPK rate, on the growth, yield and quality of potato cv. Kufri Lalima were determined in a field experiment conducted in Ranchi, Bihar, India during the rabi season of 1997-98. Application of 16% fly ash in combination with 100% recommended NPK resulted in the tallest plants (31.13 cm), highest number of leaves (41.16) and branches (5.20) per plant, and widest plant spread from east to west (48.50 cm) and from north to south (45.61 cm). The highest number of tubers per plant (15.23) was recorded with application of 8% fly ash in combination with 100% recommended NPK, whereas the heaviest tubers per plant (340.88 g) and highest dry matter (22.90%), tuber yield per plant (18.15 kg), mean tuber yield (22.41 t/ha) and tuber yield increase over the control (194.48 t/ha) were recorded with the application of 16% fly ash in combination with 100% NPK. Application of 16% fly ash resulted in the highest manganese, zinc, copper and nickel content in potato tubers. Application of 16% fly ash in combination

with 100 or either 50 or 100% recommended NPK rate resulted in the highest lead and cobalt content in the potato tubers, respectively.

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189. Effective utilisation of industrial wastes for higher yield of soybean.

Poonkodi, P. and Raghupathy, B.

Advances in Plant Sciences 14(2): 543-546. (2001)

NAL Call #: QK1.A38; ISSN: 0970-3586

Descriptors: chemical composition/ crop quality/ crop yield/ filter cake/ fly ash/ gypsum/ industrial wastes/ leaves/ methionine/ nitrogen content/ nutritive value/ plant composition/ plant height/ pods/ protein content/ pyrites/ seed oils/ seeds/ soyabeans/ sulfur/ sulfur fertilizers/ yield components/ chemical constituents of plants/ clarification mud/ elemental sulphur/ nutritional value/ quality for nutrition/ soybeans/ sulphur/ sulphur fertilizers

Abstract: A pot experiment was conducted in a clay loam soil to study the effects of various industrial wastes, i.e. pressmud (3.3 t/ha), lignite fly ash (4.0 t/ha), pyrite (228 kg/ha), gypsum (250 kg) and elemental sulfur (60 kg/ha), on the yield and quality of soyabean. The greatest plant height (44.00 cm), number of leaves per plant (22.00), seed yield per pot (12.10 g), oil content (21.82%), total N (6.64%) and total S (0.40%) were obtained with the application of gypsum. This treatment was at par with lignite fly ash in relation to the number of leaves (22.00). The protein content (41.50 and 41.25%) and methionine content (0.100 and 0.103%) were highest with the application of gypsum and lignite fly ash, respectively. The control registered the highest N : S ratio (26.2), which decreased with the application of the evaluated S sources.

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190. Effective utilisation of Neyveli lignite fly ash.

Khungar, S. C.

Fertiliser News 43(11): 27-28. (1998)

NAL Call #: 57.8 F4123; ISSN: 0015-0266

Descriptors: building materials/ fly ash/ lignite/ pesticides/ soil conditioners/ trace element fertilizers/ utilization/ micronutrient fertilizers

Abstract: The utilization of fly ash (from the combustion of lignite) in building materials, in pesticide formulations, as a trace element fertilizer and soil conditioner is briefly discussed. Its potential for use in ceramics manufacture, road building and detergent production is also considered. Reproduced with permission from the CAB Abstracts database.

191. Effectiveness of coal combustion by-products in controlling phosphorus export from soils.

Stout, W. L.; Sharpley, A. N.; and Landa, J.

Journal of Environmental Quality 29(4): 1239-1244. (2000)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: agriculture/ arsenic/ cadmium/ coal/ combustion products/ crops/ fly ash/ flyash/ freshwater pollution/ phosphorus/ pollution (soil)/ pollution (water)/ runoff/ soil/ soil contamination/ water pollution sources/ water quality control/ water quality control/ Brassica napus

Abstract: Phosphorus (P) export from high P soils is a

major cause of eutrophication in fresh waters. Recent work has shown that the solubility of P in high P soils can be reduced with coal combustion by-products (CCBs), decreasing the potential for dissolved phosphorus (DP) export from these soils. However, the effect of such treatments on plant-available P and P export has not been quantified. We measured P uptake by canola (*Brassica napus* L.) from three high P (130-370 mg kg super(-1) Mehlich-3 P) soils treated with two CCBs, fluidized bed combustion flyash (FBC), flue gas desulfurization (FGD) CaSO sub(4) anhydride, and agricultural gypsum (GYP). We measured DP, particulate phosphorus (PP), and total phosphorus (TP) concentrations in runoff from grassed and bare soils treated with these materials and subjected to simulated runoff. Phosphorus, As, Cd, and Pb uptake by canola were unaffected by CCB treatment, and dry-matter yields were unrelated to treatment. On grassed soils, FBC, FGD, and GYP reduced DP concentration in runoff by 20, 43, and 33%, respectively, but did not affect As, Cd, or Pb concentrations in runoff. Also on grassed soils, the high application rate of FGD reduced TP in runoff by 35%. On bare soils where erosion of PP controlled P loss, CCBs and GYP had no effect on DP concentration in runoff. Application of CCBs to high P soils in zones of high surface runoff potential, where there is little erosion, has the potential to reduce P export without affecting crop production. Abstract reproduced from the Water Resources Abstracts database with permission from ProQuest LLC. © 2007 ProQuest LLC; all rights reserved. Further reproduction is prohibited without permission.

192. The effectiveness of coal fly-ash to decrease phosphorus loss from grassland soils.

McDowell, R. W.

Australian Journal of Soil Research 43(7): 853-860. (2005)
NAL Call #: 56.8 Au7; ISSN: 0004-9573

Descriptors: agricultural land/ arsenic/ cadmium/ fly ash/ grassland soils/ leaching/ lead/ losses from soil/ organic carbon/ overland flow/ phosphorus/ selenium/ soil organic matter/ soil strength/ soil toxicity/ soil types/ water quality/ farmland/ losses from soil systems/ organic matter in soil/ pasture soils/ toxic soils/ water composition and quality

Abstract: Phosphorus (P) loss from soils can impair surface water quality. A study was conducted to test the efficacy of fly-ash to decrease phosphorus loss in 11 grassland soils in New Zealand. A preliminary toxicity and leaching experiment indicated that heavy metal concentrations (As, Cd, Pb, Se) in leachate and pasture from a soil treated with ash up to 50 mg/kg were not different from the control (unamended soil). Heavy metal concentrations in the ash were generally below limits for maximum concentrations in soil. Following incubation of fly ash at a rate of 20 mg/kg for 3 months with 11 grassland soils packed into boxes, overland flow was generated by simulated rainfall on each boxed soil. Analysis of overland flow indicated that in 2 semi-arid soils, P loss decreased due to decreased particulate P (PP) loss and low organic C concentration (< 20 g/kg) that facilitated soil dispersion and slaking and increased soil strength. However, in 4 other soils (including 3 volcanic-ash soils with organic C>70 g/kg), P loss increased due to increased soil pH from 6 to 7 where P is most soluble. In all soils, despite an increase in P in recalcitrant soil P fractions, increased soil pH stimulated soil C and P mineralization (decreased organic

C by, on average, 4.1 g/kg), decreased soil organic P, and increased inorganic P in labile fractions. It is concluded that the application of fly-ash from this source should not be used as an amendment to decrease P loss in pastures where soil pH is commonly <6.0, but could provide useful both as a supplement to lime and in mitigating P loss in cropping soils.

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193. Effectiveness of indigenous and non-indigenous isolates of arbuscular mycorrhizal fungi in soils from degraded ecosystems and man-made habitats.

Enkhtuya, B.; Rydlova, J.; and Vosatka, M.

Applied Soil Ecology 14(3): 201-211. (2000)

NAL Call #: QH541.5.S6 A67

Descriptors: acid rain/ ash/ chemical properties/ degradation/ disturbed soils/ ecosystems/ fly ash/ habitats/ heavy metals/ indicators/ maize/ mycelium/ mycorrhizal fungi/ mycorrhizas/ plant pathogenic bacteria/ plant pathogens/ plant pathology/ power stations/ properties/ pyrites/ rain/ soil/ soil pollution/ stress/ stress factors/ symbiosis/ vesicular arbuscular mycorrhizas/ acid precipitation/ corn/ isolates/ phytopathogens/ phytopathology/ plant growth/ rainfall

Abstract: Culturing in soils from degraded ecosystems significantly influenced the effectiveness of indigenous arbuscular mycorrhizal fungi (AMF) isolated from disturbed and undisturbed soils. The AMF isolates from degraded or artificially created habitats (acid rain polluted site, power station fly ash deposits, spoil banks, pyrite deposit), were not, in most cases, more effective than those from undisturbed soils, when grown in symbiosis with maize in the disturbed soils. Significant effects of soil or substrate on plant growth were found, while the influence of the AMF inoculant was much less pronounced. The development of AMF isolates was reduced in soils with more adverse chemical properties irrespective of the isolate origin. The length of extraradical mycelium of AMF and NADH-diaphorase activity of the mycelium were good indicators of negative effects of stress factors in the soil.

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194. The effectiveness of industrial by-products to stop phosphorous loss from a Pallic soil.

McDowell, R. W.

Australian Journal of Soil Research 42(7): 755-761. (2004)

NAL Call #: 56.8 Au7; ISSN: 0004-9573

Descriptors: boron/ eutrophication/ fly ash/ industrial effluents/ industrial wastes/ pastures/ phosphorus/ slags/ soil pH/ grazing lands

Abstract: A study was conducted of the effectiveness of applying various rates (0-50 g/kg) of fly and bottom ash (<2 mm and 2-4 mm) from a coal-fired power plant, and melter (AP10B and PAP5) and basic (KOBM) slags from a steel-manufacturing plant on mitigating phosphorus (P) loss from a Pallic soil sown to pasture. Measurements were made of soil pH, Olsen P, and H₂O-P (as a measure of P loss in overland flow), and soluble P and contaminants (B, As, Cd, Pb, Se) from a weekly leaching regime for 9 weeks. Results shows that H₂O-P had decreased up to 40% in soils treated at the greatest rate of melter slag (50 g/kg), and increased in KOBM and fly ash treated soils. The effect on Olsen P relative to H₂O-P was much less in metler slag

and bottom ash treated soils than soils treated with fly ash or KOBM slag. The fly ash was considered unsuitable for the mitigation of P loss from soils due to B toxicity to plants, while KOBM is also unsuitable due to a liming effect and the increase in soluble P loss. At the rates applied, no treated soil leached toxic metals (As, Cd, Hg, or Se) above current guidelines. In contrast, the incorporation of melter slag and bottom ash is considered an effective P loss mitigation strategy.

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195. Effects of *Alternaria tritricina* and foliar fly ash deposition on growth, yield, photosynthetic pigments, protein and lysine contents of three cultivars of wheat.

Singh, L. P. and Siddiqui, Z. A.

Bioresource Technology 86(2): 189-192. (2003)

NAL Call #: TD930.A32 ; ISSN: 0960-8524

Descriptors: chemical composition/ crop yield/ deposition/ dusting/ fly ash/ foliar application/ fungal diseases/ growth/ leaf area/ leaves/ lysine/ photosynthesis/ plant composition/ plant diseases/ plant pathogenic fungi/ plant pathogens/ protein content/ wheat/ carbon assimilation/ carbon dioxide fixation/ chemical constituents of plants/ foliar methods/ Hyphomycetes/ phytopathogens

Abstract: A greenhouse experiment was conducted to study the effects of *Alternaria tritricina* with and without foliar dusting of fly ash (0.0, 2.5, 5.0, 7.5 g plant⁻¹/day⁻¹) on the growth, yield, photosynthetic pigments, protein and lysine contents of three cultivars of wheat, *Triticum aestivum*. Dusting of 2.5 and 5.0 g fly ash caused a significant increase in growth, yield, photosynthetic pigments, protein and lysine contents of all the three cultivars. Dusting of 5.0 g fly ash caused a higher increase in the parameters than the 2.5 g dusting. However, dusting of 7.5 g fly ash had an adverse effect on growth, yield, photosynthetic pigments, protein and lysine contents. Cultivar HD-2009 suffered highest reductions in growth and yield and showed greater infected leaf area and disease symptoms from *A. tritricina* followed by HD-2329 and Lok-1. Inoculation of *A. tritricina* to plants dusted with 2.5/5.0 g fly ash gave higher reduction in growth and yield than did plants inoculated with *A. tritricina* without fly ash. Cultivar Lok-1 showed highest growth, yield, photosynthetic pigments, protein and lysine contents followed by HD-2329 and HD-2009.

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196. Effects of clinker ash on the properties of jagaru soil, and growth and mineral composition of lettuce.

Kubotera, H.

Japanese Journal of Soil Science and Plant Nutrition 77(5): 541-548. (2006); ISSN: 0029-0610

Descriptors: ash/ bulk density/ chemical composition/ coal/ crop yield/ growth/ lettuces/ particle size distribution/ Regosols/ soil amendments/ soil chemical properties/ soil density/ soil physical properties/ soil salinity/ soil strength/ soil types/ soil water content/ water availability/ chemical properties of soil/ physical properties of soil/ regosols

Abstract: A gray Terrestrial Regosol called "Jagaru" that corresponds to Udorthent in the Soil Taxonomy is widely distributed in the southwestern islands of Japan. Jagaru is a heavy-textured smectitic soil and shows problematic

physical properties such as severe hardening by air-drying. In order to improve the physical properties, the effects of clinker ash, which is the coarse fraction of coal ash, on the properties of Jagaru, and growth and mineral composition of lettuce were investigated. Physical and chemical analysis of clinker ash revealed that it is a mixture of grains of various particle sizes and chemical composition. Total elemental composition of bulk clinker ash was similar to Jagaru. Application of clinker ash increased the available water content and reduced solid ratio, bulk density and the strength of air-dried soil blocks of Jagaru, and clinker ash was more effective for the improvement of these physical soil properties than river sand of the same quantity. On the other hand, pot cultivation experiments showed that the application of clinker ash does not increase the yield of lettuce, and heavy application of the ash caused a slight reduction of yield. The yield was remarkably small in the plot that was not watered before planting in order to reduce the salinity caused by ash. The effect of clinker ash on the improvement of the soil physical properties was greater than sand and an inverse effect was observed for lettuce growth and cost for the transportation of ash. A suitable application rate was assumed to be around 10% of topsoil which corresponds to 240 t ha⁻¹. No problematic effect such as heavy metal accumulation in the plant was caused by ash application.

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197. Effects of coal fly ash amended soils on trace element uptake in plants.

Brake, S. S.; Jensen, R. R.; and Mattox, J. M.

Environmental Geology 45(5): 680-689. (2004)

NAL Call #: QE1.E5; ISSN: 0943-0105

Descriptors: antimony / arsenic/ barium/ bioavailability/ bismuth/ cadmium/ coal/ cobalt/ copper/ crop growth stage/ fly ash/ growth/ lead/ manganese/ marrows/ mercury/ molybdenum/ nickel/ phytotoxicity/ selenium/ soil amendments/ sunflowers/ temporal variation/ thallium/ thorium/ tin/ tomatoes/ trace elements/ tungsten/ uptake/ uranium/ zinc/ courgettes/ microelements/ Mn/ Mo/ United States of America/ zucchini

Abstract: Variations in As, Ba, Bi, Cd, Co, Cu, Hg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Th, Tl, U, W, and Zn uptake were evaluated in young, middle-aged, and mature basil, tomato, zucchini, and sunflower plants grown in soils amended with 5, 10, and 20% by weight fly ash. Elements susceptible to uptake with increasing fly ash were As and Tl, with As exceeding potentially toxic levels in basil and zucchini. Temporal variations in element uptake included (1) increasing Ba and Cd concentrations in tomato and As, Ba, Cd, and Tl in zucchini, (2) decreasing Co concentrations in tomato, zucchini, and sunflower, Ni in zucchini, and Tl in basil, and (3) increasing As and Ni concentrations in basil and Pb in zucchini and sunflower during early growth followed by decreasing concentrations at maturity. Although most of the trace elements were below reported toxic levels, the elevated concentrations of As in plant tissue suggests that fly ash treatment programs can lead to potentially toxic accumulations of As, and thus, should be carefully monitored.

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198. Effects of compost, coal ash, and straw amendments on restoring the quality of eroded Palouse soil.

Cox, D.; Bezdicek, D.; and Fauci, M.

Biology and Fertility of Soils 33(5): 365-372. (May 2001)

NAL Call #: QH84.8.B46; ISSN: 0178-2762

Descriptors: *Hordeum vulgare/ Pisum sativum/ Triticum aestivum/ eroded soils/ composts/ ash/ straw/ soil amendments/ soil fertility/ soil chemistry/ nitrogen fertilizers/ soil biology/ crop yield/ carbon nitrogen ratio/ phosphorus/ potassium/ nitrogen/ nutrient availability/ cation exchange capacity/ bulk density/ soil texture/ enzyme activity/ microbial activity/ application rate/ soil aggregates/ Washington/ infiltration*

Abstract: Ridgetops in the dryland farming region of eastern Washington suffer from low productivity and poor soil quality from years of erosion. Two studies investigated the effectiveness of soil amendments in restoring soil quality. Study 1 treatments were two rates of compost and a control. Study 2 treatments were compost, coal ash, wheat straw, three rates of inorganic N, and a control. A wide array of soil biological, chemical and physical parameters were measured from 1995 to 1997 and yield of spring barley, spring pea, and winter wheat were measured in different years from 1995 through 1998. In study 1, compost plus N increased barley yield and soil pH. Compost without N in study 2 increased total soil C and continued to immobilize soil N 2 years after incorporation because of the high C:N ratio of the compost. Total soil N, available P and K, some micronutrients, and cation exchange capacity were increased by the compost. Compost reduced soil bulk density and soil impedance, while increasing water-stable aggregates and improving infiltration. Coal ash slightly suppressed phosphatase activity, while tending to increase pH and soil B, and improving infiltration. Straw decreased soil bulk density and microbial activity in 1996 only. Barley grain trace element uptake, barley yield, and pea yield were uninfluenced by amendments. In 1998, 3 years after application of the amendments, winter wheat yield was significantly higher from the compost application than from any other treatments. Compost had the greatest benefit to improving soil quality and crop yield.

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199. Effects of cow manure on release regulation of microelements in coal bottom ash.

Li Fahu and Keren, R.

Transactions of the Chinese Society of Agricultural Engineering 20(6): 260-265. (2004)

NAL Call #: S671.N8; ISSN: 1002-6819

Descriptors: *arsenic/ ash/ barium/ boron/ cadmium/ cattle manure/ chromium/ cobalt/ copper/ cows/ leachates/ leaching/ lime/ lithium/ manganese/ molybdenum/ nickel/ selenium/ strontium/ tin/ titanium/ trace elements/ vanadium/ zinc/ microelements/ Mn/ Mo*

Abstract: The release regulation of microelements from bottom ash under rainfall condition was studied in laboratory. The treatments include: bottom ash, bottom ash + lime, bottom ash + lime + cow manure and incubation of bottom ash + lime + cow manure. Results indicated that the maximum concentrations of B, Sr, Ba and Li in leachate were higher than 1 mg/litre, while the concentrations of the other microelements were lower than this value. The application of lime increased the concentrations of B and

Ba but decreased those of Li, Mo and Cr in the leachate. The application of cow manure and the incubation of bottom ash and cow manure mixture increased concentrations of B, Mo, Zn, V, Cu, Ni, Cd, As, Mn, Ti, Co, Sn and Se, but decreased those of Sr, Ba, Li and Cr. Except V, the concentrations of all microelements in leachate decreased with the increase of leachate volume. Cr, Zn, Cd, Cu and As are the main microelements from bottom ash that may impose potential adverse impact on the environment.

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200. Effects of different rates of fly ash and sewage sludge mixture amendments on cation availability and their leachability.

Sajwan, K. S.; Paramasivam, S.; and Alva, A. K.

Journal of Environmental Science and Health Part A, Toxic/Hazardous Substances and Environmental Engineering 42(8): 1155-1160. (2007)

NAL Call #: TD172.J6; ISSN: 1093-4529

Descriptors: *application rates/ cations/ fly ash/ leaching/ sandy soils/ sewage sludge/ soil amendments/ soil pH/ soil types/ United States of America*

Abstract: A leaching column study was conducted to evaluate the leaching of cations from soils amended with a mixture of (1:1) fly ash (FA) from Port Wentworth power plant, Savannah, GA: sewage sludge (SS) from President Street water pollution control plant, Savannah, GA. Two sets of soil-leaching columns (30-cm high and 7.5-cm diameter; 15 columns per soil) were prepared with a fine sandy soil from Florida (Candler fine sand; pH 6.8) and Georgia (Ogeechee loamy sand; pH 5.6). The top one inch of soil from each of these columns was amended (3 columns per treatment) with 1:1 mixture of SS and FA at either 0, 24.7, 49.4, 98.8 or 148.3 Mg ha⁻¹ rate. After saturating the columns with deionized water, 18 cycles of intermittent leaching and drying was performed on weekly basis. Leaching of major cations and changes in ionic strength and pH were evaluated on half pore volume (220 mL) of leachate collected at each event. Results of this study indicated that leaching of cations increased rapidly up to the 3rd leaching event, and then rapidly decreased and the concentration of cations reached somewhat similar to that of unamended soil columns. Effects of soil type and rates of amendments on leaching of major cations along with changes of pH and ionic strength are discussed in this paper.

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201. Effects of different sources of sulphur on growth and yield performance of blackgram.

Poonkodi, P. and Deepa, B.

Journal of Ecobiology 15(6): 437-440. (2003)

NAL Call #: QH540.J56 ; ISSN: 0970-9037

Descriptors: *black gram/ crop quality/ crop yield/ filter cake/ fly ash/ growth/ gypsum/ lignite/ protein content/ pyrites/ sulfur fertilizers/ clarification mud/ sulphur fertilizers*

Abstract: A pot culture experiment was conducted on a clay loam soil to study the effect of different sources of S (applied in equivalent amounts to supply 40 kg S/ha), i.e. gypsum (250 kg/ha), pyrite (228 kg/ha), lignite flyash (LFA, 4 tonnes/ha), pressmud (PM, 6 tonnes/ha) and LFA+PM (2+3 tonnes/ha), on the growth and yield performance of

black gram cv. ADT3. Gypsum recorded the maximum seed yield of 4.22 g pot⁻¹ over control, recording 2.48 g pot⁻¹. The treatment next in order was LFA+PM combination, followed by LFA alone, pyrite and pressmud. Quality attribute, i.e. protein content, also followed the same trend. Each treatment was significantly different from each other.
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202. Effects of farming soil treated with fly-ash on soil structure and erosion through artificial rainfall simulation.

Duan XiMing; Wu Pute; Wang ChunHong; and Feng Hao
Transactions of the Chinese Society of Agricultural Engineering 22(8): 50-53. (2006)
NAL Call #: S671.N8; ISSN: 1002-6819
Descriptors: agricultural soils/ bulk density/ erosion/ fly ash/ infiltration/ porosity/ runoff/ sediment/ sediment yield/ soil conservation/ soil density/ soil structure
Abstract: Through artificial rainfall simulation, the farming soil structure and infiltration, water and sediment yields were studied under different slopes from 0 degrees to 20 degrees and different contents of fly ash from 0 to 10%. Results show that with the increase of fly ash content in the soil, soil infiltration rate obviously increased. Infiltration rate after treatment with 10% fly ash improved by 55.34% compared with the soil without fly ash. Soil bulk density decreased and soil porosity increased after adding fly ash. Compared with the contrast soil, the bulk density of the soil with 10% fly ash reduced by 17.42%, and porosity improved by 9.84% at the 10 degrees -slope. Runoff yield and soil losses decreased under the same conditions. Runoff yield of the soil with 10% fly ash accounted for 26.87% of that of the comparison at the 20 degrees -slope. Therefore, after addition of 10% fly ash in the cultivated soil layers, soil structure could be improved effectively. Furthermore, runoff and sediment are intercepted resulting to higher practical value.
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203. Effects of field application of fly ash on the growth and yield of chilli, eggplant and tomato in the presence and absence of root knot nematode.

Khan, M. R. and Ghadirpour, M. H.
Zeitschrift fur Pflanzenkrankheiten und Pflanzenschutz 106(6): 624-632. (1999)
NAL Call #: 464.8 Z3; ISSN: 0340-8159
Descriptors: aubergines/ carotenoids/ chemical control/ chlorophyll/ control/ fly ash/ fruit vegetables/ growth/ nematicides/ nematology/ organic amendments/ plant parasitic nematodes/ tomatoes/ vegetables/ yields/ brinjal/ eelworms/ eggplants/ plant/ Secernentea/ tetraterpenoids/ Tylenchida/ vegetable crops
Abstract: Fly ash @ 0.6 kg/m² was applied to soil in field plots as spot, row or broadcast treatments. The plots were planted with chilli, egg plant and tomato, and half of each treatment was inoculated with *Meloidogyne incognita*. Row or broadcast treatment significantly increased plant growth and yield of the vegetables, but spot application did not. Carotenoids and chlorophylls content of leaves were also increased due to fly ash application. The three treatments of fly ash decreased the number of galls and egg masses caused by *M. incognita* and soil population

of the nematode. The egg masses excised from the fly ash-grown plants contained fewer eggs. Row application of fly ash greatly enhanced the yield (weight of fruits/plant) of inoculated and uninoculated chilli, egg plant and tomato plants by 28.7 and 30.3%, 33.2 and 51.45%, and 95 and 67.7%, respectively, compared with plants grown in the plot not treated with fly ash.
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204. Effects of fly ash and *Alternaria triticina* on the yield, protein and lysine contents of three cultivars of wheat.

Singh, L. P. and Siddiqui, Z. A.
Thai Journal of Agricultural Science 35(4): 397-405. (2002); ISSN: 0049-3589
Descriptors: chemical composition/ crop yield/ cultivars/ fly ash/ fungal diseases/ liming materials/ loam soils/ lysine/ plant composition/ plant diseases/ plant pathogenic fungi/ plant pathogens/ protein content/ soil amendments/ soil types/ susceptibility/ varietal reactions/ wheat/ chemical constituents of plants/ cultivated varieties/ Hyphomycetes/ phytopathogens
Abstract: A greenhouse experiment was conducted to study the effects of fly ash (0, 20, 40, 60, 80 and 100% v/v) combined with loam soil (71, 18 and 11% sand, silt, and clay, respectively) and *Alternaria triticina* on the yield and protein and lysine contents of wheat cultivars Lok-1, HD-2329, and HD-2009. The application of 20 and 40% fly ash with soil significantly increased the yield and protein and lysine contents of all the cultivars, where 40% fly ash level resulted in the greatest increase in these three components. Fly ash amendments of 60, 80 and 100% had an adverse effect on the three components in all the cultivars, with 100% fly ash level having the most significant adverse effect. Inoculation of *A. triticina* had an adverse effect on the yield and protein and lysine contents in all the cultivars. HD-2009 exhibited the greatest infected leaf area and showed the highest number of disease symptoms caused by *A. triticina* followed by HD-2329 and Lok-1. Plants grown in 100% fly ash suffered higher reduction in yield when inoculated with *A. triticina* than plants grown in soil without fly ash. In general, high yield and protein and lysine contents were observed in Lok-1 followed by HD-2329 and HD-2009.
Reproduced with permission from the CAB Abstracts database.

205. Effects of fly ash and *Helminthosporium oryzae* on growth and yield of three cultivars of rice.

Singh, L. P. and Siddiqui, Z. A.
Bioresource Technology 86(1): 73-78. (2003)
NAL Call #: TD930.A32 ; ISSN: 0960-8524
Descriptors: application rates/ crop yield/ fly ash/ growth/ rice/ paddy/ Pleosporaceae
Abstract: A 120-day greenhouse experiment was conducted to study the effects of various fly ash concentrations (0, 20, 40, 60, 80 and 100% vol/vol) with normal field soil and *Helminthosporium oryzae* [*Cochliobolus miyabeanus*] on the growth and yield of three cultivars (Pusa Basmati, Pant-4 and Pant-10) of rice, *Oryza sativa*. Application of 20 and 40% fly ash with soil caused a significant increase in plant growth and yield of all the three cultivars. Forty percent fly ash caused a higher increase in growth and yield than did 20%. Sixty percent, 80 and 100%

fly ash had an adverse effect on growth and yield of all the three cultivars, the maximum being with 100% fly ash. Inoculation of *H. oryzae* had an adverse effect on the growth and yield, Pant-10 suffered higher damage by *H. oryzae* than Pusa Basmati and Pant-4. Pant-10 also exhibited higher infected leaf area and greater disease symptoms of *H. oryzae* than did Pusa Basmati and Pant-4. Plants grown in 100% fly ash suffered higher reductions in growth and yield with *H. oryzae* than plants grown in pure soil or in 20 or 40% fly ash. In general, plant growth was best in Pusa Basmati followed by Pant-4 and Pant-10, while yield was higher in Pant-4 followed by Pant-10 and Pusa Basmati.

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206. Effects of fly ash and sewage sludge amendments on transport of metals in different soils.

Alva, Ashok K.; Paramasivam, S.; Prakash, O.; Sajwan, Kenneth S.; Ornes, W. H.; and van Clief, D.

In: Fourth international conference on the biogeochemistry of trace elements. Berkeley, CA, United States.) Sajwan, Kenneth S.; Alva, Ashok K.; and Keefer, Robert F. (eds.); 1999.

Descriptors: alkalinity/ ash/ biochemistry/ chemical properties/ clastic sediments/ concentration/ effects/ geochemistry/ leachate/ loam/ mixing/ nitrogen/ nutrients/ pH/ phosphorus/ sand/ sediments/ sewage sludge/ soils/ transport/ utilization/ geochemistry of rocks, soils, and sediments

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207. Effects of fly ash and soil micro-organisms on plant growth, photosynthetic pigments and leaf blight of wheat.

Siddiqui, Z. A. and Singh, L. P.

Zeitschrift fur Pflanzenkrankheiten und Pflanzenschutz 112(2): 146-155. (2005)

NAL Call #: 464.8 Z3; ISSN: 0340-8159

Descriptors: application rates/ biological control/ biological control agents/ cation exchange capacity/ conductivity/ cultural control/ fly ash/ fungal antagonists/ fungal diseases/ growth/ inoculation/ mineral content/ plant disease control/ plant diseases/ plant pathogenic fungi/ plant pathogens/ plant pigments/ porosity/ soil amendments/ soil bacteria/ soil fertility/ soil fungi/ soil pH/ water holding capacity/ wheat/ biocontrol agents/ biological control organisms/ Glomaceae/ Hyphomycetes/ phytopathogens

Abstract: Effects of different fly ash concentrations (0, 20, 40%) and soil microorganisms (*Pseudomonas fluorescens*, *Azotobacter chroococcum*, *Glomus mosseae* and *Aspergillus awamori*) on the plant growth, photosynthetic pigments and leaf blight of wheat (*Triticum aestivum*) caused by *Alternaria tritricina* were studied in a glasshouse experiment. Amendments of soil with fly ash increased contents of minerals except nitrogen. Moreover, conductivity, pH, porosity, water-holding capacity and cation exchange capacity were also found to be increased with the addition of fly ash to soil. Addition of 20 and 40% fly ash to soil increased growth and photosynthetic pigments of wheat, maximum being with 40% fly ash. However, addition of fly ash had no visible effect on *Alternaria tritricina*-infected leaf area. Inoculation of

beneficial soil microorganisms increased plant growth and photosynthetic pigments and reduced the percentage of infected leaf area. *Glomus mosseae* caused the greatest increase in plant growth and photosynthetic pigments and greater reduction in percent infected leaf area followed by *P. fluorescens*, *Aspergillus awamori* and *Azotobacter chroococcum*.

Reproduced with permission from the CAB Abstracts database.

208. Effects of fly ash applications on soil properties, nutrient status and environment in Northern Thailand.

Inthasan, J.; Hirunburana, N.; Herrmann, L.; and Stahr, K. Bangkok, Thailand.); pp. 249; 2002.

Descriptors: application rates/ arsenic/ boron/ calcium/ cobalt/ fly ash/ heavy metals/ iron/ lead/ magnesium/ manganese/ nickel/ nutrients/ soil amendments/ soil parent materials/ soil types/ Mn

Reproduced with permission from the CAB Abstracts database.

209. The effects of fly ash-containing sludge amendment on nitrogen content and urease activity of soils.

Topac, F. O.; Baskaya, H. S.; and Alkan, U.

Fresenius Environmental Bulletin 16(5): 532-536. (2007); ISSN: 1018-4619

Descriptors: adverse effects/ ammonium nitrate/ chemical composition/ clay soils/ fly ash/ monitoring/ nitrate/ nitrogen/ sludges/ soil/ soil types textural/ urease/ waste water/ adverse reactions/ surveillance systems

Abstract: The present study was undertaken to demonstrate the effects of fly-ash addition to sludges on nitrogen content and urease activity of soils. Wastewater sludges added with varying doses of fly-ash (40, 80 and 120%, on dry weight basis) were amended to a clay soil, and the variations in ammonium, nitrate and total nitrogen contents and urease activities were monitored during incubation at 28 degrees C for 360 days. Co-application of fly-ash and wastewater sludge, especially at the dose of 120% fly-ash, caused an initial decrease in inorganic nitrogen and urease activity levels in contradiction to sludge-only application. However, after the first 3 months of incubation, this adverse effect almost disappeared. Application of fly-ash/sludge mixture to soil with appropriate dosages (<120%) may not affect the microbiological processes occurring in soil system.

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210. Effects of fly ash from coal-burning electrical utilities on ecosystem and utilization of fly ash.

Baba, Alper and Usmen, Mumtaz A. Canakkale, Turkey.)

Baba, Alper; Howard, Ken W. F.; and Gunduz, Orhan (eds.); Vol. 70.

Netherlands (NLD); pp. 15-31; 2006.

Notes: Conference: NATO Advanced Research Workshop on Groundwater and Ecosystems; ISSN: 1568-1238.

Descriptors: actinides/ aquatic environment/ ash/ chemical properties/ coal/ combustion/ concentration/ degradation/ discharge/ dissolved materials/ ecosystems/ energy sources/ environmental management/ hazardous waste/ heavy metals/ isotopes/ leaching/ metals/ pH/ pollution/

power plants/ radioactive isotopes / recycling/ sedimentary rocks/ sludge/ soils/ Th-232/ thorium/ toxicity/ trace elements / U-238/ uranium/ waste management/ water quality/ Environmental geology
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211. Effects of fly ash, gypsum, and shell on the chemical properties of soil and growth of Chinese cabbage in acidic soils.

Ha, H. S.; Lee, H.; Lee, Y. B.; and Kang, Y. G.
Korean Journal of Environmental Agriculture 17(2): 164-169. (1998); ISSN: 1225-3537.
Notes: 1 illu.; 7 tables; 32 ref. Summaries (En, Ko).
Descriptors: fly ash/ gypsum/ shell/ soils: chemical properties, growth/ Chinese cabbage/ acidic soils
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212. Effects of fly ash incorporation on heavy metal accumulation, growth and yield responses of Beta vulgaris plants.

Singh, A.; Sharma, R. K.; and Agrawal, S. B.
Bioresource Technology 99(15): 7200-7. (Oct. 2008)
NAL Call #: TD930.A32 ; ISSN: 0960-8524 . 18280142
Descriptors: Beta vulgaris: growth & development: metabolism/ Carbon: metabolism/ Crops, Agricultural: growth & development: metabolism/ Metals, Heavy: metabolism/ Particulate Matter: metabolism
Abstract: Use of fly ash (FA) to agriculture is not always beneficial, however, utilization of lower concentration of FA as soil amendment is suitable for better management of few crops. The present study was conducted to study the effects of various concentrations of FA (0%, 5%, 10%, 15% and 20%) on heavy metal accumulation, growth, and yield responses of palak (*Beta vulgaris* L. var All Green H1). The results showed that application of FA caused significant reductions in growth, biomass and yield responses of *B. vulgaris* plants at different ages of observations. The concentrations of all the heavy metals increased significantly with increasing concentrations of FA. Metal pollution index (MPI) of both roots and shoots showed significant and negative relationships with the yield of *B. vulgaris* plants. The study concludes that *B. vulgaris* plant is sensitive to FA concentrations used in this study. It is further recommended that leafy vegetable like *B. vulgaris* is not a suitable crop to be grown in a region where FA is used for amendment of agricultural soils.
This citation is from PubMed.

213. Effects of fly ash on rice-groundnut cropping system in lateritic soil.

Pradhan, K. C.; Sahu, S. K.; and Samanta, P. K.
International Arachis Newsletter 24: 49-50. (2004); ISSN: 1010-5824
Descriptors: application rates/ crop yield/ cropping systems/ farmyard manure/ fly ash/ groundnuts/ nitrogen fertilizers/ NPK fertilizers/ phosphorus fertilizers/ potassium fertilizers/ residual effects/ rice/ sequential cropping/ trace element fertilizers/ FYM/ micronutrient fertilizers/ paddy/ peanuts/ phosphate fertilizers/ potash fertilizers
Abstract: An experiment was conducted to study the direct and residual effects of fly ash on rice-groundnut (cv. AK 12-24) system in Orissa, India, during the 1999/2000 rabi

season. The treatments comprised: 20 and 40 t fly ash/ha; 10 t farmyard manure (FYM)/ha; and recommended NPK (80:17:33 kg/ha) alone and in combination with NPK and FYM. The highest yields of rice (3.8 t/ha) and groundnut (1.4 t/ha) with high shelling outturn (70%) and oil content were obtained with 40 t fly ash/ha, 5 t FYM/ha and 50% recommended dose of NPK.
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214. Effects of fly ash on soil characteristics, plant growth and soil microbial populations.

Siddiqui, Z. A. and Singh, L. P.
Heavy Metal Contamination of Soil: Problems and Remedies: 171-193. (2005)
Descriptors: application rates/ application to land/ aromatic hydrocarbons/ crop yield/ cycling/ dioxins/ electrical conductivity/ fly ash/ growth/ heavy metals/ inorganic compounds/ microbial activities/ microorganisms/ nutrient content/ organic compounds/ phenols/ physicochemical properties/ phytotoxicity/ polycyclic hydrocarbons/ seed germination/ seedlings/ soil amendments/ soil chemical properties/ soil pH/ soil physical properties/ soil properties/ toxicity/ waste management/ waste utilization/ chemical properties of soil/ land application/ micro organisms/ microbial communities/ organic chemicals/ physical properties of soil/ polycyclic aromatic hydrocarbons
Abstract: Utilization of fly ash is a practical and important waste management issue, and agronomic uses of fly ash are being explored as a means of disposal. Fly ash changes the physico-chemical properties of soil. Ash applications increase soil pH and electrical conductivity. Fly ash contains numerous plant nutrients and improves the nutritional status of soil. The effects of fly ash amendment on plants include improvements in seed germination and seedling growth, plant growth and yield. However, it also contains heavy metals and other compounds (e.g., inorganic compounds, organic compounds, polycyclic aromatic hydrocarbons, phenols, dioxins, and leachable compounds within fly ash) which are toxic to plants and microbes. Fly ash changes microbial populations and negatively affects cycling of nutrients. Over-application of fly ash can cause toxicity to animals grazing on recipient soils. Various plant pathogens show variable response to their host plants in fly ash-amended soil. Extensive field trials are required for making proper recommendations of doses of fly ash amendments to soil.
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215. Effects of fly ash pH on the uptake of heavy metals by chicory.

Scotti, I. A.; Silva, S.; and Baffi, C.
Water, Air and Soil Pollution 109(1/4): 397-406. (1999)
NAL Call #: TD172 .W36; ISSN: 0049-6979
Descriptors: availability/ biochemistry/ cadmium/ chicory/ copper/ fly ash/ heavy metals/ nickel/ NPK fertilizers/ pH/ plant composition/ plant nutrition/ pollution/ potassium/ soil/ soil pH/ uptake/ vegetables/ zinc/ chemical constituents of plants/ environmental pollution/ hydrogen ion concentration/ potential of hydrogen/ vegetable crops
Abstract: Chicory was cultivated in a pot experiment in 2 soils of different pH amended with NPK, fly ash (pH 8) +

NP, or fly ash (pH 12) + NP. Another series of pots received heavy metals in soluble form additionally to the described treatments. Fly ash generally decreased Zn, Cd, Ni and Cu concentrations of chicory. The reduction occurred both for the metals naturally present in the soil and, to a greater extent, for those added as salts. This effect was more evident when fly ash at pH 12, rather than at pH 8, was used. The increase of soil-pH through fly ash addition was the major factor decreasing heavy metal availability. K originating from fly ash was not available for crop uptake. Reproduced with permission from the CAB Abstracts database.

216. Effects of fly ash, *Pseudomonas striata* and *Rhizobium* on the reproduction of nematode *Meloidogyne incognita* and on the growth and transpiration of pea.

Siddiqui, Z. A. and Singh, L. P.

Journal of Environmental Biology 26(1): 117-122. (2005)

NAL Call #: QH540.J65 ; ISSN: 0254-8704

Descriptors: colonization/ fly ash/ galls/ growth/ nitrogen fixing bacteria/ nodulation/ peas/ phosphate solubilizing bacteria/ plant nematology/ plant parasitic nematodes/ plant pests/ reproduction/ soil amendments/ transpiration/ eelworms/ pea/ *Secernentea*/ *Tylenchida*

Abstract: Glasshouse experiments were conducted twice to assess the effect of ash amendments (0, 20, and 40% with soil), phosphate solubilizing microorganism *Pseudomonas striata* (Ps), and root nodule bacterium *Rhizobium* sp. (Rh) on the reproduction of root-knot nematode *Meloidogyne incognita*, and on the growth and transpiration of pea both in the presence and in the absence of the root-knot nematode. The effect of fly ash on nodulation and root colonization by Ps was also assessed. Amendments of fly ash with soil had no effect on transpiration. However, M. incognita reduced the rate of transpiration from the first week onwards after the inoculation, while inoculation of *Rhizobium* sp. and P. *striata* increased the transpiration from the first week onwards after the inoculation, both in the nematode-inoculated and uninoculated plants. Increase in transpiration was greater when Rh and Ps were inoculated together. The addition of 20 and 40% fly ash with soil was beneficial for plant growth both in nematode-inoculated and uninoculated plants. The inoculation of the organisms also increased the growth of nematode-inoculated and uninoculated plants in different fly ash soil mixture, but growth increase was greater when Rh and Ps were inoculated together. The use of 20% fly ash increased galling and nematode multiplication compared to plants grown without fly ash, while 40% fly ash had an adverse effect on galling and nematode multiplication. Rh had greater adverse effect on galling and nematode multiplication than Ps. The use of Rh and Ps together had greater adverse effect on galling and nematode multiplication than either of them alone. The highest reduction in galling and nematode multiplication was observed when Rh and Ps were used in 40% fly ash amended soil. However, the highest transpiration was observed in plants without nematodes, and inoculated with Rh and Ps in fly ash amended and unamended soil. Reproduced with permission from the CAB Abstracts database.

217. Effects of high rates of coal fly ash on soil, turfgrass, and groundwater quality.

Adriano, D. C.; Weber, J.; Bolan, N. S.; Paramasivam, S.; Koo, B. J.; and Sajwan, K. S.

Water, Air and Soil Pollution 139(1/4): 365-385. (2002)

NAL Call #: TD172 .W36; ISSN: 0049-6979

Descriptors: aluminium/ antimony/ arsenic/ barium/ beryllium/ boron/ cadmium/ calcium/ chromium/ copper/ fly ash/ groundwater pollution/ iron/ lawns and turf/ lead/ magnesium/ manganese/ mercury/ mineral content/ molybdenum/ nickel/ nitrogen/ nutrient content/ plant nutrition/ plant tissues/ polluted soils/ polluted water/ potassium/ selenium/ silver/ soil amendments/ soil chemical properties/ soil pH/ soil pollution/ soil salinity/ soil types/ thallium/ water quality/ zinc/ aluminum/ chemical properties of soil/ lawns and sports turf/ Mn/ Mo/ soil quality/ United States of America/ water composition and quality

Abstract: A field study (1993-96) in the USA assessed the effects of applying unusually high rates of coal fly ash as a soil additive for the turf culture of centipedegrass (*Eremochloa ophiuroides*). In addition, the quality of the soil and the underlying groundwater was evaluated. A latin square plot design was employed to include 0 (control, no ash applied), 280, 560, and 1120 t ha⁻¹ application rates of unweathered precipitator fly ash. The once applied fly ash was rototilled and allowed to weather for 8 months before sowing. Ash application significantly increased the concentrations in plant tissue of B, Mo, As, Be, Se, and Ba while also significantly reducing the concentrations of Mg, Mn, and Zn. The other elements measured (i.e., N, K, Ca, Cu, Fe, Ag, Cd, Cr, Hg, Ni, Pb, Sb, Ti, Na, and Al) were not affected. Of these elements Mg, Cu, and Mo concentrations in plant tissue increased with time while B and Se decreased temporally. The diminution of B and Na appears to be related to the leaching of soluble salts from ash-treated soils. Of all the elements measured, only Mn produced significant correlation (P=0.0001) between the tissue and soil extractable concentrations. Ash treatment elevated the soil pH to as high as 6.45 with the enhanced effect occurring primarily in the 0-15 cm depth. Soil salinity increased with the application rate with the largest increases occurring in the initial year of application. However, by the second year, most of the soluble salts had already leached from the treatment zone into deeper depths, and by the fourth year, these salts had completely disappeared from the profile. The chemical composition of the underlying groundwater was not adversely impacted by the ash application. Plant tissue and groundwater data however, indicate that much higher rates of fly ash can be used on this type of land use where the plant species is tolerant of soil salinity and does not appear to bioaccumulate potentially toxic trace elements. Reproduced with permission from the CAB Abstracts database.

218. Effects of lignite fly ash, pressmud and inorganic fertilizers on the growth performance of blackgram.

Deepa, B. and Poonkodi, P.

Journal of Ecobiology 16(2): 147-150. (2004)

NAL Call #: QH540.J56 ; ISSN: 0970-9037

Descriptors: application rates/ black gram/ clay loam soils/ fertilizers/ filter cake/ fly ash/ growth/ lignite/ soil types/ clarification mud/ Madras

Abstract: A field experiment was conducted in a clay loam soil in Tamil Nadu, India, to investigate the effects of

inorganic fertilizers, lignite fly ash (LFA) and pressmud (PM) on the growth performance of black gram. The results revealed that application of 100% recommended dose of fertilizer (RDF) along with LFA at 5 t ha⁻¹ and pressmud at 6 t ha⁻¹ significantly enhanced the growth of black gram followed by 75% RDF. However, 100 and 75% RDF were not significantly different from each other when applied along with LFA and pressmud.
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219. Effects of nitrogenous and phosphoric fertilizers, coal fly ash and CaCO₃ on bioeffect of wheat seedling and As(III) content of grain in mature with As stress.

Li ChunXi; Shao Yun; Hou XiaoLi; Jiang LiNa; and Feng ShuLi

Research of Environmental Sciences 20(6): 49-55. (2007); ISSN: 1001-6929

Descriptors: arsenic/ biomass/ calcium carbonate/ chemical composition/ chlorophyll/ fly ash/ nitrogen fertilizers/ phosphorus fertilizers/ phytotoxicity/ plant composition/ plant height/ proline/ seed germination/ seedling emergence/ seedling growth/ seedlings/ seeds/ wheat/ chemical constituents of plants/ phosphate fertilizers
Abstract: The effects of N and P fertilizers, coal fly ash (CFA) and CaCO₃ on wheat germination, seedling growth and seed As content were studied in a greenhouse pot experiment on As-polluted soil. The N fertilizer, P fertilizer, CFA and CaCO₃ enhanced seed germination and seedling growth, alleviated the toxicity of As on wheat, and reduced the As content of seeds at the maturity stage, resulting in increases in the rate of emergence, seedling height, fresh weight and content of chlorophyll a, and reduction in the concentrations of MDA [malondialdehyde], free proline and As in grains.

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220. Effects of soil acidity and cropping on solubility of by-product immobilized phosphorus and extractable aluminum, calcium, and iron from two high-phosphorus soils.

Codling, Eton Elsworth

Soil Science 173(8): 552-559. (Aug. 2008)

NAL Call #: 56.8 So3; ISSN: 0038-075X

Descriptors: sandy soils/ silt loam soils/ acid soils/ soil ph / acidification/ water solubility/ phosphorus/ aluminum/ calcium/ iron/ soil amendments/ industrial wastes/ coal fly ash/ immobilization in soil/ drinking water treatment residue/ coal combustion bed ash/ Internet resource

Abstract: Large quantities of by-products and increased costs for landfill have heightened interest in using by-products as soil amendments on agricultural lands. There are concerns of potential negative environmental impacts of by-product-amended soils when fields are taken out of agricultural production or polluted area. The objective of this study was to determine the effects of lowering soil pH and cropping on the solubility of phosphorus (P) immobilized by drinking water treatment residue (WTR) and coal combustion bed ash (BA). Two high-P soils (Evesboro sand and Matapeake silt loam) were mixed with two WTR and a BA and incubated for 15 weeks using several wetting and drying cycles. From 15 to 33 weeks, elemental sulfur

and 1N H₂SO₄ were used to adjust soil pH to levels found in the wooded areas adjacent to agricultural fields. Acidified soils were planted with Bermudagrass. By-products reduced extractable P in both soils. Mehlich-3-extractable P that was immobilized in the by-product-amended Matapeake soil did not become soluble after acidification and cropping. Water-extractable P was significantly higher for the control and BA treatments after acidification and cropping. The water-extractable P that was immobilized by WTR before acidification did not become soluble under acidic and cropping conditions in either soil. Although soil aluminum and iron concentrations were higher under acidification and cropping, it was concluded that they were not at levels that would negatively impact the environment. This citation is from AGRICOLA.

221. Effects of soil additives on spring barley yield and some soil parameters.

Kovacik, P.

Acta Fytotechnica et Zootechnica 9(1): 5-10. (2006); ISSN: 1335-258X.

Notes: Original title: Vplyv nepriamych hnojiv na urodu jarmena jarneho a niektore parametre pody.

Descriptors: arsenic/ barley/ barley straw/ basalt/ cobalt/ crop yield/ fly ash/ heavy metals/ mercury/ nickel/ sodium humates/ soil amendments/ soil ph/ straw

Abstract: The effects of soil additives (Nobasyp, Agrodrap, sodium humate and fly ash mixture) on spring barley yield and some agrochemical and pedological parameters of the soil were investigated in a pot experiment on brown soil (Haplic Luvisol). The experiment was conducted in the vegetative cage placed on the territory of the Slovak Agricultural University, Nitra (48 degrees 18'N, 18 degrees 5'E). Results showed that all tested potential soil additives increased grain and straw yields and decreased the content of starch, a rate of their significance being different. The application of Nobasyp significantly increased both grain and straw yields but at the same time it caused a minimal decrease in starch content and N-substances level. Agrodrap significantly increased straw yield and insignificantly grain one as well as the level of N-substances, the N-substances content increase of 8.76 to 9.25% was considered to be favourable. The content of starch decreased insignificantly. Sodium humate caused a significant increase in grain and straw yields and an insignificant reduction in the contents of starch and N-substances. A decrease in N-substances concentration to 8.54% was not convenient. Of all tested materials the fly ash ash mixture caused the lowest increase in grain yield and the highest decrease in starch and N-substances. The level of 9.32% in the latter was considered to be favourable. The use of Nobasyp significantly increased the contents of Hg, Co and Ni out of 11 tested metals in grain. Agrodrap increased the contents of As and Co, while sodium humate caused the As concentration increase, and a significant decrease in Hg and Ni levels. The fly ash ash mixture significantly increased Co, Mn and Hg. The hygienic limit of investigated heavy metals in grain has not been exceeded. The application of these materials determined the level of 11 heavy metals in the soil in a nearly immeasurable way. Basalt wools, fly ash, ash mixture and sodium humate slightly increased soil pH and inhibited carbon oxidation in the soil. Unlike fly ash, ash mixture and sodium humate,

wools increased the sorption capacity and porosity of the soil and subsequently they reduced volume weight. The tested materials have shown that they can be used as soil additives.

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222. Effects of soil amendments at a heavy loading rate associated with cover crops as green manures on the leaching of nutrients and heavy metals from a calcareous soil.

Wang, Q. R.; Li, Y. C.; and Klassen, W.

Journal of Environmental Science and Health Part B 38(6): 865-81. (Nov. 2003)

NAL Call #: TD172.J61 ; ISSN: 0360-1234 . 14649715

Descriptors: Abelmoschus/ Crotalaria/ Fertilizers/ Humans/ Industrial Waste/ Metals, Heavy: chemistry/ Nitrogen: chemistry/ Phosphorus: chemistry/ Refuse Disposal/ Soil/ Soil Pollutants/ Sorghum

Abstract: The potential risk of groundwater contamination by the excessive leaching of N, P and heavy metals from soils amended at heavy loading rates of biosolids, coal ash, N-viro soil (1:1 mixture of coal ash and biosolids), yard waste compost and co-compost (3:7 mixture of biosolids to yard wastes), and by soil incorporation of green manures of sunn hemp (*Crotalaria juncea*) and sorghum sudangrass (*Sorghum bicolor* x *S. bicolor* var. *sudanense*) was studied by collecting and analyzing leachates from pots of Krome very gravelly loam soil subjected to these treatments. The control consisted of Krome soil without any amendment. The loading rate was 205 g pot⁻¹ for each amendment (equivalent to 50 t ha⁻¹) of the dry weight), and the amounts of the cover crops incorporated into the soil in the pot were those that had been grown in it. A subtropical vegetable crop, okra (*Abelmoschus esculentus* L.), was grown after the soil amendments or cover crops had been incorporated into the soil. The results showed that the concentration of NO₃-N in leachate from biosolids was significantly higher than in leachate from other treatments. The levels of heavy metals found in the leachates from all amended soils were so low, as to suggest these amendments may be used without risk of leaching dangerous amounts of these toxic elements. Nevertheless the level of heavy metals in leachate from coal ash amended soil was substantially greater than in leachates from the other treatments. The leguminous cover crop, sunn hemp, returned into the soil, increased the leachate NO₃-N and inorganic P concentration significantly compared with the non-legume, sorghum sudangrass. The results suggest that at heavy loading rates of soil amendments, leaching of NO₃- could be a significant concern by application of biosolids. Leaching of inorganic P can be increased significantly by both co-compost and biosolids, but decreased by coal ash and N-viro soil by virtue of improved adsorption. The leguminous cover crop, sunn hemp, when incorporated into the soil, can cause the concentration of NO₃-N to increase by about 7 fold, and that of inorganic P by about 23% over the non-legume. Regarding the metals, biosolids, N-viro soil and coal ash significantly increased Ca and Mg concentrations in leachates. Copper concentration in leachate was increased

by application of biosolids, while Fe concentration in leachates was increased by biosolids, coal ash and co-compost. The concentrations of Zn, Mo and Co in leachate were increased by application of coal ash. The concentrations of heavy metals in leachates were very low and unlikely to be harmful, although they were increased significantly by coal ash application.

This citation is from PubMed.

223. Effects of soil application of fly ash on the fusarial wilt on tomato cultivars.

Khan, M. R. and Singh, W. N.

International Journal of Pest Management 47(4): 293-297. (2001); ISSN: 0967-0874

Descriptors: bicarbonates/ boron/ calcium/ carbohydrates/ crop yield/ cultivars/ cultural control/ fly ash/ fungal diseases/ growth/ magnesium/ manganese/ phosphorus/ plant disease control/ plant diseases/ plant pathogenic fungi/ plant pathogens/ potassium/ soil fertility/ sulfates/ tomatoes/ zinc/ cultivated varieties/ Hyphomycetes/ Mn/ phytopathogens/ saccharides/ sulphates

Abstract: A study was carried out in microplots to evaluate the effect of fly ash on the plant growth and yield of tomato cultivars, Pusa Ruby, Pusa Early Dwarf and New Uday, and on wilt disease caused by *Fusarium oxysporum* f.sp. *lycopersici*. Fly ash was applied to soil by broadcast or in rows at the rate of 1, 2, 3 and 4 kg ash/m in place of inorganic fertilizers. In control plots, NPK (about 40:20:20 kg/acre) and compost were added in place of fly ash. Ash application greatly increased the soil P, K, B, Ca, Mg, Mn, Zn, carbonate, bicarbonate and sulfate content. Plants grown in the ash-treated plots, especially at 3 or 4 kg dose, showed luxuriant growth and greener foliage, and plant growth and yield of the three cultivars were significantly increased in comparison with the plants grown in plots without fly ash. The wilt fungus, *F. oxysporum* f.sp. *lycopersici* at the inoculum level of 2 g/plant caused significant suppression of growth and yield in all three cultivars. Application of fly ash, however, checked the suppressive effect of the fungus, leading to a significant increase in the considered variables compared with the inoculated control. Soil population of the fungus (colony-forming units g/soil) gradually decreased with an increase in ash dose. Row application was found to be relatively more effective in enhancing the yield of tomato cultivars and suppressing the wilt disease. The greatest increase in the yield of fungus inoculated and uninoculated plants due to broadcast or row application at 3 or 4 kg ash/m was recorded in tomato cv. Pusa Ruby (39-61 and 9-24%), followed by Pusa Early Dwarf (31-61 and 17-34%) and New Uday (21-35 and 4-22%).

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224. Effects of the mixture with different proportion of fly ash and filtered mud on red soil properties and barley yield.

Xing Shihe and Zhou Biqin

Journal of Fujian Agriculture and Forestry University (Natural Science Edition) 32(2): 240-244. (June 2003); ISSN: 1671-5470.

Notes: 6 tables, 11 ref.. Summaries (En, Zh). Citation Notes: CN (China).

Descriptors: fly ash/ mud/ soil properties/ barley/ yield
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225. Effects of various modifiers on soil fertility properties and tobacco yields and qualities.

Xing ShiHe; Xiong DeZhong; Zhou BiQing; Xu Qian; and Liu ChunYing

Journal of Fujian Agriculture and Forestry University Natural Science Edition 33(3): 384-389. (2004); ISSN: 1671-5470

Descriptors: calcium/ cellulase/ cellulose/ crop yield/ dolomite/ enzyme activity/ enzymes/ fertilizers/ fly ash/ lime/ magnesium/ nitrogen/ peroxidases/ phosphate/ phosphoric monoester hydrolases/ phosphorus/ potassium/ soil bacteria/ soil fertility/ soil pH/ tobacco/ urease/ phosphatases

Abstract: The effects of various modifiers such as lime, fly ash, dolomite, culture waste of edible fungi and chemical fertilizers on soil major fertility properties and tobacco yields and qualities in China were studied. Results showed that the effects of applying modifier composed of lime, culture waste of edible fungi and chemical fertilizer were the best among the modifiers studied. After applying these modifiers, soil pH, contents of rapidly available N, P and K, contents of exchangeable Ca and Mg were 21.33, 44.81, 63.97, 123.2, 56.70 and 88.64%, respectively, higher than those of the other modifiers. The quantities of soil bacteria, actinomyces, phosphate-degrading bacteria, potassium silicate-degrading bacteria and cellulose-degrading bacteria increased to approximately 252.54, 125.00, 466.67, 129.59, and 3114.29%, respectively. The activities of soil peroxidase, urease, phosphatase and cellulase increased to approximately 130.77, 100.00, 110.00 and 515.38%, respectively. The biomass, economic yields and quantities of the highest class tobacco were 50.89, 49.18 and 38.33%, respectively.

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226. Effects on plant height and flowering of winter ornamental plants when grown in mediums of soil and fly ash.

Khan, M. R. and Abdussalam

Tests of Agrochemicals and Cultivars 22: 44-45. (2001)
NAL Call #: S587.T47; ISSN: 0951-4309

Descriptors: crop yield/ flax/ flowering/ fly ash/ growing media/ linseed/ ornamental plants/ plant height/ sage/ yield components/ Acroclinium/ Acroclinium roseum/ anthesis/ Brachycome/ Bracteantha/ Bracteantha bracteata/ ornamentals/ potting composts/ Rhodanthe/ Rhodanthe chlorocephala/ Rhodanthe chlorocephala subsp rosea/ rooting media

Reproduced with permission from the CAB Abstracts database.

227. Efficacy of alum and coal combustion by-products in stabilizing manure phosphorus.

Dou, Z.; Zhang, G. Y.; Stout, W. L.; Toth, J. D.; and Ferguson, J. D.

Journal of Environmental Quality 32(4): 1490-1497. (2003)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: byproducts/ cattle manure/ coal/ combustion/ dry matter/ fly ash/ losses from soil/ phosphorus/ pig

manure/ poultry manure/ runoff/ stabilization/ waste management/ waste utilization/ losses from soil systems/ poultry litter

Abstract: Animal manures contain large amounts of soluble phosphorus (P), which is prone to runoff losses when manure is surface-applied. Here we report the efficacy of alum and three coal combustion by-products in reducing P solubility when added to dairy, swine, or broiler litter manures in a laboratory incubation study. Compared with unamended controls, alum effectively reduced readily soluble P, determined in water extracts of moist manure samples with 1 h of shaking, for all three manures. The reduction ranged from 80 to 99% at treatment rates of 100 to 250 g alum kg⁻¹ manure dry matter. The fluidized bed combustion fly ash (FBC) reduced readily soluble P by 50 to 60% at a rate of 400 g kg⁻¹ for all three manures. Flue gas desulfurization by-product (FGD) reduced readily soluble P by nearly 80% when added to swine manure and broiler litter at 150 and 250 g kg⁻¹. Another by-product, anthracite refuse fly ash (ANT), was ineffective for all three manures. In all cases, reduction in readily soluble P is primarily associated with inorganic phosphorus (P_i) with little change in organic phosphorus (P_o). Sequential extraction results indicate that the by-product treatments shifted manure P from H₂O-P into a less vulnerable fraction, NaHCO₃-P, while the alum treatment shifted the P into even more stable forms, mostly NaOH-P. Such shifts in P fractions would have little influence on P availability for crops over the long term but would retard and reduce potential losses of P following manure applications. Reproduced with permission from the CAB Abstracts database.

228. Efficacy of fly-ash based Rhizobium on growth and incidence of powdery mildew in pea.

Vipin Kumar and Pramila Gupta

Annals of Plant Protection Sciences 16(1): 248-249. (2008)
NAL Call #: SB950.A1A46; ISSN: 0971-3573

Descriptors: fly ash/ formulations/ fungal diseases/ lignite/ nodulation/ nodules/ peas/ plant diseases/ plant height/ plant pathogenic fungi/ plant pathogens/ priming/ seed germination/ Erysiphaceae/ pea/ phytopathogens

Abstract: Pea seeds were primed with Rhizobium mixed with fly ash, fly ash + lignite (1:1) or lignite at a concentration of 2x10⁹/g. Seed germination and root nodulation were markedly enhanced by the Rhizobium formulations. Rhizobium mixed with fly ash resulted in the greatest seed germination (85.4%), plant height (22.3 cm) and number of nodules per plant (54.6), and lowest powdery mildew [Erysiphe sp.] incidence at 45 days after sowing (0.0%). The results showed the potential of fly ash as a carrier in commercial Rhizobium populations. Reproduced with permission from the CAB Abstracts database.

229. Efficacy of various amendments for amelioration of fly-ash toxicity: growth performance and metal composition of Cassia siamea Lamk.

Tripathi, R. D.; Vajpayee, P.; Singh, N.; Rai, U. N.; Kumar, A.; Ali, M. B.; Kumar, B.; and Yunus, M.

Chemosphere 54(11): 1581-1588. (2004)
NAL Call #: TD172 .C54; ISSN: 0045-6535

Descriptors: amendments/ bioavailability/ biomass/ cattle manure/ chlorophyll/ copper/ detoxification/ fly ash/ gardens/ growth/ iron/ landfills/ leaves/ nickel/

photosynthesis/ phytotoxicity/ polluted soils/ protein/ revegetation/ roots/ soil pollution/ soil types/ toxicity/ uptake/ zinc/ carbon assimilation/ carbon dioxide fixation/ *Cassia siamea*

Abstract: Plants of *Cassia siamea* Lamk were grown in garden soil (control), fly-ash (100%) and fly-ash amended by various ameliorants (cowdung manure, press-mud, garden soil; 1:1, w/w). The plants survived in fly-ash (100%) though their growth was less in comparison to the treatments. Fly-ash+press-mud (1:1, w/w) proved to be the best combination as growth (total biomass, leaf number, photosynthetic area, total chlorophyll and protein) was significantly high in this treatment followed by cowdung manure and garden soil. Leaves and roots accumulated significant amount of Cu, Zn, Ni and Fe. However, the concentration of all the metals was more in roots than leaves except Ni. Although, fly-ash contains high amount of metals but the metal uptake was more in the plants grown in fly-ash+press-mud mixture. In spite of high metal availability in fly-ash and press-mud mixture, plant growth was good. This might be attributed to the some metal detoxification mechanism active in this treatment. The present study concluded that *C. siamea* seems to be a suitable plant for developing a vegetation cover on fly-ash dumps.

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230. The efficiency of *Candiotia's* mineral coal ashes in the correction of soil pH.

Martins, J. L.; Vahl, L. C.; Jablonski, A.; Nunes, H. C.; and Soares, E. R.

Revista Brasileira de Agrociencia 6(3): 248-250. (2000); ISSN: 0104-8996.

Notes: Original title: Eficiencia da cinza do carvão mineral resultante da dessulfuração na correção da acidez do solo.

Descriptors: desulfurization/ fly ash/ lime/ limestone/ liming/ liming materials/ red yellow podzolic soils / soil acidity/ soil pH/ soil types/ Ultisols/ desulphurization

Abstract: A red-yellow podzolic soil (Paleudult) was incubated for 90 days with the purpose of evaluating the efficiency of fly ashes resulting from the burning of coal in the correction of soil acidity. Two kinds of ash have been used in the incubation: one from the Usina Termelétrica Presidente Medici (UTPM), without desulfurization process; the other from the Universidade da Região da Campanha (URCAMP), with desulfurization. The experiment consisted of a 5x5x2 factorial (five levels of ash 0, 5, 10, 20 and 30 t ha⁻¹, five limestone levels and two types of ash) in a totally randomized design, with two replications, in a split-plot experiment. The pH was measured four times in water after 21, 42, 63 and 90 days of incubation. The ash produced at UTPM, even though it had an alkaline pH, did not increase the pH of the soil, which happened only with limestone. The ash produced at URCAMP increased soil pH from 4.5 to 5.1, indicating that it can partially substitute limestone in soil amendment.

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231. Enhancement of hardpan formation by amending sulphidic tailings with limestone or fly ash.

Xenidis, A.; Mylona, E.; and Harokopou, A. D.

Land Contamination and Reclamation 15(3): 359-373. (2007); ISSN: 0967-0513

Descriptors: drainage / fly ash/ heavy metals/ hydraulic conductivity/ leachates/ leaching/ lignite/ limestone/ mine tailings/ oxidation/ pH/ polluted soils/ resistance to penetration/ soil amendments/ soil depth/ soil pollution/ soil types/ sulfides/ hydrogen ion concentration/ potential of hydrogen/ remediation/ sulphides

Abstract: The potential formation of low-permeability hardpan layers by mixing limestone or lignite fly ash with oxidized sulphidic tailings was investigated under actual field conditions. Field tests covering an area of 900 m² were implemented in Lavrion, Greece. The field testing area was divided into four equal testpads, which were filled with: (a) Lavrion sulphidic tailings without any amendment (control test); (b) sulphidic tailings covered by a 60-cm-thick layer of tailings homogeneously mixed with 75 kg/t limestone; (c) sulphidic tailings - 75 kg/t limestone mixture having a thickness of 150 cm; and (d) sulphidic tailings covered by a 30-cm-thick layer of tailings homogeneously mixed with 180 kg/t lignite fly ash. After four years of field test operations, cemented layers or hardpan, exhibiting increased resistance to penetration, were formed in the testpads. The hardpan layer in the control test was observed at a depth of 65 cm and had a thickness of 30 cm. Limestone and fly ash addition to the oxidized tailings resulted in the formation of hardpan layers at depths of 35 and 15 cm, respectively. The samples collected from the hardpan layers had paste pH higher than 4.5, as compared to pH 2.0 of the oxidized tailings. Limestone was proved to be more effective than fly ash in neutralizing the acidity and maintaining near-neutral pH conditions within the hardpan. On the other hand, the hardpan samples collected from limestone and fly-ash-amended testpads exhibited similar hydraulic conductivity values in the order of 10-6 m/second.

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232. Enrichment of pressmud through different amendments during composting.

Babitha, J. S.; Devi, L. S.; and Datta Amlan

Current Research University of Agricultural Sciences Bangalore 30(5/6): 86-87. (2001); ISSN: 0253-7133

Descriptors: calcium/ cattle dung/ coir/ composting/ composts/ electrical conductivity/ filter cake/ fly ash/ magnesium/ nitrogen/ nutrient content/ organic amendments/ organic carbon/ pH/ phosphorus/ rock phosphate/ trace elements/ waste utilization/ clarification mud/ coconut fibre/ hydrogen ion concentration/ microelements/ Mysore/ phosphate rock/ potential of hydrogen

Abstract: A composting experiment was conducted in Bangalore, Karnataka, India during 1999. The treatment combinations used in the study include: (C1) pressmud + cow dung; (C2) pressmud + cow dung + coir dust; (C3) pressmud + cow dung + gliricidia; (C4) pressmud + cow dung + gliricidia + rock phosphate; (C5) pressmud + cow dung + gliricidia + rock phosphate + micronutrients; and (C6) pressmud + fly ash + urea + rock phosphate. Maximum pH and Mg content was recorded with C6 while the minimum values was recorded with C2 and C1 treatments, respectively. C5 treatment resulted to maximum values of electrical conductivity, and contents of N, P and Ca. Minimum values of electrical conductivity, and P and Ca content were recorded under C1. C2 treatment gave maximum organic C content but had minimum N content. Minimum organic C was recorded under C6. Results on the

biochemical composition of pressmud compost showed that C2 allowed for maximum lignin, lignin:cellulose ratio and C:N ratio while C5 gave minimum values for these parameters. On the other hand, cellulose content was maximum under C3 and minimum under C6. The protocol emerged from this study involves the use of rock phosphate at 5%, gliricidia at 5%, cow dung at 10%, and micronutrients at 400 ppm (Zn), 200 ppm (Fe and Mn) and 20 ppm (Cu).

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233. Environmental impact of fly ash and its management.

Banerjee, S. K. and Kashyap, M. K.

Advances in Forestry Research in India 18: 31-53. (1998); ISSN: 0971-2704

Descriptors: composts / fly ash/ growing media/ growth/ increment/ mixtures/ mortality/ multipurpose trees/ nutrients/ plant succession/ planting/ reclamation/ soil chemistry/ soil fertility/ soil properties/ species trials/ survival/ trees/ vegetation/ woody plants/ death rate/ potting composts/ rooting media/ soil development

Abstract: The introductory part of the paper discusses the hazardous effects of fly ash, a byproduct formed in increasing amounts from thermal power plants using coal in India. Studies by the authors are then reported on fly ash management through forestry. Data are provided on the physicochemical characteristics, nutrient status and vegetation development of different aged fly ash dykes (6, 12, 24, 36 and 60 yr old, with comparative natural forest data) in [Madhya Pradesh]. Trials are reported from Chachai, on fly ash dykes from the Amarkantak Thermal Power Station (Madhya Pradesh). In the first experiment, seedlings of 10 multipurpose tree species were established at 2x2 m spacing in pits ([45 cm]^{superscript 3}) filled with various media (soil, fly ash, soil + sand + fly ash and soil + sand + fly ash + compost); only Eucalyptus hybrid [E. tereticornis] and Acacia auriculiformis survived. Growth measurements and details of the ground vegetation which developed after 6 yr are given; growth was best in the soil + sand + fly ash + compost medium, and poor in the fly ash only medium. In the second experiment a 2.54 cm layer of soil was spread over the fly ash, and seedlings of 4 species were planted in pits of the same size. All the species survived and growth was satisfactory, although less than that in the best treatment in the first experiment; the soil spreading operation is also expensive. E. tereticornis grew best, followed by A. auriculiformis, Peltophorum ferrugineum [P.

pterocarpum] and Pongamia pinnata (also tested in the first experiment).

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234. Environmental risks of farmed and barren alkaline coal ash landfills in Tuzla, Bosnia and Herzegovina.

Dellantonio, A.; Fitz, W. J.; Custovic, H.; Repmann, F.; Schneider, B. U.; Grunewald, H.; Gruber, V.; Zgorelec, Z.; Zerem, N.; Carter, C.; Markovic, M.; Puschenreiter, M.; and Wenzel, W. W.

Environmental Pollution 153(3): 677-86. (June 2008)

NAL Call #: QH545.A1E52; ISSN: 0269-7491 . 17949870

Descriptors: Adsorption/ Agriculture/ Arsenic: analysis/ Bosnia-Herzegovina/ Chromium: analysis/ Coal/ Copper: analysis/ Environmental Monitoring: methods/ Environmental Pollution/ Environmental Remediation: methods/ Humans/ Hydrogen-Ion Concentration/ Incineration/ Industrial Waste/ Molybdenum: analysis/ Power Plants/ Refuse Disposal/ Risk/ Soil Pollutants: analysis/ Time

Abstract: The disposal of coal combustion residues (CCR) has led to a significant consumption of land in the West Balkan region. In Tuzla (Bosnia and Herzegovina) we studied previously soil-covered (farmed) and barren CCR landfills including management practises, field ageing of CCR and the transfer of trace elements into crops, wild plants and wastewaters. Soil tillage resulted in mixing of cover soil with CCR. Medicago sativa showed very low Cu:Mo ratios (1.25) which may cause hypocuprosis in ruminants. Total loads of inorganic pollutants in the CCR transport water, but not pH (approximately 12), were below regulatory limits of most EU countries. Arsenic concentrations in CCR transport water were <2microgl(-1) whereas reductive conditions in an abandoned landfill significantly enhanced concentrations in leachates (44microgl(-1)). The opposite pattern was found for Cr likely due to large initial leaching of CrVI. Public use of landfills, including farming, should be based on a prior risk assessment due to the heterogeneity of CCR. This citation is from PubMed.

235. Enzyme activities in a sandy soil amended with sewage sludge and coal fly ash.

Lai, K. M.; Ye, D. Y.; and Wong, J. W. C.

Water, Air and Soil Pollution 113(1/4): 261-272. (1999) NAL Call #: TD172 .W36; ISSN: 0049-6979

Descriptors: biological activity in soil/ copper/ enzyme activity/ fly ash/ heavy metals/ manganese/ phosphoric monoester hydrolases/ sandy soils/ sewage sludge/ sludges/ soil amendments/ soil types/ urease/ zinc/ Mn/ phosphatases

Abstract: Previous studies showed that coal fly ash could stabilize sewage sludge by reducing metal availability, but fly ash may cause an adverse effect on soil microbial activities. Therefore, an experiment was performed to evaluate the effects of amendment of soil with anaerobically digested dewatered sewage sludge, stabilised with alkaline coal fly ash, on soil enzyme activity and the implications for soil nutrient cycling. Sewage sludge was amended with 0, 5, 10, 35 and 50% w/w of fly ash, and then the ash-sludge mixtures were incubated with a sandy soil at 1:1 (v/v). Dehydrogenase activity decreased with an increase in fly ash amendment level and the time of incubation. Soil receiving 5% ash-sludge amendment had a higher dehydrogenase activity than other treatments. Soil receiving 10% ash-sludge mixture had the highest urease activity and in general, urease activity decreased with increasing incubation time. Phosphatase activity was the highest at 5% ash-sludge mixture amended soil and no general trend was observed with time. Water-soluble Zn, Mn and Cu contents were suppressed by the addition of fly ash. The present experiment indicated that addition of 10% ash-sludge mixture should have a positive benefit on the activity of soil microorganisms, N and P nutrient cycling, and reduce the availability of heavy metals. Reproduced with permission from the CAB Abstracts database.

236. Enzyme activity of an acid sulphate soil:

Dehydrogenase, phosphatase, arylsulphatase.

Ramesh, V. and Chhonkar, P. K.

Journal of the Indian Society of Soil Science 49(1): 207-210. (2001)

NAL Call #: 56.9 IN2; ISSN: 0019-638X

Descriptors: acid sulfate soils/ application rates/ arylsulfatase/ enzyme activity/ fly ash/ lettuces/ lime/ liming/ oxidoreductases/ phosphoric monoester hydrolases/ residual effects/ rice/ soil enzymes/ acid sulphate soils/ arylsulphatase/ paddy/ phosphatases/ redox enzymes/ thionic soils

Abstract: A greenhouse study was conducted to determine the effects of fly ash (0, 72 and 144 g kg⁻¹ soil) and lime (0, 3.0, and 6.0 kg⁻¹ soil), used as ameliorants, on dehydrogenases [oxidoreductases], phosphatases [phosphoric monoester hydrolases] and arylsulfatase in an acid sulfate soil under rice-lettuce system. The direct effect of fly ash and lime was studied using rice as the test crop. The residual effects were determined using lettuce. Fly ash application at 0.5 calcium equivalent basis (CEB) increased the dehydrogenase activity during the first two stages. Lime application at the highest level (1.0 lime requirement) decreased dehydrogenase activity (DHA) throughout the experiment. The residual effects of fly ash on DHA was not positive indicating a short term beneficial effect following its application. Soil phosphatase and arylsulfatase activity decreased with increased ash and lime treatments. The residual effects of fly ash and lime at the highest level failed to influence phosphatase activity under lettuce, while the effect of fly ash application (72 g kg⁻¹) and lime increased arylsulfatase activity. The residual effect corresponding to the interaction between 3.0 kg⁻¹ soil and 72 g kg⁻¹ soil was beneficial with respect to the enzymes' activity. Reproduced with permission from the CAB Abstracts database.

237. Erodibility of fly ash used as a topsoil substitute in mineland reclamation.

Gorman, J. M.; Sencindiver, J. C.; Horvath, D. J.; Singh, R. N.; and Keefer, R. F.

Journal of Environmental Quality 29(3): 805-811. (May 2000-June 2000)

NAL Call #: QH540.J6; ISSN: 0047-2425 [JEVQAA]

Descriptors: fly ash/ mined soils/ erosion control/ waste utilization/ land restoration

Abstract: Fly ash, a by-product of coal-fired power plants, has been used successfully in reclaiming abandoned mine lands by improving minesoil chemical and physical properties. However, the fine sand-silt particle size of fly ash may make it more susceptible than natural soils to detachment and transport by erosive processes. Furthermore, the high content of silt-size particles in fly ash may make it more susceptible to surface crust formation, resulting in reduced infiltration and increased surface runoff and erosion. In the summer of 1989, fly ash-wood waste mixtures, used as a topsoil substitute, were surface applied on two separate mine sites in Preston County, WV, one with 10% slope and the other 20% slope. Erosion rates were measured directly using the Linear Erosion/Elevation Measuring Instrument (LEMI). Erosion measurements were taken during the first two growing seasons on both sites. Erosion values were up to five times greater on the fly ash-treated minesoil than on the untreated minesoil. Mulching with wood chips reduced fly ash erosion to about one-half

the loss of the unmulched plots. Erosion was related to both the amount and type of ground cover. Increased vegetative ground cover resulted in reduced erosion. Mosses and fungi appeared to provide better erosion protection than grass-legume cover.

This citation is from AGRICOLA.

238. Evaluating possibility of heavy metal accumulation by fly ash application in rice paddy soils.

Hong, C. O.; Lee, C. H.; Lee, H.; Lee, Y. B.; and Kim, P. J.

Korean Journal of Environmental Agriculture 25(4): 331-338. (2006); ISSN: 1225-3537

Descriptors: heavy metals/ fly ash/ rice paddy/ soils

Abstract: Coal combustion fly ash, which has a high available Si content and alkaline pH, was selected as a potential source of soil amendment in this study. Two field experiments were carried out to evaluate the possibility of heavy metal accumulation in silt loam (Pyeongtaeg series) and loamy sand (Nagdong series) of rice (*Oryza sativa*) paddy soils to which 0, 40, 80, and 120 Mg ha⁻¹ of fly ash were added. Rice yields increased significantly with fly ash application and the highest rice yields were achieved following the addition of around 90 Mg ha⁻¹ fly ash.

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239. Evaluation of bottom ash and composted dairy manure as a fill material.

Mukhtar, S.; Sadaka, S.; Kenimer, A.; and Mathis, J.

In: 2000 ASAE Annual International Meeting. Milwaukee, Wisconsin, USA.; pp. 1-14; 2000.

Descriptors: ash/ cattle manure/ composts/ conferences/ leaching/ nutrients

Abstract: In a column study, blends of bottom ash (BA) and composted dairy manure (CM) were evaluated for use as a soil fill material. Four blends (BA: CM, v/v) namely, B1 (100%:0%), B2 (70%:30%), B3 (50%:50%) and B4 (0%:100%) were subjected to flow-through and constant-head water table regimes (B2 and B3 only) using de-ionized water. Leachate and standing water samples were collected and analysed for total solids, volatile solids, COD, pH, N, NO₃-N, P and K. Blend effects on chemical properties of leachate and standing water are discussed. Reproduced with permission from the CAB Abstracts database.

240. Evaluation of bottom ash and composted manure blends as a soil amendment material.

Mukhtar, S.; Kenimer, A. L.; Sadaka, S. S.; and Mathis, J. G.

Bioresource Technology 89(3): 217-228. (2003)

NAL Call #: TD930.A32 ; ISSN: 0960-8524

Descriptors: agricultural byproducts/ ash/ cattle manure/ chemical oxygen demand/ composts/ heavy metals/ leachates/ nitrogen/ phosphorus/ polluted water/ potassium/ soil amendments/ standing water/ total solids/ waste management/ water pollution/ water quality/ water table/ United States of America/ water composition and quality

Abstract: The long-term goal of this project was to find alternative uses for bottom ash (BA) and composted dairy manure (CM), by-products of coal combustion and livestock production, respectively. The study discussed in this paper focused on potential water quality impacts associated with using blended BA and CM as a soil amendment. The constituents of BA and CM include heavy metals and other chemicals that, while essential nutrients for plant growth,

also pose a potential threat to water quality. Four blends (BA:CM, v/v) namely, B1 (100%:0%), B2 (70%:30%), B3 (50%:50%) and B4 (0%:100%), were subjected to flow-through water table management and two blends, B2 (70%:30%) and B3 (50%:50%), were subjected to constant head water table management using de-ionized water. Leachate and standing water from saturated and flooded blends of BA and CM were examined for total solids (TS), volatile solids (VS), COD, pH, total Kjeldahl nitrogen (TKN), NO₃-N, total P, total K as well as selected metals over a 5 and 7 week period for flow-through and constant head watertables, respectively. The results showed that higher CM content resulted in higher TS, VS, TKN, P and K concentrations in the leachate and standing water. Concentrations of these constituents were higher in leachate than in the standing water. Even though, marked reductions of most chemicals in the leachate and standing water were realized within one to three weeks, initially high concentrations of chemicals in leachate and standing water from these particular blends made them unsuitable as soil amendment material. Based upon these results, it was concluded that additional column studies of BA and CM blends with reduced CM content (5%, 10% and 20%) should be performed to further assess the feasibility of BA and CM blends as an environmentally safe soil amendment material. Reproduced with permission from the CAB Abstracts database.

241. Evaluation of cocomposted coal fly ash on dynamics of microbial populations and heavy metal uptake.

Vallini, G; Vaccari, F; Pera, A; Agnolucci, M; Scatena, S; and Varallo, G
Compost Science and Utilization. 1999; 7(1): 81-90 (1999)
 NAL Call #: TD796.5.C58 ; ISSN: 1065-657X
Descriptors: alkalinity/ clay soils/ coal/ composts/ faba beans/ fly ash/ heavy metals/ microorganisms/ plant residues/ pot experimentation/ sandy soils/ uptake/ broad beans/ fava beans/ field beans/ horse beans/ micro organisms/ tic beans
Abstract: *Vicia faba*, in a pot experiment with sandy and clayey soils under greenhouse conditions, was checked for growth response to different amendments with coal alkaline fly ash or co-composted fly ash mixed with lignocellulosic residues. Soil microbial populations, pH and electrical conductivity as well as heavy metal uptake by plants were monitored. At rates of 5 and 10% (on a dry matter basis) in both soils, neither fly ash alone nor co-composted fly ash exerted any negative effect. Plant biomass production was not influenced in either clayey or sandy soil. Alkaline fly ash did not promote microbial growth when applied alone to the soils. However, co-composted fly ash generally increased bacterial and Actinomycetales counts in both soils. Fungi were not affected by ash. Due to the increase of soil pH by alkaline fly ash or co-composted fly ash, plant uptake of heavy metals was depressed in the sandy soil. Heavy metal mobility did not cause change in the clayey soil where a high buffering capacity mitigated the effects of fly ash amendments. Reproduced with permission from the CAB Abstracts database.

242. Evaluation of fine brown coal and brown coal ash as organomineral fertilizers for vegetables .

Suchorska Orowska, J.
Rozprawy Akademia Rolnicza w Szczecinie 184: 92. (1998); ISSN: 0239-6467.
Notes: Original title: Przydatność miazgi węgla brunatnego o popiołu z węgla brunatnego do produkcji nawozów organiczno mineralnych stosowanych w uprawie warzyw.
Descriptors: amendments/ ammonium nitrate/ application rates/ ash/ brown coal/ cabbages/ carrots/ coal/ dust/ farmyard manure/ lignite/ manures/ nitrogen fertilizers/ onions/ organomineral fertilizers/ plant composition/ root crops/ rotations/ spinach/ sugar/ vegetables/ Araliales/ Capparales/ chemical constituents of plants/ crop rotation/ FYM/ rotational cropping / vegetable crops
Abstract: Two separate field experiments conducted in Poland investigated the effects of organomineral fertilizers (obtained from brown coal dust and brown coal ash) on cabbages, onions, *Beta vulgaris*, as compared with farmyard manure, or of organomineral fertilizers together with different forms of N on cabbages, carrots and spinach. The results showed that application of organomineral fertilizers had no significant effect on P, K, Ca, and Mg, but increased the sugar content of plants. The nutrient content of cabbages was significantly increased by organomineral fertilizers applied together with ammonium nitrate. It was concluded that preparations of brown coal ash and brown coal dust are a safe substitute for farmyard manure and improve both the yield and quality of vegetables. Reproduced with permission from the CAB Abstracts database.

243. Evaluation of fly ash and ceramic dust as a soil amendment and its effect on growth and yield performance in tomato.

Raghav, D.; Khan, A. A.; and Chauhan, B.
Tests of Agrochemicals and Cultivars 24: 18-19. (2003)
 NAL Call #: S587.T47; ISSN: 0951-4309
Descriptors: application rates/ biomass/ dust/ fly ash/ fruits/ growth/ roots/ shoots/ soil amendments/ tomatoes
Abstract: A study was conducted to investigate the effects of fly ash and ceramic dust (10, 20, 30, 40, 50, 60, 70, 80, 90 and 100%) as soil amendment on the growth and yield of tomato cv. 'Ruby'. The length, fresh weight and dry weight of root and shoot, fruit number and fresh fruit weight of tomato plant were significantly affected by fly ash inclusion rate. The growth and biomass accumulation peaked at 30% fly ash inclusion rate, after which there was a steady decline. The root and shoot length, fresh and dry weight and fruit number and yield, were all significantly affected by the inclusion rate of the ceramic dust. The performance of tomato peaked at 20% inclusion rate. Reproduced with permission from the CAB Abstracts database.

244. Evaluation of fly ash as a carrier for diazotrophs and phosphobacteria.

Sunita Gai and Gaur, A. C.
Bioresource Technology 95(2): 187-190. (2004)
 NAL Call #: TD930.A32 ; ISSN: 0960-8524
Descriptors: fly ash/ nitrogen fixation/ nitrogen fixing bacteria/ phosphate solubilizing bacteria/ soil amendments/ waste management/ biofertilizers

Abstract: Fly ash and its different combinations with soil (w/w) were tested to explore its possible use as a potential carrier for diazotrophs and phosphobacteria. *Azotobacter chroococcum*, *Azospirillum brasilense* and *Bacillus circulans* showed their maximum viability in fly ash alone whereas *Pseudomonas striata* proliferated most in soil:fly ash (1:1) combination.
Reproduced with permission from the CAB Abstracts database.

245. Evaluation of oilseed crops to different concentrations of fly ash.

Era Upadhyay and Khan, A. A.

Tests of Agrochemicals and Cultivars 23: 24-25. (2002)

NAL Call #: S587.T47; ISSN: 0951-4309

Descriptors: carotenoids/ chlorophyll/ flax/ flowers/ fly ash/ growth/ Indian mustard/ leaves/ linseed/ plant pigments/ roots/ seeds/ shoots/ trace element fertilizers/ Capparales/ micronutrient fertilizers/ tetraterpenoids

Abstract: The impact of fly ash incorporation in soil on the growth, productivity and photosynthetic pigments of linseed (*Linum usitatissimum*) and Indian mustard (*Brassica juncea*) was studied under pot conditions. Fly ash was mixed with soil to produce concentrations of 0, 15, 30, 45, 60, 75 and 100%. The fresh weight of the shoots and roots, number of seeds per capsule, and chlorophyll b and carotenoid contents of linseed increased up to 45% fly ash. However, the length and dry weight of the shoots and roots, and chlorophyll a content significantly increased up to 60% fly ash. The numbers of flowers, seeds per silique and leaves, and length and dry weight of shoots and roots of Indian mustard significantly increased up to 60% fly ash. However, the number of siliquae, fresh weight of shoots and roots, and contents of photosynthetic pigments significantly increased up to the 45% concentration. All the parameters of both crops were best at 15% fly ash.
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246. Evaluation of radioactive security for applying coal ash in farmland.

Shi JianJun; Chen Hui; and Xu YinLiang

Journal of Shanghai Agricultural College 18(2): 95-100.

(2000); ISSN: 1000-193X

Descriptors: agricultural land/ fly ash/ maize/ potassium/ radioactivity/ radionuclides/ rice/ thorium/ uranium/ Anhwei/ Chekiang/ corn/ farmland/ paddy/ radioactive isotopes/ radioactive nuclides/ radioisotopes/ Shantung

Abstract: Ten coal ash samples from the electric power plants of Zhejiang, Shandong and Anhui were measured by HPGE gamma spectrometer analyzer respectively. The results showed that the main radioactive nuclides in ash are ²³⁸U, ²³²Th and ⁴⁰K. The specific activities of ²³⁸U, ²³²Th and ⁴⁰K were from 75-284, 96-164 and 120-382Bq/kg respectively. The simulated experiment on the application of coal ash showed that the specific activity of ²³⁸U, ²³²Th and ²²⁶Ra in the treated soil were 2.44, 1.39 and 1.88 times higher than those in control soil, respectively, when the coal ash was applied up to 525 tonnes/hm². The specific activity of three nuclides in paddy and maize seed grown in soil with coal ash were similar to that in control soil. The effect of edible security is not evident. The results of sampling from the farmland used

coal ash showed that the specific activity of the 3 nuclides in paddy grown in soil with silicon fertilizer did not exceed security standard.

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247. Evaluation of use of fly ash-gypsum mixture for rice production at different nitrogen rates.

Lee YongBok; Ha HoSung; Lee KyungDong; Park KiDo;

Cho YoungSon; and Kim PilJoo

Soil Science and Plant Nutrition 49(1): 69-76. (2003)

NAL Call #: 56.8 SO38 ; ISSN: 0038-0768

Descriptors: application rates/ boron/ clay loam soils/ crop yield/ fly ash/ gypsum/ Inceptisols/ nitrogen fertilizers/ nonclay minerals/ nutrient availability/ nutrient balance/ nutrient uptake/ paddy soils/ plant nutrition/ rice/ silicates/ soil amendments/ soil types/ paddy/ South Korea

Abstract: Although a silicate fertilizer had been recommended for application at 4-year intervals by the Korean government to enhance rice production, since the quantity was not sufficient, it became necessary to identify an alternative source of cheaper silicate fertilizer. Fly ash, which has a high silicate content, was selected as an alternative. To improve fly ash, that is highly alkaline and has a high boron content, it was mixed with a by-product of gypsum (hereafter, referred to as gypsum) at the 75:25 ratio on a weight basis. A field experiment was carried out to evaluate the productivity of rice (*Oryza sativa*) on a silty clay loam to which 0 and 25 Mg ha⁻¹ of the fly ash-gypsum mixture had been applied. Under these two conditions, five levels of nitrogen (0, 40, 80, 120, and 160 kg ha⁻¹) were set up to compare the rice response. The mixture increased the maximum grain yield by 8%. With increasing N uptake of rice, the mixture could decrease nitrogen application level to about 50 kg N ha⁻¹ to produce the target yield i.e., the maximum yield in the non-amendment treatment. The use of the mixture increased the uptake of silicate by rice, but did not result in an excessive uptake of heavy metals. The level of available B increased with the mixture application up to 1.5 mg kg⁻¹ in the surface soil at the initial stage, but did not reach toxicity levels. In conclusion, the mixture was considered to be a good alternative as a soil amendment to restore the nutrient balance in paddy soils and to reduce the nitrogen application rate of rice.

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248. An experiment with lignite ash from power plants for soil restoration: A case study in the Arnsberg forest.

Asche, N.

In: *Proceedings of the International Conference. Forest Ecosystem Restoration: Ecological and Economical Impacts of Restoration Processes in Secondary Coniferous Forests*. Vienna, Austria.; pp. 35-43; 2000.

Descriptors: acidification/ aluminium/ case studies/ fly ash/ forest soils/ leaching/ lime/ liming/ liming materials/ mineral soils/ nitrate/ plant nutrition / polluted soils/ soil conservation/ soil invertebrates/ soil pollution/ soil solution/ soil types/ sulfate/ aluminum/ Nordrhein Westfalen

Abstract: High acid loads lead to the acidification of forest soils. In order to compensate soil acidification, ~38% of the forests in North Rhine-Westphalia, Germany have been

limed since the early eighties. Approximately 90% of the used lime originated from quarries of different geological formations. Because some lignite ashes from power plants have a high acid neutralization capacity, their use could help reduce the use of natural lime and the negative impacts caused by quarries to the landscape. Results of this study showed positive effects on mineral soil, soil solution, beech (*Fagus sylvatica*) nutrition and earthworm abundance and fresh weight compared to an untreated control five years after the application of 6 t lignite ash per hectare. Undesired effects as high nitrate, sulfate and aluminium leaching were limited to the intensively rooted layers and therefore led not to significant loads of seepage water in 90 cm depth. Sulfate retention of the soil was high and until 1998 approximately 80% of sulfate input was adsorbed in the soil. Lignite ash, which fulfils not only the demands of substances used for forest soil restoration but also preconditions of different fertilizer laws, could be a practical example for a Kreislaufwirtschaft in an ecological sensitive society. It could help to reduce the use of natural lime and the negative effects of lime exploitation to landscape and environment.

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249. Experimental research on improvement of reclaimed soil properties and plant production based on different ratios of coal-based mixed materials.

Hu ZhenQi; Kang JingTao; Wei XiuJu; Ji JingJing; and Wang WanJie

Transactions of the Chinese Society of Agricultural Engineering 23(11): 120-124. (2007)

NAL Call #: S671.N8; ISSN: 1002-6819

Descriptors: coal/ crop production/ crude protein/ fly ash/ lucerne/ mined land/ nutrients/ reclaimed soils/ soil amendments/ soil compaction/ soil fertility/ soil types/ waste management/ waste utilization/ alfalfa/ mined sites

Abstract: On the goal of comprehensive utilization of coal-based mixed materials, weathered coal, coal waste and fly ash are being used, by mixing those materials according to a certain formula which is weathered coal:coal waste: fly ash=5:1:4, as well as adding the exact quantitative fertilizer, which improve reclaimed soil in mined area. This kind of coal-based mixture is full of nutrient for soil improvement. Through pot experiments, coal-based mixture could distinctly improve the fertility of soil, the pot experiments results showed that the output of lucerne (*Medicago sativa*) is two times as much as that of the controlled, and the crude proteins are also distinctly improved. Using coal-based mixture can avoid problems of soil compaction caused by only using of fertilizer, and improved ratio of comprehensive utilization of waste materials in mined area. Reproduced with permission from the CAB Abstracts database.

250. Experimental study on phytoremediation of reclaiming substrate contaminated by heavy metal.

Zheng JiuHua; Feng YongJun; Yu KaiQin; and Liu XiMin

Transactions of the Chinese Society of Agricultural Engineering 24(2): 84-88. (2008)

NAL Call #: S671.N8; ISSN: 1002-6819

Descriptors: absorption/ cabbages/ cadmium/ Chinese cabbages/ copper/ fly ash/ growth/ heavy metals/ phytoremediation/ polluted soils/ rape/ sewage sludge / soil pollution/ soil types/ substrates/ swede rape/ vinasse/ waste

utilization/ zinc/ canola/ Capparales/ oilseed rape

Abstract: The effects on the growth of cabbage, Chinese cabbage and rape planted on fly ash plus vinasse substrate and fly ash plus sewage sludge substrate were studied and the remediation of cabbage, Chinese cabbage and rape on heavy metal Cd, Cu and Zn was investigated by calculating absorption coefficient, transmission coefficient and absorption modulus. The conclusions were that: the absorption coefficient, transmission coefficient and absorption modulus of cabbage, Chinese cabbage and rape increased along with the time lapsed and it indicated the remediation effects of the plants in anaphase were better than that in prophase; the results showed cabbage, had effective functions in phytoremediation on heavy metal Cd, rape had some potential in phytoremediation on Cu and cabbage was better than Chinese cabbage and rape in absorption on Zn; absorption modulus was an ideal index which can estimate the ability of phytoremediation on heavy metal, because it took into account the above-ground biomass of plants and the heavy metal gross in plant root-layer.

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251. Exploiting fly ash as soil ameliorant to improve productivity of sabai grass (*Eulaliopsis binata* (Retz) C.E. Hubb) under acid lateritic soil of India.

Manisha Basu; Mahapatra, S. C.; and Bhadoria, P. B. S. *Asian Journal of Plant Sciences* 5(6): 1027-1030. (2006); ISSN: 1682-3974

Descriptors: crop yield/ dry matter accumulation/ farmyard manure/ fertilizers/ fly ash/ leaves/ tillers/ FYM/ vermicomposts

Abstract: The effects of fly ash (FA), organic wastes such as farmyard manure (FYM), vermicompost (VC) and green manure (*Sesbania rostrata*) (GM) and chemical fertilizers on the growth and yield of sabai grass (*Eulaliopsis binata*) were determined in a field experiment conducted in West Bengal, India in 2002-04. Integrated application of FA, organic wastes and CF resulted in significantly higher tiller number, dry matter accumulation and green leaf yield to sole application of CF in all experimental years. Application of AF in combination with organic wastes and chemical fertilizers resulted in the highest yield advantage (up to 22.8 and 27.6% in the wet season of first and second year, respectively), while the yield increase was 3.6 and 9% in the first and second year, respectively when it was used in combination with chemical fertilizers only. GM application resulted in higher yield compared to FYM or VC application during the wet season, however, the performance of sabai grass was superior under residual fertility of VC-based treatments compared to FYM or GM application during the dry season.

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252. A feasibility research on improving desert soil by combined solid wastes: A case study of the yulin city, shaanxi province.

Huang, G.; Chi, Z.-W.; and Yang, X.-M.

Bulletin of Mineralogy Petrology and Geochemistry 27(1): 63-68. (2008); ISSN: 10072802 .

Notes: Language of Original Document: Chinese.

Descriptors: coal ash / improving desert soil/ sewage sludge/ yulin city, shaanxi province/ ash/ desert soil/

feasibility study/ sludge/ soil improvement/ soil quality/ solid waste/ asia/ china / eurasia/ far east/ shaanxi/ yulin/ zea mays

Abstract: In this study, combined urban solid wastes including coal ash and sewage sludge have been firstly used to test if they could meliorate the quality of desert soil in the Maowusu Desert, south edge of the Yulin City of Shaanxi Province. The feasibility of this method has been discussed through the experiment of corn growing in pot. The results are given below. (1) With the addition of urban solid wastes into the desert soil, the nutrient contents of the treated desert soil are significantly increased, heavy metal contents of the treated desert soil are lower than the soil environmental quality standards, and the C/N ratios are in accordance with the soil standards. (2) With the addition of urban solid wastes into the desert soil, the physical properties of the treated desert soil has been greatly improved, as its bulk density is decreased, its porosity is increased, its fertilizer and water conservation capability is improved significantly, and its pH value is decreased obviously with the water consumption decreased 44% to 48%. (3) The desert soil (coarse sandy soil) has been changed as a sandy loam and light loam. This is of great significance for cultivating plant and restoring the ecological environment of the arid desert areas and for effectively reutilizing the urban solid wastes simultaneously.

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253. Field disease potential of tomato cultivation in West Bengal.

Kanjilal, S.; Samaddar, K. R.; and Samajpati, N.
Journal of Mycopathological Research 38(2): 121-123. (2000)

NAL Call #: QK600.J68 ; ISSN: 0971-3719

Descriptors: bleaching powder/ crop yield/ cultivars/ fly ash/ hybrids/ plant diseases/ plant pathogenic bacterial/ plant pathogenic fungi/ plant pathogens/ plant viruses/ soil amendments/ tomatoes/ urea/ yield losses/ chlorinated lime/ cultivated varieties/ Hyphomycetes/ Peronosporomycetes/ phytopathogens/ Pythiaceae
Abstract: Survey of disease potential of hybrid and deshi (indigenous) cultivars of tomatoes were conducted in Coochbehar, Jalpaiguri, Nadia and Murshidabad districts of West Bengal, India. Results showed heavy disease incidence on hybrid compared to deshi cultivars. Predominant diseases of hybrid cultivars were bacterial wilt caused by *Ralstonia solanacearum*, leaf curl by virus, blight caused by *Phytophthora infestans* and *Alternaria* sp. The field disease incidence of hybrid cultivars were severe in North Bengal acidic sandy soils than in nearly neutral loam soil of Nadia and Murshidabad districts. The deshi cultivars showed little or no infection due to the above pathogens. Bacterial wilt was the most serious disease in North Bengal districts. Crop loss in fields ranged from 70 to 100%, resulting in a complete loss of economic stability of the local farmers. In the absence of resistant cultivars, disease management by soil amendments was attempted. Significant decrease in wilt occurrence was observed following treatment of soil with urea, fly ash and active bleaching powder singly or in combination. Reproduced with permission from the CAB Abstracts database.

254. Flue gas desulfurization by-products additions to acid soil: Alfalfa productivity and environmental quality.

Chen, L.; Dick, W. A.; and Nelson, S.
Environmental Pollution 114(2): 161-8. (2001)
NAL Call #: QH545.A1E52; ISSN: 0269-7491
Descriptors: agriculture/ air pollutants: metabolism/ coal/ environmental monitoring/ gases/ hydrogen-ion concentration/ incineration/ medicago sativa: growth & development/ refuse disposal/ soil/ soil pollutants: analysis
Abstract: Flue gas desulfurization (FGD) by-products are created when coal is burned and SO₂ is removed from the flue gases. These FGD by-products are often alkaline and contain many plant nutrients. Land application of FGD by-products is encouraged but little information is available related to plant responses and environmental impacts concerning such use. Agricultural lime (ag-lime) and several new types of FGD by-products which contain either vermiculite or perlite were applied at 0, 0.5, 1.0, and 2.0 times the soil's lime requirement (LR) rate to an acidic soil (Wooster silt loam). The highest FGD by-products application rate was equivalent to 75.2 Mg ha⁻¹. Growth of alfalfa (*Medicago sativa* L.) was significantly increased compared to the untreated control in the second year after treatment with yields for the 1 x LR rate of FGD approximately 7-8 times greater compared to the untreated control and 30% greater than for the commercial ag-lime. Concentrations of Mo in alfalfa were significantly increased by FGD by-products application, compared to the untreated control, while compared to the ag-lime treatment, concentrations of B increased and Ba decreased. No soil contamination problems were observed, even at the 2xLR rate, indicating these materials can be safely applied to agricultural soils. This citation is from PubMed.

255. Flue gas desulfurization products as sulfur sources for corn.

Chen, L.; Kost, D.; and Dick, W. A.
Soil Science Society of America Journal 72(5): 1464-1470. (2008)
NAL Call #: 56.9 So3; ISSN: 03615995 [SSSJD].
Notes: doi: 10.2136/sssaj2007.0221.
Descriptors: desulfurization/ corn growth/ interactive effects/ nitrogen deficiency/ sulfur sources/ Zea mays L./ sulfur/ concentration (composition)/ cost-benefit analysis/ crop production/ fertilizer application/ gas/ growth response/ hybrid/ maize/ nutrient uptake/ silty loam/ sulfur/ water quality/ yield response/ North America/ Ohio/ United States/ Wooster
Abstract: Nitrogen deficiency in the soil often limits corn (*Zea mays* L.) production. Recently, S deficiency in several crops, including corn, has been observed. Little information is available, however, related to the interactive effects of N and S fertilization on corn growth and yield using modern corn hybrids. Field experiments were conducted from 2002 to 2005 to test corn response to seven rates (0-233 kg ha⁻¹) of N and two rates (0 and 33 kg ha⁻¹) of S applied to a silt loam soil at Wooster, OH. The S was applied as flue gas desulfurization (FGD) products and was primarily in the form of gypsum. Corn grain yields were significantly (P < 0.05) increased by N fertilizer addition from 2003 to 2005. Sulfur addition also significantly increased the average yield

of corn in 2002 and 2003. An N x S interaction for corn yield was observed in 2005. Sulfur application at 33 kg ha⁻¹ significantly ($P < 0.05$) increased corn yield at the intermediate N rate of 133 kg ha⁻¹, and showed a general tendency to increase yield at lower N rates in 2004 and 2005. Nitrogen and S concentrations in corn grain were increased by application of 200 kg N ha⁻¹, and S concentration was increased by S application in 2005. These results suggest that application of S fertilizer, with N, can promote the uptake of N by corn in S-responsive soils. This will decrease the amount of N required for high-yield corn production and reduce production costs and degradation of water quality associated with oversupply of N. © Soil Science Society of America. All rights reserved. © 2009 Elsevier B.V. All rights reserved.

256. Fly ash amendment of sandy soil to improve water and nutrient use efficiency in turf culture.

Pathan, S. M.; Aylmore, L. A. G.; and Colmer, T. D. *International Turfgrass Society Research Journal* 9: 33-39. (2001)

Descriptors: application rates/ biomass production/ fly ash/ growth/ heavy metals/ hydraulic conductivity/ lawns and turf/ nutrients/ phosphorus/ plant water relations/ rhizomes/ roots/ sandy soils/ soil amendments/ soil texture/ use efficiency/ water holding capacity/ water use efficiency/ Bermuda grass/ lawns and sports turf

Abstract: Sandy soils pose a particular challenge for water and nutrient management due to the low water retention and low ionic adsorption capacities of these substrates. Fly ash is comprised primarily of fine sand- and silt-sized particles so, if applied at sufficient rates, can permanently change soil texture. Fly ash from Kwinana Power Station and also Karrakatta sand were evaluated in field experiments conducted in Western Australia, from 1999 to 2000, for a range of physical and chemical properties. Field plots of Karrakatta sand were amended to a depth of 12-15 cm with several rates (0 to 20%, wt/wt) of fly ash and effects on soil water holding capacity, hydraulic conductivity, plant nutrition and turf growth during establishment were assessed. Plant available water increased progressively with increasing rates of fly ash additions, whereas hydraulic conductivity decreased. Fly ash also provided a source of plant available phosphorus. Possible release of heavy metals was evaluated using the toxicity characteristic leaching procedure. Values obtained for heavy metals were all well below the regulatory guideline levels. *Cynodon dactylon* cv. Wintergreen planted as rhizomes had a 1.3- to 1.6-fold larger root biomass after 9 weeks of growth in plots amended with fly ash when compared to non-amended plots. Thus, fly ash amendment may be a useful management option for turf culture on sandy soils. Reproduced with permission from the CAB Abstracts database.

257. Fly ash: An exploitable resource for management of Australian agricultural soils.

Yunusa, I. A. M.; Eamus, D.; DeSilva, D. L.; Murray, B. R.; Burchett, M. D.; Skilbeck, G. C.; and Heidrich, C. *Fuel* 85(16 SPEC. ISS.): 2337-2344. (2006)
NAL Call #: S590.G4 TP315; ISSN: 00162361 [FUELA].
Notes: doi: 10.1016/j.fuel.2006.01.033.

Descriptors: Plant growth/ Soil acidity/ Soil structure/ Agriculture/ Coal/ Combustion/ Costs/ Soils/ Coal

combustion products (CCP)/ Coal-fired power stations/ Plant growth/ Soil acidity/ Soil structure/ Soil treatment/ Fly ash/ Coal/ Costs/ Fly Ash/ Soil

Abstract: Agricultural soils in Australia have inherent limitations of structural and nutritional nature that pose major constraints to crop productivity. These soils are still productive due to intensive management that involves routine treatments with lime and gypsum at significant costs both to the farmer and the environment. Production costs associated with these inputs average about 30% of the total cost of soil treatment. Furthermore, reserves of gypsum are under pressure. There is therefore an opportunity for the more than 13 million tonnes of coal combustion products (CCPs) produced annually by coal-fired power stations to be utilised in the management of agricultural soils. At present, about 70% of the ash is emplaced within landfills. In this paper we briefly describe the main constraints of major agricultural soils that could be ameliorated with fly-ash. We used a model to estimate that application of fine (<20 µm) fly-ash to the top 0.15 m coarse textured (sandy) soil would reduce hydraulic conductivity by 25% and so improve water-holding capacity. The same treatment of fine textured clayey soil with coarse (>20 µm) fly-ash would increase conductivity by up to 20%. We cite examples of studies that have shown beneficial use of coal-ash for crop production, including our ongoing glasshouse study in which fly-ash was found to increase early growth vigour and seed yield by 20% for canola (*Brassica napus*). There are several issues, including costs and regulation, and knowledge-gaps that need to be addressed before adoption of CCP for routine soil management. © 2006 Elsevier Ltd. All rights reserved.

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258. Fly ash and sewage sludge as potential source of soil amendment and component of integrated plant nutrient supply system.

Yeledhalli, N. A.; Prakash, S. S.; and Ravi, M. V. *Environment and Ecology* 25(Special 4): 998-1002. (2007)
NAL Call #: TD172.E5; ISSN: 0970-0420

Descriptors: application rates/ calcium/ copper/ crop yield/ fly ash/ groundnuts/ magnesium/ NPK fertilizers/ phosphorus/ plant nutrition/ potassium/ seed production/ sewage sludge/ soil amendments/ sulfur/ sunflowers/ use efficiency/ zinc/ elemental sulphur/ Mysore/ peanuts/ sulphur

Abstract: To determine the suitability of fly ash (FA) and sewage sludge (SS) in agricultural application, a field investigation was carried out for three years, 1999 to 2001. An attempt was made to develop an integrated plant nutrition supply system (IPNS) utilizing fly ash, sewage sludge and recommended dose of NPK fertilizers (RDF) for sunflower-groundnut cropping system in Karnataka, India. The treatments include: (1) control; (2) RDF (NPK); (3) 30 tonnes FA/ha; (4) 30 tonnes SS/ha; (5) 15 tonnes FA + SS/ha; (6) FA + RDF; (7) SS + RDF; and (8) FA + SS + RDF. The direct and residual effects of fly ash and sewage sludge were assessed based on crop response and changes in soil characterization. The application of FA at 30 tonnes/ha, SS at 30 tonnes/ha and RDF fertilizers increased the seed yield of sunflower, pod yield of groundnut and equivalent yield of both crops by 6.2 and 18.00%, respectively, as compared to RDF alone. There was beneficial effect of application of FA and SS individually or in combination with RDF at same level and

yield advantage derived by groundnut through IPNS was greater than sunflower. Further, there was improvement in nutrient use efficiency and the availability of P, K, Ca, Mg, S, Zn and Cu besides improving soil physico-chemical properties. The results indicated the prospect of safe disposal and utilization of FA and SS in agriculture for retaining production of sandy soils, reduced the use of costly chemical fertilizer, bring greater economy in cultivation and minimize environmental pollution. Reproduced with permission from the CAB Abstracts database.

259. Fly ash and slag mixture from heat and power generating plant as environmentally friendly industrial waste.

Zerbe, J.; Siepak, J.; and Elbanowska, H.
Polish Journal of Environmental Studies 10(2): 113-117. (2001); ISSN: 1230-1485
Descriptors: chemical composition/ environmental impact/ fly ash/ groundwater/ heavy metals/ mixtures/ slags/ soil amendments/ environmental effects
Abstract: Mixtures of fly ash and slags taken from the ash-disposal grounds at the Karolin plant in Poznan, Poland, were subjected to laboratory tests in order to estimate their influence on natural water and soil condition in order to check their possible application towards for recultivation or landfilling. The chemical composition of the mixtures and their extracts obtained with solutions of sulphuric acid (pH 2 or 4) as eluent (simulating acid rain) were determined. Assuming the criteria to be met by drinking water specified by the European Union and WHO documents, it was established that the heavy metals content in the fly ash and slag mixtures is not expected to have a negative effect on groundwater. Reproduced with permission from the CAB Abstracts database.

260. Fly ash application on two acid soils and its effect on soil salinity, pH, B, P and on ryegrass growth and composition.

Matsi, T. and Keramidias, V. Z.
Environmental Pollution 104(1): 107-112. (1999)
 NAL Call #: QH545.A1E52; ISSN: 0269-7491
Descriptors: acid soils/ application rates/ boron/ fly ash/ growth/ phosphorus/ plant composition/ red soils/ soil amendments/ soil pH/ soil salinity/ uptake/ yields/ chemical constituents of plants/ red earths
Abstract: Samples of alkaline fly ash from two different sources were added to two red Mediterranean acid soils at rates equal to 5, 20 and 50 g kg⁻¹ soil, and changes, relative to the untreated soil, of soil pH, salinity, B and P levels were measured. Ryegrass (*Lolium perenne*) was grown in pots containing fly ash-soil mixtures for 300 days, and dry biomass yield and cumulative plant uptake of B and P were calculated. Soil application of fly ash at these rates increased the pH, up to ~8, and the electrical conductivity of the saturation extract, up to ~2.5 dS m⁻¹, in both soils. Available soil P (0.5 M NaHCO₃ extractable) was unaffected by fly ash application. Water soluble B remained <1 mg litre⁻¹ in the saturation extract, and hot-water-extractable B was <1 mg kg⁻¹ soil. Dry biomass yield of ryegrass and cumulative plant uptake of B and P increased significantly with fly ash application. Therefore, fly ash with

low B and salt content can be used as liming agents in acid soils at rates not exceeding 40 t ha⁻¹. Potential environmental impacts must also be considered. Reproduced with permission from the CAB Abstracts database.

261. Fly ash as a liming material for corn production.

Tarkalson, D. D.; Hergert, G. W.; Stevens, W. B. ; McCallister, D. L.; and Kachman, S. D.
Soil Science 170(5): 386-398. (2005)
 NAL Call #: 56.8 So3; ISSN: 0038-075X
Descriptors: acid soils/ acidification/ aluminium/ calcium/ crop yield/ exchangeable aluminium/ exchangeable calcium/ exchangeable magnesium/ exchangeable potassium/ exchangeable sodium/ fly ash/ liming/ magnesium/ maize/ potassium/ sandy loam soils/ sodium/ soil acidity/ soil pH/ soil types/ aluminum/ corn/ exchangeable aluminum/ United States of America
Abstract: Fly ash produced as a by-product of subbituminous coal combustion can potentially serve as an alternative liming material without negatively affecting corn (*Zea mays* L.) production in areas where use of conventional liming materials can be uneconomical due to transportation costs. A study was conducted to determine if fly ash produced from the Nebraska Public Power District Gerald Gentleman Power Station located in Sutherland, NE could be used as an alternative liming material. This study had the following objectives: (1) compare the effects of fly ash on soil pH with other common agricultural lime materials; (2) determine the effects of fly ash on percent Al saturation in selected soils; and (3) determine the effects of fly ash on corn grain yields. Combinations of dry fly ash (DFA), wet fly ash (WFA), beet lime (by-product of sugar beet [*Beta vulgaris* L.] processing) (BL), and agricultural lime (AGL) were applied at rates ranging from 0.43 to 1.62 times the recommended lime rate to plots on four acidic soils (Anselmo fine sandy loam, Hord fine sandy loam, Holdrege sandy loam, and Valentine fine sand). Soil samples were collected to a depth of 0.2 m from plots and analysed for pH before lime applications and twice periodically after lime application. The Hord and Valentine soils were analysed for exchangeable Ca, Mg, K, Na, and Al for determination of percent Al saturation on selected treatments and sampling dates. Corn grain yields were determined annually. Depending on the lime source, soil pH increased in the upper 0.2 m of soil the year after application compared with the pre-application soil pH values for some sites and years, whereas in others there were no significant increases in pH. However, all lime materials at each site failed to raise the soil pH in the upper 0.2 m of all the treatments and soil types to the target pH of 6.5. Fly ash and AGL treatments did not significantly increase corn grain yields compared with the control on the Anselmo, Hord, and Holdrege soils. At the Hord site, AGL and DFA significantly reduced percent Al saturation by 3.1% and 3.7% compared with the control 5 years after application, respectively. Fly ash did not negatively affect corn grain yields compared with AGL. Yields were 12,472, 12,233, and 12,177 kg ha⁻¹ for the Anselmo, Holdrege, and Hord sites averaged over all treatments and years. The lack of yield response to lime additions was potentially a result of lime materials not raising the soil pH to sufficient levels, higher subsoil pH values, or the exchangeable Al not being

high enough prior to lime material application to reduce grain yields in these soils. We conclude that the fly ash utilized in this study and applied at rates in this study, increases soil pH comparable to agricultural lime and is an appropriate alternative liming material.
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262. Fly ash as a liming material for cotton.

Stevens, G. and Dunn, D.

Journal of Environmental Quality 33(1): 343-348. (Jan. 2004-Feb. 2004)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: fly ash/ liming/ soil amendments/ *Gossypium hirsutum*/ lint cotton/ sandy loam soils/ chemical constituents of plants/ magnesium/ boron/ sodium/ soil chemical properties/ soil pH/ crop yield/ field experimentation/ Missouri

Abstract: A field experiment was conducted to determine the effect of fly ash from a coal combustion electric power facility on soil acidity in a cotton (*Gossypium hirsutum* L.) field. Fresh fly ash was applied to a Bosket fine sandy loam (fine-loamy, mixed, thermic Mollic Hapludalf) soil with an initial soil pH(salt) of 4.8. The fly ash was equivalent to 42 g kg⁻¹ calcium carbonate with 97% passing through a 60 mesh (U.S. standard) sieve. Fly ash was applied one day before cotton planting in 1999 at 0, 3.4, 6.7, and 10.1 Mg ha⁻¹. No fly ash was applied in 2000. Within 60 d of fly ash application in 1999, all rates of fly ash significantly increased soil pH above 6.0. Manganese levels in cotton petioles were reduced significantly by 6.7 and 10.1 Mg ha⁻¹ of fly ash. Soil boron (B) and sodium (Na) concentrations were significantly increased with fly ash. In 1999, B in cotton leaves ranged from 72 to 84 mg kg⁻¹ in plots with fly ash applications. However, no visual symptoms of B toxicity in plants were observed. In 1999, cotton lint yield decreased on average 12 kg ha⁻¹ for each Mg of fly ash applied. In 2000, cotton yields were significantly greater for the residual 3.4 and 6.7 Mg fly ash ha⁻¹ plots than the untreated check. Due to the adverse yield effects measured in the first year following application, fly ash would not be a suitable soil amendment for cotton on this soil at this time. This citation is from AGRICOLA.

263. Fly ash as a liming material for cotton: A rate study.

Dunn, D. and Stevens, G.

In: 2000 Proceedings Beltwide Cotton Conferences. San Antonio, USA.; Vol. 2.; pp. 1402-1404; 2000.

Descriptors: application rates/ boron/ chemical composition/ cotton/ fly ash/ liming/ manganese/ plant composition/ potassium/ soil acidity/ soil amendments/ soil pH/ chemical constituents of plants/ Mn/ United States of America

Abstract: Fly ash from a coal burning electric power plant was used to reduce the soil acidity in a Southeast Missouri cotton field. Three rates of fly ash as well as an untreated check were compared. Fly ash treatments raised soil pH levels over a 5-month period. Fly ash rate did not significantly affect cotton lint yields. Boron, potassium, and sodium levels in cotton leaves and petioles collected during full bloom were increased for fly ash treatments. The magnitude of these increases corresponds to the fly ash

application rates. Manganese levels in leaf and petiole were reduced for fly ash treatments. Total soil manganese levels were similar for all treatments. DTPA extractable manganese levels were lower for fly ash treatments.
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264. Fly ash as a soil ameliorant for improving crop production: A review.

Sudha Jala and Dinesh Goyal

Bioresource Technology 97(9): 1136-1147. (2006)

NAL Call #: TD930.A32; ISSN: 0960-8524

Descriptors: biomass/ biomass production/ crop production/ degraded land/ fly ash/ groundwater pollution/ pollutants/ polluted soils/ polluted water/ reviews/ soil amendments/ soil pollution/ soil types/ solid wastes/ waste disposal/ waste management/ waste utilization/ water quality/ water composition and quality

Abstract: Fly ash, a resultant of combustion of coal at high temperature, has been regarded as a problematic solid waste all over the world. Many possible beneficial applications of fly ash are being evaluated to minimize waste, decrease cost of disposal and provide value-added products. The conventional disposal methods for fly ash lead to degradation of arable land and contamination of the ground water. However fly ash is a useful ameliorant that may improve the physical, chemical and biological properties of problem soils and is a source of readily available plant macro and micronutrients. In conjunction with organic manure and microbial inoculants, fly ash can enhance plant biomass production from degraded soils. Detailed studies on the nature and composition of fly ash, conducted during the latter half of the 20th century have helped in repeatedly confirming the various useful applications of this hitherto neglected industrial waste. The purpose of this paper is to review the available information on various attributes of fly ash and explore the possibility of exploiting them for agronomic advantage.

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265. Fly ash as a source of plant nutrients and soil conditioner.

Anjali Deshmukh; Matte, D. B.; and Bharti Bhaisare

Journal of Soils and Crops 9(2): 278-279. (1999); ISSN: 0971-2836

Descriptors: fly ash/ plant nutrition/ soil amendments/ soil conditioners/ trace element fertilizers/ micronutrient fertilizers

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266. Fly ash--can it be used as nursery mix?

Dhevagi, P.; Udayasurian, C.; and Oblisami, G.

Journal of Ecobiology 16(1): 33-36. (2004)

NAL Call #: QH540.J56 ; ISSN: 0970-9037

Descriptors: container grown plants/ fly ash/ growth/ ornamental plants/ seed germination/ seedlings/ soil amendments/ vigour/ microbial communities/ ornamentals/ vigor

Abstract: The effect of fly ash as a nursery mix for raising *Abizia labbek* [*Albizia lebbek*] tree seedlings in polybags was studied. Flyash had glass like particles (0.1 mm) with

alkaline pH and had an EC of 1.4 dS m⁻¹. It had low levels of nitrogen and phosphorus and considerable amounts of potassium. As the flyash content decreased, the vigour index and germination percentage of the seedlings increased. The volume index was maximum at 30%. Soil amendment with flyash seemed to result in decreased microbial numbers from 87.0 to 34.7x10⁶/g. Reproduced with permission from the CAB Abstracts database.

267. Fly ash characteristics and its incorporation effects on germination of maize and rice.

Sharma, S. K.; Kalra, N.; and Singh, G. R.

Journal of Scientific and Industrial Research 60(12): 951-952. (2001)

NAL Call #: 475 J82; ISSN: 0022-4456

Descriptors: fly ash/ maize/ rice/ seed germination/ corn/ paddy

Abstract: Pot culture experiments were conducted during the summer season of 1996 to evaluate the effect of fly ash addition in soil on germination and stand establishment of maize (*Zea mays*) and rice (*Oryza sativa*). Fly ash was added to soil at 0, 5, 10, 15 or 20% levels for both the crops. The changes in physical and physico-chemical characteristics of soil, due to fly ash addition were analysed. Data on germination time, i.e. time taken for 75% germination, and delay index, a normalized parameter, was analysed and discussed.

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268. Fly ash effect on improving soil properties and rice productivity in Korean paddy soils.

Lee Hyup; Ha HoSung; Lee ChangHoon; Lee YongBok; and Kim PilJoo

Bioresource Technology 97(13): 1490-1497. (2006)

NAL Call #: TD930.A32 ; ISSN: 0960-8524

Descriptors: application rates/ crop yield/ fly ash/ loam soils / paddy soils/ phosphorus/ productivity/ rice/ sandy soils/ silicates/ silicon/ silt loam soils/ soil pH/ soil properties/ soil types/ paddy/ South Korea

Abstract: Paddy soils in Korea generally require the addition of Si to enhance rice productivity. Coal combustion fly ash, which has a high available Si content and alkaline pH, was selected as a potential source of Si in this study. Two field experiments were carried out to evaluate rice (*Oryza sativa*) productivity in silt loam and loamy sand soils to which 0, 40, 80, and 120 Mg ha⁻¹ of fly ash were added with 2 Mg ha⁻¹ Si as a control. Fly ash increased the soil pH and available Si and P contents of both soils. The amount of available B increased to a maximum of 2.57 mg kg⁻¹, and the B content of the rice plants increased to a maximum of 52-53 mg kg⁻¹ following the addition of 120 Mg ha⁻¹ fly ash. The rice plants did not show toxicity effects. The highest rice yields were achieved following the addition of around 90 Mg ha⁻¹ fly ash. The application of fly ash increased Si, P and K uptake by the rice plants, but did not result in an excessive uptake of heavy metals in the submerged paddy soil. In conclusion, fly ash could be a good supplement to other inorganic soil amendments to improve the nutrient balance in paddy soils.

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269. Fly ash in integrated plant nutrition system and its impact on soil properties yield and nutrient uptake of groundnut.

Selvakumari, G.; Baskar, M.; Jayanthi, D.; and Mathan, K. K.

Madras Agricultural Journal 86(10/12): 556-561. (1999)

NAL Call #: 22 M262; ISSN: 0024-9602

Descriptors: composts / crop yield/ fly ash/ groundnuts/ lateritic soils/ NPK fertilizers/ nutrient availability/ nutrient uptake/ plant nutrition/ soil amendments/ soil fertility/ soil properties/ soil types/ peanuts

Abstract: A pot experiment was conducted in 1997 using groundnut (VR 12) as a test crop in a laterite soil to study the effect of fly ash (FA) alone and in combination with compost and fertilizers on nutrient uptake, yield of groundnut and available NPK status of the postharvest soil. The increase in the alkaline KMnO₄-N status of the postharvest soil was marked by the addition of FA alone as well as FA integrated with fertilizers and compost. The application of FA also significantly increased the nutrient uptake and yield of groundnut. The presence of essential plant nutrients, and the physical properties of FA could be attributed for its favourable effects on yield of groundnuts as well as for the maintenance of soil fertility. It was also inferred that integration of FA with other components of the nutrient supply system, on account of the synergistic effects, resulted in better nutrient uptake, higher yield and maintenance of soil fertility.

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270. Fly ash incorporation effect on soil health and yield of maize and rice.

Sharma, S. K.; Naveen Kalra; and Singh, G. R.

Journal of Scientific and Industrial Research 60(7): 580-585. (2001)

NAL Call #: 475 J82; ISSN: 0022-4456

Descriptors: bulk density/ cadmium/ copper/ crop yield/ fly ash/ growth/ hydraulic conductivity/ iron/ maize / manganese/ moisture/ rice/ soil fertility/ wilting point/ zinc/ corn/ Mn/ paddy

Abstract: Field experiments were conducted in villages around National Capital Power Project, Dadri, Uttar Pradesh, India during 1995 to evaluate fly ash incorporation effects on soil health, and growth and yield of maize (*Zea mays*) and rice (*Oryza sativa*). Fly ash application levels (up to 10t/ha) were decided on the basis of an ash/dust fall range from 5 to 12 t/ha/y in the villages adjoining the thermal power station. The grain yield of maize increased in fly ash-treated plots, whereas rice yield was similar to fly ash treated plots. Fly ash-treated plots had marginally higher uptake of Zn, Cu, Fe, Mn and Cd, but values were insignificant. Fly ash application in soil resulted in lower bulk density. Fly ash addition also reduced hydraulic conductivity and improved moisture retention at field capacity and permanent wilting point. These changes in the soil characteristics might have been due to modifications in the macro- and micro-pore size distribution which also contributed to increased yield of maize in light and medium textured soils.

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271. Fly-ash-induced oxidative stress and tolerance in *Prosopis juliflora* L grown on different amended substrates.

Sinha, S.; Rai, U. N.; Bhatt, K.; Pandey, K.; and Gupta, A. K.

Environmental Monitoring and Assessment 102(1/3): 447-457. (2005)

NAL Call #: TD194 .E5 ; ISSN: 0167-6369

Descriptors: chemical composition/ cysteine/ farmyard manure/ fly ash/ soil amendments/ thiols/ tolerance/ biofertilizers/ FYM/ malondialdehyde/ mercaptans/ oxidative stress

Abstract: Field experiments were conducted to study the impact of metal accumulation on malondialdehyde (MDA), cysteine and non-protein thiol (NPSH) contents in the plants of *Prosopis juliflora* grown on the fly ash (FA) amended with soil, blue green algae (BGA) biofertilizer, farm yard manure, press mud and *Rhizobium* inoculation. The analysis of data revealed that the level of MDA, cysteine and NPSH was higher in the roots of the plant than leaves, which was found positively correlated with metal accumulation. An increase of 361.14, 64.25 and 305.62% in MDA, cysteine and NPSH contents, respectively was observed after 45 days in the roots of the plants grown in 100% FA as compared to 100% garden soil (GS). The level of MDA, cysteine and NPSH was found less in the plants grown on various amendments of FA showing ameliorating effect on the toxicity induced due to the accumulation of metals. The decrease in MDA, cysteine and NPSH contents was higher in *Rhizobium*-inoculated plants as compared to uninoculated plants grown on 100% FA. The results showed a high tolerance potential of the plant, which is further increased by inoculating the plant with FA-tolerant *Rhizobium* showing feasibility of using *P. juliflora* in environmental monitoring of FA landfills. Reproduced with permission from the CAB Abstracts database.

272. Fly-ash induced synthesis of phytochelatin in chickpea (*Cicer arietinum* L.) plants.

Gupta, D. K.; Rai, U. N.; Tripathi, R. D.; Sinha, S.; Rai, P.; and Inouhe, M.

Journal of Environmental Biology 26(3): 539-46. (July 2005)

NAL Call #: QH540.J65 ; ISSN: 0254-8704 .

16334294

Descriptors: Carbon: chemistry: metabolism/ Chromatography, High Pressure Liquid/ *Cicer*: metabolism/ Cysteine: analysis/ Electric Conductivity/ Glutathione: analysis: biosynthesis/ Hydrogen / Ion Concentration/ India/ Metals, Heavy: analysis: metabolism/ Particulate Matter/ Phytochelatin/ Soil: analysis/ Species Specificity

Abstract: Phytochelatin and related metabolites (cysteine and GSH) were found to be induced in the shoots of two varieties of *Cicer arietinum* viz., CSG-8962 and C-235 grown under different amendments of fly-ash with garden soil and press mud. Cysteine, GSH, PCs and its speciation were found in higher concentrations in amended fly-ash than in the control 100% soil. Two species of metal binding peptides i.e., PC2 and PC4 were found in both varieties and in amendments, however, their concentration varied depending upon the fly-ash concentrations in both amendments. Further, var. CSG-8962 was found more tolerant than var. C-235 because of higher concentrations of PCs and related metabolites.

This citation is from PubMed.

273. Fly ash influence on near-surface temperature of a clay loam soil.

Hammermeister, A. M.; Chanasyk, D. S.; and Naeth, M. A.

Canadian Journal of Soil Science 78(2): 345-350. (1998)

NAL Call #: 56.8 C162 ; ISSN: 0008-4271

Descriptors: application rates/ bulk density/ capacity/ clay fraction/ clay loam soils/ coal mined land/ density/ fly ash/ particle size/ particle size distribution/ soil/ soil amendments/ soil temperature/ soil water/ soil water content/ specific heat/ summer/ temperature/ treatment/ water content/ soil moisture

Abstract: Four fly ash treatments (0, 100, 200, and 400 t ha⁻¹) were applied to clay loam soil in a randomized block design at a coal mine site in Alberta, Canada. Bi-hourly soil temperatures were measured on 3 summer days over 2 years, and afternoon temperatures were measured on randomly selected spring days at 5-, 10-, and 20-cm depths in the four fly ash treatments. Temperatures were measured in conjunction with surface bulk density, water content, and particle size distribution which were also used to calculate thermal heat capacity. Fly ash decreased percentage clay, soil water content, and soil heat capacity. Fly ash amendment did not significantly increase mean daily soil temperature under dry conditions. Generalizations in the literature regarding the influence of fly ash on soil temperature, bulk density, and water-holding capacity must be considered carefully since they generally relate only to coarse to medium textured soils.

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274. The fly ash influenced the heavy metal status of the soil and the seeds of sunflower: A case study.

Shazia Siddiqui; Ahmad, A.; and Hayat, S.

Journal of Environmental Biology 25(1): 59-63. (2004)

NAL Call #: QH540.J65; ISSN: 0254-8704

Descriptors: bicarbonates/ calcium/ carbonate/ case studies/ cation exchange capacity/ chloride/ crop yield/ electrical conductivity/ fly ash/ heavy metals/ lead/ manganese/ phosphorus/ polluted soils/ porosity/ potassium/ sandy loam soils/ seed production/ seed quality/ seeds/ soil amendments/ soil pH/ soil pollution/ soil types/ sulfate/ sunflowers/ trace elements/ water holding capacity/ zinc/ microelements/ Mn

Abstract: In this case study, four cultivars of sunflower (*Helianthus annuus*) were grown in a sandy loam soil, supplemented with graded (v/v) quantity (0, 20, 40, 60, 80, 100%) of fly ash released by the combustion of coal from a thermal power plant. The presence of fly ash in the soil increased its porosity, water holding capacity, pH, electrical conductivity, cation exchange capacity, and the content of sulfate, carbonate, bicarbonate, chloride, phosphorus, potassium, calcium and various trace elements. However, in the seeds, except for Fe, Pb, Mn and Zn and other heavy metals remained untraced up to 40% of the fly ash, above that their quantity slightly increased but the values were very much under the permissible limits.

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275. Flyash as a carrier for *Rhizobium* inoculant.

Lal, J. K. and Mishra, B.

Journal of Research, Birla Agricultural University 10(2):

191-192. (1998); ISSN: 0971-1724

Descriptors: charcoal / farmyard manure/ fly ash/ inoculant

carriers / lignite/ longevity/ storage life/ FYM

Abstract: An incubation study was conducted to test the suitability of Bokaro fly ash, alone or in combination with lignite, charcoal and farmyard manure, to act as a carrier for the *Rhizobium* inoculant. *Rhizobium leguminosarum* broth containing 108 cells/ml was mixed with the prospective carriers, packed in polythene and maintained at room temperature. Observations were taken on 0, 15, 30, and 60 days after incubation. Charcoal and lignite produced the highest populations of *Rhizobium*, possibly due to its ability to absorb toxic compounds and aerate the medium. Fly ash in combination with charcoal (1:1 or 1:3) had the highest population. The *Rhizobium* increased up to 45 days, and then remained constant. It is concluded that 25% fly ash in combination with lignite or charcoal can be used as a carrier for bioinoculants.

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276. Flyash as a post-harvest preservative for five commonly utilized pulses.

Mendki, P. S.; Maheshwari, V. L.; and Kothari, R. M. *Crop Protection* 20(3): 241-245. (Apr. 2001); ISSN: 0261-2194 [CRPTD6]

Descriptors: *Callosobruchus chinensis*/ storage pests/ fly ash/ insect control/ postharvest treatment/ soybeans/ mung beans/ black gram/ chickpeas/ cowpeas/ waste utilization/ food quality/ seed germination/ nutritive value/ infestation

Abstract: Flyash, one of the major industrial wastes, generated as a result of coal burning in thermal power stations, was evaluated for post-harvest preservation of five commonly used pulses; viz. soybean (*Glycin max*), bengal gram (*Cicer arietinum*), green gram (*Vigna radiata*), black gram (*V. mungo*) and red gram (*V. unguiculata*). All the pulses were deliberately infested with stored grain pest, commonly known as pulse beetle, *Callosobruchus chinensis* and treated with 1 gm flyash per 5 kg of pulses under ambient storage conditions for 18 months. No adult *C. chinensis* were found in pulses treated with flyash even after 12 months of treatment. After 18 months, bengal gram was most infested, both in terms of number of insects observed in gunny bags and percent damaged grains, whereas soybean and black gram were least infested. Percentage insect-damaged grains were directly proportional to the number of insects observed in gunny bags. There was no effect of flyash on the nutritional quality and percent germination of pulses.

This citation is from AGRICOLA.

277. Flyash as a soil conditioner and fertilizer.

Naveen Kalra; Jain, M. C.; Joshi, H. C.; Choudhary, R.; Harit, R. C.; Vatsa, B. K.; Sharma, S. K.; and Vinod Kumar *Bioresource Technology* 64(3): 163-167. (1998)

NAL Call #: TD930.A32 ; ISSN: 0960-8524

Descriptors: amendments/ available water/ bulk density/ canopy/ capacity/ density/ effects/ electrical conductivity/ field capacity/ fly ash/ grain/ health/ hydraulic conductivity/ incorporation/ Indian mustard/ iron/ maize/ manganese/ moisture/ pH/ power stations/ productivity/ properties/ retention/ rice/ soil/ soil conditioners/ soil properties/ trace elements/ uptake/ wheat/ wilting/ wilting point/ yields/ zinc/ Capparales/ corn/ crown cover/ hydrogen ion concentration/ leaf canopy/ microelements/ Mn/ New Delhi/ paddy/ potential of hydrogen

Abstract: Field experiments were conducted in Uttar Pradesh and New Delhi, India, to evaluate the effects of fly ash incorporation (up to 50 t/ha) on soil properties and the growth and yield of wheat, mustard (*Brassica juncea*), rice and maize. The grain yield of maize increased in fly ash-treated plots with the addition of ash up to a maximum addition of 10 t/ha. Dusting crop canopies with ash decreased the yield in proportion to the amount applied. The yield of wheat increased up to an addition of ash of 20 t/ha, and declined thereafter, but was still higher than the yield when no fly ash was added. Rice yield when 10 t/ha of ash was added was similar to that with no fly ash, whereas mustard showed improvements in seed yield with fly ash addition at 10 t/ha. fly ash-treated plots had a marginally higher uptake of Zn, Cu, Fe, Mn and Cd. fly ash addition to soil resulted in lower bulk density, although the differences compared with non-treated plots were not significant. The addition of fly ash also reduced the hydraulic conductivity and improved moisture retention at field capacity and wilting point, but no changes in available water were observed. These changes in soil properties might have been due to modifications in macro- and micro-pore size distribution and which may also have contributed to the increased crop yields in light- and medium-textured soils. Reproduced with permission from the CAB Abstracts database.

278. Flyash for acidic soils.

Sengupta, P. 22(1): 119-120. (2002); ISSN: 02537141 [IJEPTD]

Descriptors: coal/ agriculture/ combustion/ crop improvement/ environmental reclamation/ fly ash/ forestry/ land use/ short survey/ soil acidity/ *Fraxinus*
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279. Formulation of environmentally sound waste mixtures for land application.

Schumann, A. W. and Sumner, M. E. *Water, Air and Soil Pollution* 152(1/4): 195-217. (2004) NAL Call #: TD172 .W36; ISSN: 0049-6979

Descriptors: ammonia/ application to land/ boron/ calcium carbonate/ fertilizers/ fly ash/ groundwater pollution/ growth/ heavy metals/ manganese/ nitrite/ nitrogen/ nutrient availability/ nutrient deficiencies/ nutrients/ organic wastes/ phosphorus/ phytotoxicity/ plant nutrition/ polluted soils/ polluted water/ potassium/ poultry manure/ sewage sludge/ soil alkalinity/ soil pollution/ soil types/ soybeans/ water quality/ land application/ Mn/ poultry litter/ soybeans/ water composition and quality

Abstract: Major impediments to the land application of coal combustion byproducts (fly ash) for crop fertilization have been the presence of heavy metals and their relatively low and imbalanced essential nutrient concentration. Although nutrient deficiencies, in particular N, P, and K, may be readily augmented by adding organic wastes such as sewage sludge and animal manure, the indiscriminate application of mixtures to crops can cause excessive soil alkalinity, imbalanced nutrition (P, Mg), phytotoxicities (B, Mn, ammonia, nitrite), and unspecified contamination of the food chain by elements such as As. In this study, nutrient availability data and linear programming (LP) were used to solve these problems by formulating fly ash-biosolid triple mixtures which complied with both plant and soil fertilization requirements, and met existing U.S.A. environmental

regulations for total As application in sewage sludge (EPA-503). Thirteen different fly ash samples were LP-formulated with sewage sludge, poultry manure, CaCO₃, and KCl to yield 13 unique mixtures, which were then evaluated in greenhouse pot experiments. Results indicated that normal growth and balanced nutrition of sorghum (*Sorghum bicolor* L.) and soybean (*Glycine max* (L.) Merr.) crops were achieved in all mixtures, comparable to a balanced fertilizer reference treatment, and significantly better than the untreated control. Phytotoxic levels of B, NH₃, NO₂⁻, overliming problems, and excessive As levels which were previously encountered from indiscriminate use of these waste materials, were all well controlled by LP-formulated mixtures. Most fly ash quantities in mixtures were limited by either available B (<4 kg ha⁻¹) or total As (<2 kg ha⁻¹) restrictions during formulation, while the most alkaline fly ash was limited by its high calcium carbonate equivalence (CCE=53.9%). These results confirmed that fly ash land application should not be at arbitrary fixed rates, but should be variable, depending on the soil, crop, and particularly the fly ash chemistry.
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280. Fungal ergosterol as an indicator of heavy metal accumulation in soils amended with coal ash.

Aparna Asokan; Mohini Saxena; and Asokan Pappu
Fresenius Environmental Bulletin 13(1): 16-20. (2004);
ISSN: 1018-4619

Descriptors: agricultural production/ ash/ biological indicators/ clay loam soils/ clay soils/ coal/ ergosterol/ farmyard manure/ heavy metals/ polluted soils/ productivity/ sandy soils/ silty soils/ soil amendments/ soil fungi/ soil pollution/ soil types/ soil water content/ waste land/ waste management/ waste utilization/ FYM/ waste ground
Abstract: Based on the results obtained from the lab scale study, pilot scale experiments were conducted on the use of 15-25% i.e. 300 to 650 MT ha⁻¹ (metric tonnes per hectare of land) of coal ash to increase the agricultural productivity of sandy, silty clay loam and clayey soil of wasteland located at different parts of India. The present work is an attempt to evaluate the contribution of coal ash addition to these soils in terms of heavy metal loading through fungal invasion via ergosterol estimation in sequestering the heavy metals. The ergosterol estimation was done by HPLC. Ergosterol was eluted at 8 min after injecting of 20 micro l of the extract. An increased content of ergosterol with increased concentration of coal ash is noticed, which is influenced by the sample moisture content, thus freeze-dried samples have 25% more ergosterol content. Statistically significant results were obtained with freeze-dried soil samples with 25% coal ash addition on sandy soil (p<0.05), while with silty clay loam or clayey soil and 20% or 15% coal ash application, respectively, significant results at p<0.05 were obtained with Farm Yard Manure (FYM). Soil amended with coal ash addition showed an increase in concentration of heavy metals and trace elements with higher dose of coal ash treatment.

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281. Geotechnical characteristics of fly ash-soil mixtures.

Kaniraj, S. R. and Havanagi, V. G.
Geotechnical Engineering 30(2): 129-147. (Aug. 1999);
ISSN: 0046-5828.
Notes: Features: References: 23; illus. incl. 8 tables.
Descriptors: ash/ Asia/ Atterberg limits/ Baumineral/ Bochum Germany/ California bearing ratio/ Central Europe/ chemical composition/ compaction/ Delhi India/ Europe/ Germany/ granulometry/ India/ Indian Peninsula/ New Delhi India/ North Rhine-Westphalia Germany/ permeability/ physical properties/ power plants/ Rajghat thermal power station/ shear tests/ soil mechanics/ soils/ triaxial tests/ Engineering geology
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282. Germination behaviour of teak (*Tectona grandis* Linn F.) drupes in flyash incorporated medium.

Masilamani, P. and Dharmalingam, C.
Advances in Plant Sciences 12(1): 57-61. (1999)
NAL Call #: QK1.A38; ISSN: 0970-3586
Descriptors: age/ fly ash/ forest nurseries/ growing media/ seed germination/ seedling growth/ seeds/ soil amendments/ Madras/ potting composts/ rooting media
Abstract: The germination of fresh and 1-yr-old teak drupes collected from a 60-yr-old seed production area in Tamil Nadu (India) was tested in nursery growing media incorporating fly ash from the coal fired plant of the Pugalur Paper Industry. Only drupes of >10 mm in diameter were used in the tests, and before sowing they were pretreated by alternate soaking and drying at 12-h intervals over 6 days. The test media were sand, red earth, red earth + sand + farmyard manure (FYM) at 2:1:1, fly ash, fly ash + red earth + FYM (1:1:1), and fly ash + sand + FYM (1:1:1). The older drupes germinated and produced more and better quality seedlings than the fresh drupes in all the media. The best germination, seedling growth and vigour were in the sand only medium, but this was closely followed by the fly ash + red earth + FYM mixture. Fly ash alone gave the poorest germination and seedling performance.
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283. Growing highbush blueberry in coal ash-compost mixtures.

Zimmerman, Richard H.
In: 96th Annual International conference of the American Society for Horticultural Science. Minneapolis, Minnesota, USA.; Vol. 34(3); pp. 475; 1999.
NAL Call #: SB1.H6
Descriptors: Horticulture: Agriculture/ Ericaceae: Angiosperms, Dicots, Plants, Spermatophytes, Vascular Plants/ coal ash compost mixture culture: cultivation method/ Flowering/ Fruit Set/ Shoot Growth/ Meeting Abstract/ Meeting Poster
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284. Growth analysis of spring wheat growing in the soil substrate at different content of fly ash.

Gregorczyk, A.
Roczniki Nauk Rolniczych Seria A, Produkcja Roslinna 114(1/2): 13-24. (1999)
NAL Call #: 20.5 R59 SER. A; ISSN: 0080-3650.

Notes: Original title: Wskaznikowa analiza wzrostu pszenicy jarej rosnacej na podozu o zroznicowanej zawartosci popioow lotnych.

Descriptors: fly ash/ growth/ growth analysis/ growth rate/ leaf area/ plant development/ sandy soils/ soil amendments/ wheat

Abstract: Spring wheat cv. Eta grown in pots of light soil with or without amendment with fly-ash (1 kg per 9 kg pot) and harvested 12 times during vegetative growth. Relative growth rate (RGR), unit leaf rate (ULR), leaf area ratio (LAR), specific leaf area (SLA) and leaf weight ratio (LWR) were calculated. Fly ash amendment reduced RGR and delayed wheat development. Changes in RGR mainly resulted from the variability of LAR, which was determined by LWR.

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285. Growth and biochemical parameters of *Cicer arietinum* L. grown on amended fly ash.

Gupta, D. K.; Tripathi, R. D.; Rai, U. N.; Mishra, S.; Srivastava, S.; Dwivedi, S.; and Maathuis, F. J. M.

Environmental Monitoring and Assessment 134(1-3): 479-487. (Nov. 2007)

NAL Call #: TD194 .E5 ; ISSN: 0167-6369

Descriptors: ascorbic acid/ *Cicer arietinum*/ cysteine/ fly ash/ nitrate reductase/ Internet resource

Abstract: Growth and metal accumulation were investigated in two *Cicer arietinum* L. varieties (var. CSG-8962 and var. C-235) when grown in various combinations of fly ash (FA) amended with garden soil (GS), press mud (PM) or saw dust (SD). In addition, the levels of photosynthetic pigments, nitrate reductase (NR) activity, cysteine, non-protein thiols (NP-SH), and ascorbic acid were studied. FA amended with GS or PM led to a 5-10 times increase in biomass compared to FA control and was most pronounced in the less metal tolerant variety CSG-8962. Amendment of FA with either GS or PM only moderately increased the contents of some essential metals whereas the non-essential Cd and Cr remained similar or decreased slightly compared to FA control. FA combined with either GS or PM increased the amount of photosynthetic pigments and was largely absent when SD was added to FA. Improved nitrogen availability led to increased nitrate reductase (NR) activity with all amendments but less so with SD. Metal stress indicating parameters were generally reduced (cysteine and non-protein thiols) or unchanged (ascorbic acid). In conclusion, of the tested ameliorants both GS and PM greatly improved growth of *C. arietinum* making FA a suitable component of plant growth substrates.

This citation is from AGRICOLA.

286. Growth and elemental accumulation by canola on soil amended with coal fly ash.

Yunusa, I. A.; Manoharan, V.; DeSilva, D. L.; Eamus, D.; Murray, B. R.; and Nissanka, S. P.

Journal of Environmental Quality 37(3): 1263-70. (May 2008-June 2008)

NAL Call #: QH540.J6; ISSN: 0047-2425.

18453446

Descriptors: plant growth/ elemental accumulation/ canola/ soil amendment/ coal fly ash

Abstract: To explore the agronomic potential of an Australian coal fly ash, we conducted two glasshouse experiments in which we measured chlorophyll fluorescence, CO₂ assimilation (A), transpiration, stomatal conductance, biomass accumulation, seed yield, and elemental uptake for canola (*Brassica napus*) grown on soil amended with an alkaline fly ash. In Experiment 1, application of up to 25 Mg/ha of fly ash increased A and plant weight early in the season before flowering and seed yield by up to 21%. However, at larger rates of ash application A, plant growth, chlorophyll concentration, and yield were all reduced. Increases in early vigor and seed yield were associated with enhanced uptake of phosphorus (P) by the plants treated with fly ash. Fly ash application did not influence accumulation of B, Cu, Mo, or Zn in the stems at any stage of plant growth or in the seed at harvest, except Mo concentration, which was elevated in the seed. Accumulation of these elements was mostly in the leaves, where concentrations of Cu and Mo increased with any amount of ash applied while that of B occurred only with ash applied at 625 Mg/ha. In Experiment 2, fly ash applied at 500 Mg/ha and mixed into the whole 30 cm soil core was detrimental to growth and yield of canola, compared with restricting mixing to 5 or 15 cm depth. In contrast, application of ash at 250 Mg/ha with increasing depth of mixing increased A and seed yield. We concluded that fly ash applied at not more than 25 Mg/ha and mixed into the top 10 to 15 cm of soil is sufficient to obtain yield benefits. This citation is from PubMed.

287. Growth and metal accumulation response of *Vigna radiata* L. var PDM 54 (mung bean) grown on fly ash amended soil: Effect on dietary intake.

Gupta, A. K. and Sinha, S.

Environmental Geochemistry and Health(July 2008)

NAL Call #: TD195.M5 M54; ISSN: 0269-4042

Descriptors: growth/ metal accumulation/ *Vigna radiata*/ mung bean/ fly ash/ soil amendment/ dietary intake

Abstract: Plants of *Vigna radiata* L. var. PDM 54 (mung bean) were grown in soil amended with different amounts (10 and 25%) of fly ash (FA). Although total metal content increased with increasing FA amendment, DTPA-extractable metals were higher for 10% FA. Accumulation of metals by the plants increased with increasing FA amendment and was greater in shoots than in roots (except for Mn and Cu) and seeds (except Mn). The total daily intake (TDI) of all the tested metals in seeds was within the recommended dietary allowance (RDA)/provisional tolerable daily intake (PTDI) for adults, except for Cd, which was higher than recommended values. Principal-components analysis (PCA) based on studies of physicochemical properties, DTPA-extractable metals, and metal accumulation in the different parts of *V. radiata* showed that physicochemical properties such as cation-exchange capacity, organic carbon, and organic matter had significant positive effects on accumulation of Cd, Co, Ni, and Pb by the plant, whereas EC had a significant negative effect. Although addition of fly ash (10%) initially increased the rate of growth, toxic symptoms were observed for 25% FA. Results from analysis of antioxidants (carotenoids, ascorbic acid, non-protein thiol, and free proline) revealed that these increased more in plants grown in 10% FA than in those grown in garden soil. Cysteine and

malondialdehyde (MDA) content increased with increasing FA amendment. PCA also showed that all the antioxidants studied behaved similarly except cysteine, for which there was a close relationship with MDA content. Thus, the results obtained during this study revealed that *V. radiata* L. var. PDM 54 may be grown in 10% FA and/or contaminated agricultural soil.

This citation is from PubMed.

288. Growth and nutrient uptake of arbuscular mycorrhizal maize in different depths of soil overlying coal fly ash.

Bi, Y. L.; Li, X. L.; Christie, P.; Hu, Z. Q.; and Wong, M. H. *Chemosphere* 50(6): 863-869. (2003)

NAL Call #: TD172 .C54; ISSN: 0045-6535

Descriptors: bioremediation/ crop establishment/ crop yield/ endomycorrhizas/ fly ash/ growth/ maize/ mycorrhizal fungi/ mycorrhizas/ nutrient uptake/ plant development/ arbuscular mycorrhizas/ corn/ Glomaceae

Abstract: Application of topsoil over phytotoxic mine wastes is often practised to establish perennial plant communities on minespoil areas. In China, population pressure encourages attempts to remediate such areas by growing arable crop plants, but efforts to establish agricultural crops often fail. We report an outdoor pot experiment that compared the effects of two arbuscular mycorrhizal (AM) fungi, *Glomus mosseae* (Nicol. and Gerd.) Gerdemann and Trappe and *G. versiforme* (Karsten) Berch, on the growth and nutrient uptake of maize (*Zea mays* L.) grown in different depths of soil layer overlying coal fly ash. Colonization by both AM fungi increased plant growth compared with non-mycorrhizal controls, with *G. mosseae* giving higher yields of maize than *G. versiforme* at the same depths of soil. Increasing soil depth led to increased plant yields. Mycorrhizal plants absorbed more nutrients than non-mycorrhizal controls, and translocated less Na to the shoots, perhaps protecting the plants from excessive Na accumulation. These preliminary results indicate that arbuscular mycorrhizas may make a substantial contribution to successful crop establishment in soils overlying areas of coal fly ash.

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289. Growth and uptake of nutrients by rice and lettuce grown on an acid sulphate soil amended with flyash and lime.

Ramesh, V. and Chhonkar, P. K.

Journal of the Indian Society of Soil Science 49(1): 222-225. (2001)

NAL Call #: 56.9 IN2; ISSN: 0019-638X

Descriptors: acid sulfate soils/ application rates/ crop yield/ fly ash/ growth/ lettuces/ lime/ liming/ mineral content/ nutrient content/ nutrient uptake/ phosphorus/ plant nutrition/ potassium/ residual effects/ rice/ soil amendments/ soil types/ acid sulphate soils/ paddy/ thionic soils

Abstract: A greenhouse experiment assessed the direct and residual effect of fly ash (0, 72 and 144 gm kg⁻¹ soil on calcium equivalent basis, CEB) and lime (0, 3 and 6 gm kg⁻¹ soil bases on lime requirement) on growth and uptake of nutrient by rice cv. Pusa 834 and lettuce cv. Great Lakes grown in a sequence on acid sulfate soil. Various fly ash, lime levels and their interaction significantly influenced the available P content of soil under rice. However, at

postharvest stage, the lowest level of available P was noted irrespective of treatments. The residual effect of application of different amounts of fly ash failed to influence the available P content of soil, while lime increased available P in the soil under lettuce. Available K content of the soil was increased due to fly ash and lower rate of lime. Fly ash at all levels significantly increased the grain yield while it increased the straw yield only at the highest level. The influence of lime was non-significant with respect to grain and straw yield. The highest level of fly ash and lime significantly increased lettuce yield while the interaction between the two was not significant. The P uptake by rice grain as well as lettuce was significantly influenced by both levels of fly ash and the highest level of lime. The different levels of lime failed to influence K uptake by rice grain and lettuce while it was highly significant for rice straw.

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290. Growth and yield of cymbopogon martinii as influenced by fly ash, am fungi inoculation and farmyard manure application.

Sharma, Mahaveer P.; Kaur, Tanu; and Adholeya, Alok.

In: 2001 International Symposium on Soil and Plant Analysis. Edmonton, Alberta, Canada.; Vol. 33(15-18).; pp. 2373-2374; 2002.

NAL Call #: S590.C63

Descriptors: agronomy: agriculture/ soil science/ Gramineae: angiosperms, monocots, plants, spermatophytes, vascular plants/ Phycomycetes: fungi, microorganisms, nonvascular plants, plants/ farmyard manure

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291. The growth of corn seedlings in alkaline coal fly ash stabilized sewage sludge.

Su, D. C. and Wong, J. W. C.

Water, Air and Soil Pollution 133(1/4): 1-13. (2002)

NAL Call #: TD172 .W36; ISSN: 0049-6979

Descriptors: ammonium nitrogen/ application to land/ boron/ cadmium/ calcium/ crop yield/ electrical conductivity/ fertilizers/ fly ash/ loam soils/ magnesium/ maize/ nickel/ nutrient content/ phosphate/ phosphorus/ plant nutrition/ potassium/ seedling growth/ seedlings/ sewage sludge/ soil amendments/ soil fertility/ soil pH/ soil types/ stabilizing/ zinc/ ammonia nitrogen/ corn/ land application

Abstract: The aim of the present study was to determine the amount of coal fly ash required to stabilize sewage sludge, without causing an adverse effect on the growth of *Zea mays* seedlings (maize) in a loamy soil receiving the ash-sludge mixtures amendment. Sludge was stabilized by mixing with fly ash at an amendment rate of 0, 5, 10, 35 and 50% (w/w) before undergoing a short fermentation period to produce a range of ash-sludge fertilizer product. Each mixture was then mixed with a loamy soil at either 1 : 1 or 1 : 5 ash-sludge mixture : soil (v/v). Soil pH, electrical conductivity, and soluble Ca, Mg and B contents increased while soluble NH₄-N, PO₄-P, K, Cd, and Ni contents decreased with an increase in ash amendment rate. Dry weight yields of pots receiving 1 : 5 ash-sludge : soil mixture (v/v) were significantly higher than their counterparts with a soil mixing ratio of 1 : 1 (v/v). The highest yields were obtained at 5 and 10% ash-sludge mixture amended soil at 1 : 5 soil mixing ratio.

Nevertheless, the yield at 35% ash-sludge amended loamy

soil at 1 : 1 v/v was still higher than that of the control soil with fertilizer treatment. The nutrient content of maize seedlings was higher at 35 and 10% ash-sludge mixture amended soil at 1 : 1 v/v, and 5 and 10% at 1 : 5 v/v than other treatments. Zinc concentrations of maize seedlings increased while B decreased with the decreasing amounts of fly ash added. Hence, the present experiment demonstrates the beneficial effects of the ash-sludge mixture on soil nutrient status and plant root growth environment. An ash amendment rate of up to 35% in the ash-sludge mixture would not have any adverse effects on plant production even at a high soil mixing volume of 1 : 1 (v/v), but an addition of 5 to 10% ash-sludge mixture at 1 : 5 (v/v) produced the optimum condition for maize seedlings growth. The results support the use of coal fly ash as a stabilizing agent for sewage sludge and the product could be used for land application.

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292. Growth parameters in tomato and spinach as influenced by fly ash, soil and their combinations.

Malewar, G. U.; Adsul, P. B.; and Syed Ismail
Journal of Soils and Crops 9(1): 30-33. (1999); ISSN: 0971-2836

Descriptors: cultural methods/ fruit vegetables/ growing media/ growth stages/ industrial wastes/ leaves/ plant development/ plant height/ spinach/ tomatoes/ vegetables/ potting composts/ rooting media/ vegetable crops

Abstract: The effect of fly ash alone or in combination with soil on growth of tomato and spinach in pots was investigated during rabi [winter] 1996 in India. Tomato growth (height) was reduced by fly ash (alone or in combination with soil), but a fly ash:soil ratio of 1:1 increased the number of leaves and number of branches above control values. Spinach growth (height) was promoted by fly ash. On a dry matter yield basis, a fly ash:soil ratio of 1:3 promoted dry matter accumulation in both crops.

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293. Growth performance and biochemical responses of three rice (*Oryza sativa* L.) cultivars grown in fly-ash amended soil.

Dwivedi, S.; Tripathi, R. D.; Srivastava, S.; Mishra, S.; Shukla, M. K.; Tiwari, K. K.; Singh, R.; and Rai, U. N.
Chemosphere 67(1): 140-151. (2007)

NAL Call #: TD172 .C54; ISSN: 0045-6535

Descriptors: application rates/ arsenic/ biochemistry/ biomass/ cadmium/ copper/ crop yield/ fly ash/ growth/ iron/ manganese/ nickel/ phytotoxicity/ plant height/ polluted soils/ power stations/ rice/ silica/ soil amendments/ soil pollution / soil types/ tillers/ zinc/ Mn/ paddy

Abstract: The disposal of fly-ash (FA) from coal-fired power stations causes significant economic and environmental problems. Use of such contaminated sites for crop production and use of contaminated water for irrigation not only decreases crop productivity but also poses health hazards to humans due to accumulation of toxic metals in edible grains. In the present investigation, three rice cultivars viz., Saryu-52, Sabha-5204, and Pant-4 were grown in garden soil (GS, control) and various amendments (10%, 25%, 50%, 75% and 100%) of FA for a period of 90 days and effect on growth and productivity of plant was

evaluated vis-a-vis metal accumulation in the plants. The toxicity of FA at higher concentration ($\geq 50\%$) was reflected by the reduction in photosynthetic pigments, protein and growth parameters viz., plant height, root biomass, number of tillers, grain and straw weight. However, at lower concentrations (10-25%), FA enhanced growth of the plants as evident by the increase of studied growth parameters. The cysteine and non-protein thiol (NP-SH) content showed increase in their levels up to 100% FA as compared to control, however, maximum content was found at 25% FA in Saryu-52 and Pant-4 and at 50% FA in Sabha-5204. Accumulation of Fe, Si, Cu, Zn, Mn, Ni, Cd and As was investigated in roots, leaves and seeds of the plants. Fe accumulation was maximum in all the parts of plant followed by Si and both showed more translocation to leaves while Mn, Zn, Cu, Ni and Cd showed lower accumulation and most of the metal was confined to roots in all the three cultivars. As was accumulated only in leaves and was not found to be in detectable levels in roots and seeds. The metal accumulation

order in three rice cultivars was $Fe > Si > Mn > Zn > Ni > Cu > Cd > As$ in all the plant parts. The results showed that rice varieties Saryu-52 and Sabha-5204 were more tolerant and could show improved growth and yield in lower FA application doses as compared to Pant-4. Thus, Sabha-5204 and Saryu-52 are found suitable for cultivation in FA amended agricultural soils for better crop yields. Reproduced with permission from the CAB Abstracts database.

294. Growth rate of fenugreek plant, *Trigonella foenum-graecum*, as influenced by fly ash.

Srivastava, S.; Ansari, A. A.; Singh, S.; Mohd Naeem; and Hashmi, F.

Bionotes 4(4): 92. (2002); ISSN: 0972-1800

Descriptors: application rates/ fenugreek/ fly ash/ growth/ growth rate/ medicinal plants/ soil amendments/ weight/ drug plants/ medicinal herbs/ officinal plants

Abstract: The effects of fly ash on the growth rate of *T. foenum-graecum* (methi) were studied. Different concentrations of fly ash in the soil were given: 0, 25, 50, 75 and 100%. Sampling was done at three different stages: 60, 70 and 80 days after sowing. The fly ash amendment up to 50% increased the total fresh and dry weights of treated plants compared to the plants grown in fly ash-free soil. However, the highest increase of 11% in the plant fresh and dry weights was recorded upon treatment with 25% fly ash. The maximum reduction in plant fresh and dry weights was recorded upon treatment with 100% fly ash. At both stages (60-70 and 70-80 days), the maximum plant growth was achieved by 50% fly ash compared to the control. Complete (100%) fly ash application reduced the growth parameters drastically. Results show that the soils treated with fly ash in low concentrations are more useful for vegetable plant growth, yield and high nutrient status, particularly for leafy vegetables.

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295. Growth response in crops raised in flyash amended soil.

Nikhil, K. 21(4): 409-416. (2002); ISSN: 02578050 [PORS]

Descriptors: biomass/ crop/ flyash amendment/ plant growth/ soil chemical properties/ yield/ agricultural soil/ crop

yield/ fly ash/ growth response/ soil amendment/ trace element/ Brassica/ Brassica juncea/ Cicer/ Cicer arietinum/ Fraxinus/ Pisum/ Pisum sativum/ Triticum/ Triticum aestivum

Abstract: Flyash disposal is a major problem in and around coal based thermal power plants. Although, the flyash contains several essential minerals, its application in agriculture is common. The present study was undertaken to elucidate the possibility of flyash application to agricultural soils to improve crop yields. Three different amounts of flyash (2,4 and 8% w/w) were mixed with soil in 1m² plots and seeds of Triticum vulgare, Cicer arietinum, Pisum sativum and Brassica juncea were sown in these soil-amended plots. Plants and soils were sampled at the time of harvesting (each had five replicates) and analysed with respect to plant growth and yield with change in the soil for the pH, EC, OC, available phosphorus and potassium and DTPA extractable trace elements Zn, Cu, Fe and Mn. The result revealed that flyash application, particularly in higher amount (8% w/w) increased the pH and conductivity of the soils, however, the application of low amounts (2% and 4% w/w) favoured plant growth and improved yield. Although, the element concentration OC, pH, available phosphorus and potassium, EC and DTPA extractable trace elements Zn, Cu, Fe and Mn were found more in flyash amended soils than the control, their levels remained well below the threshold limit and thus helped in the crop plant growth and yields.

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296. Growth response of mustard of fly ash under irrigated and induced drought conditions.

Singh, S. and Lone, P. M.

Advances in Plant Sciences 17(1): 137-141. (2004)

NAL Call #: QK1.A38; ISSN: 0970-3586

Descriptors: agrichemicals/ horticulture: agriculture/ pollution assessment control and management/ cruciferae: angiosperms, dicots, plants, spermatophytes, vascular plants/ irrigation: applied and field techniques/ drought induced conditions/ thermal power station

Abstract: The effect of fly ash was studied at 60d after sowing on chlorophyll harvest, specific leaf weight, plant fresh weight and plant dry weight of two cultivars of mustard grown under irrigated and induced drought conditions. Of the fly ash concentrations used in the study, 20% fly ash to soil application enhanced the characteristics studied and higher concentrations had inhibitory effect. Therefore, fly ash may be used for mustard growth under irrigated as well as drought conditions.

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297. Growth response of phaseolus aureus I Cv. K 851 and cv. Pusa vaisakhi in fly-ash amended soils.

Kumar, G. Sarat and Dubey, P. S.

Geobios (Jodhpur) 25(2-3): 125-130. (1998); ISSN: 0251-1223

Descriptors: agronomy: agriculture/ Leguminosae: angiosperms, dicots, plants, spermatophytes, vascular plants/ dry matter production/ fly ash amended soil/ growth response/ soil mixtures

Abstract: The amended soil enhanced growth, dry matter production and photosynthetic pigments in low FA-soil mixtures on P. aureus. Plants growing in fly-ash-black cotton soil mixtures exhibited improved qualities as compared to those of fly-ash-Ujjain alluvial soil mixtures.

and cv. K 851 responded better than that of cv. Pusa Vaisakhi.

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298. Growth, yield and elemental status of rice (Oryza sativa) grown in fly ash amended soils.

Mamata Mishra; Sahu, R K; and Padhy, R. N.

Ecotoxicology 16(2): 271-278. (2007); ISSN: 0963-9292

Descriptors: application rates/ cadmium/ catalase/ chromium/ cobalt/ copper/ crop yield/ enzyme activity/ enzymes/ growth/ heavy metals/ lead/ leaf area/ leaves/ manganese/ nickel/ panicles/ peroxidase/ phosphorus/ potassium/ rice/ seed weight/ seeds/ shoots/ soil amendments/ soil physical properties/ yield components/ zinc/ Mn/ paddy/ physical properties of soil

Abstract: Fly ash (FA) from coal in Orissa (India) was used for amending soil at levels equivalent to 0, 1, 2.5, 5, 10 and 15 metric tons per ha in which, rice was grown and elemental residues of amended soil and plant parts were enumerated. FA amendments caused significant improvement in soil quality and germination percentage of rice seeds. Growth (shoot length, leaf area and pigment composition) and yield (panicle length, seeds per panicle, seed weight and yield per plant) of rice increased with an increase in FA amendments. Catalase and peroxidase activities of young leaves increased initially in plants cultivated at lower FA levels but declined sharply at higher FA levels while the protein content of seeds improved at higher FA levels. Sodium content of rice-roots did not change with FA amendments but the contents of K, P, Mn, Ni, Co, Pb, Zn, Cu, Cr, and Cd showed a progressive increase. Seeds of plants grown in FA amended soils accumulated Cu, Pb, Cr and Cd in amounts below allowable limits. Based on the data obtained we found that flooded-rice soil amended at 10 metric tons FA per ha level of FA not only improved the physical properties of the soil but also contributed to better growth and yield of rice. Reproduced with permission from the CAB Abstracts database.

299. Growth, yield, metabolism and elemental status of green gram (Phaseolus aureus) and til (Sesamum indicum) grown in soils amended with fly ash.

Mamata Mishra; Sahu, R. K.; and Padhy, R. N.

Fresenius Environmental Bulletin 14(7): 559-564. (2005); ISSN: 1018-4619

Descriptors: application rates/ atomic absorption spectrophotometry/ biomass/ cadmium/ chemical composition/ chromium/ cobalt/ copper/ crop yield/ fly ash/ green gram/ growth/ heavy metals/ iron/ lead/ manganese/ nickel/ nutrient content/ phosphorus/ potassium/ sesame/ sodium/ soil amendments/ waste utilization/ zinc/ beniseed/ Mn/ mung bean

Abstract: Fly ash (FA) amendments (0, 5, 10, 20, 40, and 80 mega gram/ha, or Mg/ha) in soils for the winter crop, a pulse, green gram (Phaseolus aureus cv. Sujata) without and with supplementations of a commercial Rhizobium stock are described. Growth characteristics and biomass were enhanced in plants grown in higher levels of FA (20, 40 and 80 Mg/ha). Further, Rhizobium supplementation caused invariably increments in each growth parameter. The levels of 40 and 80 Mg FA/ha were ideal for grain yield. Biochemical analysis data of healthy leaves corroborated growth and yield, observing that 20 and 40 Mg FA/ha amendments with Rhizobium supplementation caused

better metabolic rates of the plant. Physico-chemical characteristics of the soil were erratically altered by FA amendments, but Rhizobium supplementation caused improvements of soils characteristics. The elemental composition (Na, K, P, Fe, Mn, Ni, Co, Zn, Cu, Pb, Cr, and Cd) of soil was affected adversely due to FA, as analyzed for the latter eight elements by atomic absorption spectrophotometry. Heavy metals, Mn, Ni, Co, Zn, Pb, Cr, and Cd, continued to occur in objectionable concentrations, unsafe for public health. Fly ash (FA) amendments (0, 5, 10, 20, 40 and 80 Mg/ha) in soils for the winter oil seed, til crop (*Sesamum indicum* cv. Kalika) are also described. Growth was enhanced in plants grown in moderate f FA levels (10, 20 and 40 Mg/ha). Yield of the plant was ideal at 2.5 Mg FA. The biochemical analysis of healthy leaves corroborated growth and yield data as above, and elemental composition (Na, K, P, Fe, Mn, Ni, Co, Zn Cu, Pb, Cr and Cd) of soil was enhanced due to FA. Heavy metals continued to occur in objectionable concentrations in the seeds.

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300. Gypsum additions reduce ammonia nitrogen losses during composting of dairy manure and biosolids.

Tubail, K.; Chen, L.; Michel Jr., F. C.; Keener, H. M.; Rigot, J. F.; Klingman, M.; Kost, D.; and Dick, W. A. *Compost Science and Utilization* 16(4): 285-293. (2008)
NAL Call #: TD796.5.C58 ; ISSN: 1065657X [CSUTE]
Descriptors: ammonia/ biological materials/ biosolids/ coal combustion/ coal gas/ composting/ cultivation/ desulfurization/ evaporative cooling systems/ flue gases/ heavy metals/ heavy water/ inorganic acids/ manures/ sewage/ stainless steel/ sulfur/ sulfur dioxide/ surface waters/ waste incineration/ waste treatment/ water pollution/ water quality/ ammonia nitrogens/ ammonia volatilizations/ boric acid solutions/ by-product gypsums/ C:N ratios/ combustion of coals/ composting process / crop productions/ dairy manures/ dry weights / final composts/ flue-gas desulfurizations/ high qualities/ organic materials/ organic wastes/ plant nutrients/ quality products / rate controls/ stainless steel vessels/ surface water qualities/ gypsum/ ammonia/ biosolid/ composting/ gypsum/ manure/ nutrient loss/ volatilization/ North America/ United States
Abstract: Composting of N rich organic materials often leads to N loss via ammonia volatilization. Literature references from as early as 1922 have suggested gypsum can prevent N loss from manure. Millions of tons of high quality by-product gypsum are produced each year in the United States as a result of flue gas desulfurization (FGD) scrubbing of sulfur dioxide during combustion of coal. Our objective was to determine the impact of this gypsum on N release when mixed with dairy manure and biosolids during composting. A preliminary experiment was conducted involving 4-liter vessels containing 1.1 kg of dairy manure mixed with by-product gypsum at dry weight rates (w/w) of 0, 6%, 13% and 23% and composted for 18 days. The ammonia-N released in the off gas was trapped in 0.67 M boric acid solution. Loss of ammonia-N was essentially complete after seven days. When expressed as percent of initial N in the mixes, the amount of N lost ranged from 6.4% for the zero rate control to 2.6-2.8% for the gypsum

treatments. Composting studies were also conducted in insulated 210-liter stainless steel vessels over a 28-day period using dairy manure and biosolids treated with or without 17% gypsum (dry weight, w/w). Results revealed the amount of N lost, as a percentage of that originally present in the compost mix, was 7.27% and 15.6% without gypsum for dairy manure and biosolids, respectively, and 3.62% and 13.6% with gypsum. The difference between the dairy manure and biosolids results is attributed primarily to a lower C:N ratio of the biosolids compared to the dairy manure. The final composts were found to contain significant amounts of plant nutrients while heavy metals were well below values considered to be harmful to surface water quality of for crop production. We conclude that combining organic waste streams, especially N-rich streams, with by-product gypsum produces a quality product while also decreasing the loss of N and reducing odors associated with the volatilization of ammonia during the composting process.

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301. Heavy metal and phosphorus content of fractions from manure treatment and incineration.

Möller, H B; Jensen, H S; Tobiasen, L; and Hansen, M N *Environmental Technology* 28(12): 1403-1418. (2007)
NAL Call #: TD1.E59; ISSN: 0959-3330
Descriptors: cadmium/ cattle manure/ coagulants/ copper/ energy sources/ fertilizers/ flocculants/ fly ash/ heavy metals/ nickel/ nitrogen/ phosphorus/ pig manure/ pollutants/ polluted water/ soil amendments/ waste management/ waste treatment/ water pollution/ water quality/ zinc/ water composition and quality
Abstract: Alternative uses of pig manure are being considered, including separation and eventual incineration of the solid fraction to produce energy and ash. The efficiency of a screw press, a decanting centrifuge and chemical treatment in transferring N, P and heavy metals from slurry to a solid fraction were compared. Chemical treatment by coagulants and flocculants removed heavy metals most efficiently; they were transferred to the solid fraction in the order Zn > Cu > Cd by all three types of equipment. With centrifugation the heavy metal load on land where the solid fraction was applied was very low, whereas on land where the liquid fraction was applied it was only slightly less than that from un-separated manure. Conversely, chemical treatment resulted in a heavy metal load similar to that from un-separated manure with the solid fraction, while with the liquid fraction it was reduced to 20% of that from un-separated manure. Incineration of the solid fraction produces bottom ash and fly ash containing high levels of P. Most of the P and less than 10% of Cd is present in the bottom ash, producing an ash low in Cd content and a fly ash high in Cd. However, Cu and Ni tend to accumulate in the bottom ash. Chemical extraction procedures revealed that P-availability was high in all liquid and solid fractions except the bottom ash from incineration where ~80% of the P was transformed into a form of apatite. Since more bottom ash than fly ash is being formed, significant amounts of P may be immobilized by incineration of solid fractions.

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302. Heavy metal leaching from coal fly ash amended container substrates during Syngonium production.

Li, Q. S.; Chen, J. J.; and Li, Y. C.

Journal of Environmental Science and Health. Part B, Pesticides, Food Contaminants, and Agricultural Wastes 43(2): 179-186. (2008)

NAL Call #: TD172.J61 ; ISSN: 0360-1234

Descriptors: arsenic/ ash/ cadmium/ chromium/ coal/ copper/ dry matter/ groundwater/ growth/ heavy metals/ leachates/ leaching/ lead/ manganese/ mercury/ molybdenum/ nickel/ ornamental plants/ selenium/ substrates/ surface water/ zinc/ Mn/ Mo/ ornamentals/ United States of America

Abstract: Coal fly ash has been proposed to be an alternative to lime amendment and a nutrient source of container substrates for ornamental plant production. A great concern over this proposed beneficial use, however, is the potential contamination of surface and ground water by heavy metals. In this study, three fly ashes collected from Florida, Michigan, and North Carolina and a commercial dolomite were amended in a basal substrate. The formulated substrates were used to produce *Syngonium podophyllum* Schott 'Berry Allusion' in 15-cm diameter containers in a shaded greenhouse. Leachates from the containers were collected during the entire six months of plant production and analyzed for heavy metal concentrations. There were no detectable As, Cr, Hg, Pb, and Se in the leachates; Cd and Mo were only detected in few leachate samples. The metals constantly detected were Cu, Mn, Ni, and Zn. The total amounts of Cu, Mn, Ni, and Zn leached during the six-month production period were 95, 210, 44, and 337 micro g per container, indicating that such amounts in leachates may contribute little to contamination of surface and ground water. In addition, plant growth indices and fresh and dry weights of *S. podophyllum* 'Berry Allusion' produced from fly ash and dolomite-amended substrates were comparable except for the plants produced from the substrate amended with fly ash collected from Michigan which had reduced growth indices and fresh and dry weights. Thus, selected fly ashes can be alternatives to commercial dolomites as amendments to container substrates for ornamental plant production. The use of fly ashes as container substrate amendments should represent a new market for the beneficial use of this coal combustion byproduct. Reproduced with permission from the CAB Abstracts database.

303. Heavy metals adsorption and their distribution in three soil types of india: Effect of coal fly ash and sewage sludge amendment.

Tripathy, S.; Veeresh, H.; Chaudhuri, D.; Powell, M. A.; and Hart, B. R.

In: *Coal Combustion Byproducts and Environmental Issues*. Uppsala, Sweden.)

233 Spring Street, New York, NY 10013: Springer; pp. 66-83; 2006 .

Notes: 7th International Conference on Biogeochemistry of Trace Elements.; ISBN: 0387258655

Descriptors: Pollution Assessment Control and Management/ Waste Management: Sanitation/ Sewage Sludge/ Coal Fly Ash

Abstract: Even though both coal fly ash and sewage sludge are rich sources of bio-essential nutrients, one of the

major limiting factors in their use either individually or in mixture proportions as for amendment into agricultural soil is the presence of various metals likely to be potentially toxic at their elevated concentrations. This study evaluated the adsorption and distribution behaviours of selected metals in three different soils from India amended with mixtures of ash and sludge in various proportions at a maximum application rate of 52t ha⁻¹ and incubated up to 90 days at near field capacity moisture level. The properties of amended soils were affected significantly by sludge than the ash and the Freundlich distribution coefficients (K(D)s) of metals were marginally higher compared to their respective controls. The degree of impact of amendment on soil properties, distribution coefficients of metals and their adsorption affinity sequences, based on KDS, within and across soil types were determined. Sequential extraction indicated that, the concentrations of native metals in each soil type tends to be less in highly mobile and moderately mobile fractions than the resistant; and changed marginally following amendment while the distribution patterns remained more or less undisturbed. The sequential extraction of adsorbed metals at various equilibrating concentrations of their addition indicated shifts in the distribution patterns in each soil type. However, the changes in the partitioning of adsorbed metals were wide and clearly noticeable only at higher loadings and the metals showed propensity to accumulate preferentially in more mobile fractions, depending on the type of soil surface and substrate. The results indicated that at low rate of application, ash and sludge, though capable of changing the soil properties and its metal adsorption capacities to certain extent; they had no major influence on metal distribution patterns in the amended soils which mainly depended on the soil properties, type of metal and its concentration.

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304. Hydraulic conductivity and leachate characteristics of stabilized fly ash.

Ghosh, A. and Subbarao, C.

Journal of Environmental Engineering 124(9): 812-820. (Sept. 1998); ISSN: 0733-9372.

Notes: Language: English.

Descriptors: chemical treatment/ fly ash/ fly ash/ groundwater pollution/ hydraulics/ land disposal/ leachates/ leaching/ lime/ permeability coefficient/ recycling/ waste disposal/ waste treatment/ water pollution sources/ gypsum

Abstract: Disposal of fly ash on land amounts to sacrificing precious land space. Recycling of fly ash is one of the methods of solving the disposal problem. Stabilization of a low lime fly ash with lime and gypsum was studied through large scale tests on the stabilized material designed to simulate field recycling conditions as closely as possible, and found to be a very effective means to control hydraulic conductivity and leachate characteristics. The effects of moulding water content, lime content, gypsum content, curing period, and flow period on hydraulic conductivity, and on leachate of metals flowing out of the stabilized fly ash are reported herein. With proper proportioning of the mix, and adequate curing, the values of hydraulic conductivity on the order of 10 super(-7) cm/s were achieved. The concentrations of As, Cd, Cr, Cu, Fe, Hg, Mg, Ni, Pb, and Zn in the effluent emanating from the hydraulic conductivity specimens of mixes with higher

proportions of lime or lime and gypsum were below threshold limits acceptable for contaminants flowing into ground water.

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305. Hydraulic conductivity of the composite materials consisting of fly-ash and organic soils from Zuawy region.

Olchawa, A.

Wiadomosci Instytutu Melioracji i Uzytkow Zielonych 20(4): 175-187. (2000); ISSN: 0509-6677.

Notes: Original title: Przewodnosc hydrauliczna materiaow kompozytowych zozonych z popiou lotnego i gruntow organicznych z obszaru Zuaw. Language: Polish.

Descriptors: fly ash/ hydraulic conductivity/ organic soils/ permeability/ soil compaction/ soil organic matter/ soil types/ soil water content/ organic matter in soil

Abstract: A study was conducted to determine the permeability coefficient of composite material consisting of a fly ash and organic soils from Zulawy region, Poland. The organic matter content of the materials was less than or approximately equal to 2%. Required relative compaction of 0.92 and 0.95 was achieved by process of compaction and corresponding water content. The water content of compacted samples was less or greater than optimum moisture. The permeability coefficients increased with increased relative compaction ranging from 10-8 to 10-10 m/s.

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306. Impact of addition of coal ash from a power plant "Dolna Odra" on chemical properties of medium soil and yield of winter crops.

Stosio, M. and Tomaszewicz, T.

Inzynieria Rolnicza 5(l): 257-262. (1999)

NAL Call #: 381 J8223 S671 .A372.

Notes: Original title: Wplyw dodatku popioow z wegla kamiennego pochodzacych z elektrowni "Dolna Odra" na wasciwosci chemiczne gleby sredniej i plonowanie zboz ozimych.

Descriptors: application rates/ barley/ cations/ chemical properties/ coal/ fly ash/ lead/ magnesium/ properties/ responses/ rye/ saturation/ soil/ soil amendments/ soil chemical properties/ soil pH/ soil properties/ trace elements/ Triticale/ wheat/ winter/ yields/ chemical properties of soil/ microelements

Abstract: Tests carried out at Ostoja, Poland, in 1997 investigated the impact of 4 ash doses (0, 50, 100, 150 t/ha) on soil chemical properties and yields of 4 winter crop varieties (rye, wheat, triticale, barley). The maximum ash dose (150 t/ha) resulted in increases of magnesium and phosphorus content, not increasing the lead content soluble in 1N HCl. Other macro- and microelements tested did not show significance changes in their content. Increasing ash doses caused increases of soil reaction from slightly acid (0 t/ha) to neutral (50, 100 t/ha) and alkaline as well as growth in the saturation ratio of alkaline cations from 90.0% (0 t/ha) to 97.8% (150 t/ha). Crop varieties reacted differently to soil properties, changing as the result of ash doses. For rye and wheat the yield was similar irrespective of the ash dose. For

triticale distinct yield changes were also not found. Higher yields of ~10% were obtained after using a dose of 100 t/ha compared with 150 t/ha. Only barley showed a steady increase in the yield with an increase of ash dose from 0 to 150 t/ha.

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307. Impact of bulk utilization of fly ash/pond ash in irrigated vertisols on long term basis vis-a-vis on grain yield of cropping system and micronutrient content in grain.

Yeledhalli, N. A.; Prakash, S. S.; Ravi, M. V.; and Rao, K. N.

Asian Journal of Soil Science 3(1): 124-129. (2008); ISSN: 0973-4775

Descriptors: copper/ crop yield/ cropping systems/ electrical conductivity/ fly ash/ iron/ maize/ manganese/ nutrient content/ pH/ soil amendments/ soil fertility/ soil physical properties/ soil types/ sunflowers/ Vertisols/ water holding capacity/ zinc/ corn/ hydrogen ion concentration/ Mn/ Mysore/ physical properties of soil/ potential of hydrogen

Abstract: Analysis of fly ash and pond ash collected from Raichur Super Thermal Power Station, Shakhinagar, Karnataka, India, has revealed that both the ashes contained higher proportion of silt sized particles (40.1 to 50.2%). The maximum water holding capacity of ash ranged from 48.1 to 68.1, pH from 7.9 to 10.5 and electrical conductivity (EC) from 0.34 to 1.00 dS/m. Pond ash had higher WHC than fly ash. However, the pH and EC of pond ash were less as compared to fly ash. The available amount of DTPA extractable Fe, Mn, Cu and Zn varied from 8.7 to 12.5, 10.3 to 13.1, 0.3 to 0.6 and 1.0 to 1.5, respectively. Fly ash contained higher amount of available micronutrients than pond ash. The limitation of utilization of fly ash in agriculture was mainly due to presence of reserve alkalinity and high salt content, on the contrary fly ash can be used as an amendment to improve the soil physical conditions and also as a source of trace elements. Application of fly ash/pond ash at maximum rate significantly increased the concentration of micronutrients in sunflower and maize grains. Further, combined application with farmyard manure at 20 t/ha increased the micronutrient content due to increased solubility of metal ions by forming stable complexes with organic legends. The percent increase in the concentration of micronutrients in sunflower seeds over control due to application of fly ash at 40 t/ha varied from 0.7 to 20.8% in Zn, 1.4 to 14.2% in Mn, 0 to 4.3 in Cu and 0.7 to 63.9% in Fe. Similarly, in the succeeding maize grain, the same varied from 5.1 to 34.0% in Zn, 0 to 3.4% in Mn, 17.6 to 34.7% in Cu and 2.4 to 4.0% in Fe. Reproduced with permission from the CAB Abstracts database.

308. Impact of coal combustion product amendments on soil quality; 1, Mobilization of soil organic nitrogen; comment [modified].

Franklin, Ralph

Soil Science 164(9): 692. (Sept. 1999)

NAL Call #: 56.8 So3; ISSN: 0038-075X.

Notes: For reference to original see Stuczynski, T. I., McCarty, G. W., and Wright, R. J., *Soil Sci.*, Vol. 163, p. 952-959, 1998.

Descriptors: agriculture/ ash/ carbon/ coal/ combustion/ fertilization/ geochemistry/ liming/ nitrogen/ organic nitrogen/ pH/ reclamation/ sedimentary rocks/ soil quality/ environmental geology

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309. Impact of coal combustion product amendments on soil quality: I. Mobilization of soil organic nitrogen.

Stuczynski, T. I.; McCarty, G. W.; and Wright, R. J.

Soil Science 163(12): 952-959. (1998)

NAL Call #: 56.8 So3; ISSN: 0038-075X

Descriptors: acids/ agricultural soils/ amino acids/ ash/ chemical composition/ coal/ combustion/ fly ash/ liming/ losses/ measurement/ mobilization/ nitrogen/ nitrogen content/ organic matter/ organic nitrogen/ reclamation/ requirements/ soil/ soil amendments/ soil organic matter/ soil pH/ sugars/ metrology/ organic matter in soil

Abstract: The effects were studied of fly ash and bed ash applied at rates of 0, 20, 40, and 80 g kg⁻¹ soil on the content of organic N in soils incubated for 10, 25, or 60 days. Studies comparing the influence of these products on the organic N content of the soil showed that although applications of fly ash had little influence on the fate of this N, application of bed ash caused substantial decreases in the total N content of water-extracted soil through the mobilization of organic N. Measurements of the changes in acid hydrolysable N components of organic matter in soils treated with high rates of bed ash showed that within the first 10 days of incubation, losses of N in the forms of amino sugars, amino acids, and hydrolysable NH₄⁺ could largely account for losses of total N in bed ash-amended soils. Decreases in the amino acid content of soil organic matter accounted for most of these losses, and such decreases were directly related to increases in soil pH caused by the bed ash amendment.

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310. Impact of coal combustion product amendments on soil quality: II. Mobilization of soil organic carbon.

Stuczynski, T. I.; McCarty, G. W.; Wright, R. J.; and Reeves, J. B. III

Soil Science 163(12): 960-969. (1998)

NAL Call #: 56.8 So3; ISSN: 0038-075X

Descriptors: acids/ amino acids/ application rates/ ash/ carbohydrates/ carbon/ coal/ combustion/ degradation/ fly ash/ liming/ losses/ mobilization/ organic carbon/ organic matter/ requirements/ soil/ soil amendments/ soil fertility/ soil organic matter/ soil pH/ stabilizing/ treatment/ humic substances/ organic matter in soil/ saccharides

Abstract: The effects were studied of different amounts (0, 20, 40, and 80 g kg⁻¹ soil) of bed ash and fly ash on the mobilization of organic C in soil. Whereas fly ash mobilized little or no organic C when applied at rates as high as 80 g kg⁻¹ soil, bed ash caused substantial mobilization and loss of soil organic C when applied at or above the rate of 20 g kg⁻¹ soil. Chromatographic and spectroscopic methods were used to characterize the different forms of carbon mobilized in soil amended with combustion products. These studies showed that various forms of organic C were mobilized by bed ash treatments such as carbohydrates, phenolic substances, humic substances, and amino acids. The total amounts of soil organic C mobilized by bed ash treatments were related to increased soil pH and with the

losses of C associated with increases of soluble humic substances. The losses of organic C from soils treated with bed ash reached 15.5% of the total soil organic C. These studies also provided evidence for stabilization of some forms of soil organic C by Ca²⁺ from bed ash. Reproduced with permission from the CAB Abstracts database.

311. Impact of coal pile leachate and fly ash on soil and groundwater.

Ghuman, G. S.; Sajwan, Kenneth S.; and Denham, M. E. In: Fourth international conference on the Biogeochemistry of trace elements. Berkeley, CA, United States.) Sajwan, Kenneth S.; Alva, Ashok K.; and Keefer, Robert F. (eds.) New York, NY, United States (USA): Kluwer Academic/Plenum Publishers; 1999.

Notes: Features: References: 42; illus. incl. 5 tables.

Descriptors: acetates/ attenuation/ boron/ chemical composition/ chlorides/ coal/ coal mines/ concentration/ dissolved materials/ dissolved oxygen/ enrichment/ esters/ ground water/ halides/ leaching/ metals/ mines/ nitrates/ organic compounds/ oxygen/ pH/ phosphorus/ pollutants/ pollution/ remediation/ sampling/ sedimentary rocks/ soils/ storage/ sulfates/ waste disposal/ environmental geology

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312. Impact of different levels of fly ash on growth attributes and dry matter yield of various crops.

Malewar, G. U.; Adsul, P. B.; and Syed Ismail

Journal of Maharashtra Agricultural Universities 24(2): 220-221. (1999); ISSN: 0378-2395

Descriptors: fly ash/ soil amendments/ sunflowers/ wheat/ yields

Abstract: Wheat, sorghum and sunflowers were grown in pots in soil or 3:1, 1:1 or 1:3 fly ash:soil mixtures. Recommended NPK fertilizers were applied. Plant dry weight of wheat and sunflowers was highest in 1:3 fly ash:soil mixtures, while in sorghum the 3:1 fly ash:soil plants gave the greatest weight.

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313. Impact of fly ash amendment and incorporation method on hydraulic properties of a sandy soil.

Gangloff, W. J.; Ghodrati, M.; Sims, J. T.; and Vasilas, B. L. *Water, Air and Soil Pollution* 119(1/4): 231-245. (2000)

NAL Call #: TD172 .W36; ISSN: 0049-6979

Descriptors: available water/ crop production/ fly ash/ hydrological factors/ hydrology/ infiltration/ monitoring/ mouldboards/ plant water relations/ ploughs/ sandy soils/ soil amendments/ soil depth/ soil management/ soil physical properties/ soil types/ soil water/ soil water content/ tillage/ water distribution/ water holding capacity/ water relations/ moisture relations/ moldboards/ physical properties of soil/ plows/ soil cultivation/ soil moisture/ surveillance systems/ United States of America

Abstract: Coal fly ash has physical and chemical characteristics that make it useful as a soil amendment, one of the more important being the potential to permanently improve the soil water relations of sandy, drought-prone soils. Changes in the infiltration rate and water holding capacity of a sandy soil after application of high rates (up to 950 t/ha) of a Class F fly ash. Fly ash was applied to large field plots in the USA by either conventional

tillage (CT, mouldboard plough-disk) or intensive tillage (IT, chisel plough-rotovator-disk), and to microplots using a rototiller. Infiltration rate (i) was measured in both studies with a disk permeameter on three occasions over a 12-month period. Ash effects on gravimetric water content (θ_{g_0}) at the 0-40 cm soil depth were measured during a 168 h period following a 2.5 cm rainfall event and water release curves (33 to 500 kPa) were constructed in the laboratory using soils from the large plots. In both studies i was decreased by ~80% one year after addition of fly ash and θ_{g_0} in ash-amended soil was higher than unamended soil throughout the 168 h monitoring period. Soil water distribution varied with tillage, the IT treatment had the highest θ_{g_0} increases in the 0-20 cm depth while the CT treatment had θ_{g_0} increases throughout the 0-40 cm depth. Soil water content and distribution in ash-amended microplots were similar to IT treatments. Fly ash amendment not only increased water holding capacity but also increased plant available water by 7-13% in the 100-300 kPa range. These results suggest fly ash amendment may have the potential to improve crop production in excessively drained soils by decreasing i and increasing the amount of plant available water in the root zone. Reproduced with permission from the CAB Abstracts database.

314. Impact of fly ash and phosphate solubilising bacteria on soybean productivity.

Sunita Gaiand and Gaur, A. C.

Bioresource Technology 85(3): 313-315. (2002)

NAL Call #: TD930.A32 ; ISSN: 0960-8524

Descriptors: crop yield/ fly ash/ leaching/ nitrogen fertilizers / nutrient uptake/ phosphorus fertilizers/ soil amendments/ soybeans/ trace elements/ microelements/ phosphate fertilizers/ soybeans

Abstract: Fly ash was characterized for the leaching potential of some major and minor constituents and then added to soil at 20, 40, 60 and 80 tonnes/ha with N and P fertilizer to evaluate its effect on nutrient uptake and soybean yield singly as well as in combination with an efficient phosphate solubilizer *Pseudomonas striata*. The application of fly ash at 40 tonnes/ha in conjunction with *P. striata* inoculation improved the bean yield and P uptake by grain. The available phosphorus of soil also showed an upward trend. The fly ash did not exert any detrimental effect on the population of inoculated bacteria. However, the uptake of trace elements did not improve significantly. Reproduced with permission from the CAB Abstracts database.

315. Impact of fly ash application in soil on root colonization by a VAM fungus and root nodulation by Rhizobium.

Madhu Kulshreshtha and Khan, M. W.

Indian Phytopathology 52(2): 185-187. (1999)

NAL Call #: 464.8 IN2 ; ISSN: 0367-973X

Descriptors: air pollution/ fly ash/ mycorrhizal fungi/ mycorrhizas / nitrogen fixing bacteria/ nodulation/ plant pathology/ vesicular arbuscular mycorrhizas/ atmospheric pollution/ Glomaceae/ phytopathology/ root colonization

Abstract: The effect of fly ash from a thermal power plant on *Glomus caledonium* and *Rhizobium* sp. on the roots of *Vigna mungo* was investigated in Aligarh, Uttar Pradesh,

India. It was demonstrated that mycorrhizas and root nodulating bacterium protected the plants from some of the harmful effects caused by fly ash.

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316. Impact of fly ash application on consumptive and water use efficiency in wheat (*Triticum aestivum*) under different soils.

Singh, C. B.; Oswal, M. C.; and Grewal, K. S.

Indian Journal of Agricultural Sciences 72(7): 396-399.

(2002)

NAL Call #: 22 AG83I; ISSN: 0019-5022

Descriptors: application rates/ crop yield/ evapotranspiration/ fly ash/ loam soils/ plant water relations/ roots/ sandy loam soils/ sandy soils/ soil types/ soil water balance/ straw/ trace element fertilizers/ water uptake/ water use efficiency/ wheat/ wheat straw/ micronutrient fertilizers

Abstract: A lysimetric study was conducted during 1995-97 in Haryana, India to assess the effect of fly ash application on the performance of wheat on sandy, sandy loam, and loam soils. The treatments were 0.0, 2.5, 5.0, and 10.0% fly ash (w/w) mixed in the top 15-cm layer and 2.5-cm fly ash on the surface of each soil type. The highest grain and straw yields were obtained with the application of 2.5-cm fly ash, irrespective of the soil type. In addition, soil type significantly influenced the grain and straw yields, where the highest were obtained in loam soil. A maximum reduction in evaporation was observed under 2.5-cm fly ash layer (13.3%) treatment and in loam soils. Wheat, on an average, consumed 346-, 330-, and 316-mm water as evapotranspiration to complete its life cycle, respectively, in loam, sandy loam, and sandy soils. Fly ash at 2.5 cm gave the highest water use efficiency compared to the control. The mean water use efficiency improved by 9.9, 20.5, and 27.2 in loam; 7.0, 12.6, and 22.5 in sandy loam; and 7.7, 18.9, and 26.5 in sandy loam soil with incorporation of 2.5, 5.0, and 10.0% fly ash, respectively. Root density improved with an increase in the application rate of fly ash and was highest with 2.5 cm fly ash layer in all soil types. Reproduced with permission from the CAB Abstracts database.

317. Impact of fly ash from coal-fired power stations in Delhi, with particular reference to metal contamination.

Mehra, A.; Farago, M. E.; and Banerjee, D. K. 50(1): 15-35. (1998); ISSN: 01676369 [EMASD].

Notes: Chapter Number: Dordrecht, Netherlands. doi: 10.1023/A:1005860015123.

Descriptors: Brassica juncea/ Eichhornia crassipes/ Electrostatic precipitators (esp)/ Fly ash/ Indraprastha Power Station (IPP Stn)/ Rajghat Power House (RPH)/ River Yamuna/ Coal slurries/ Contamination/ Environmental impact/ Fossil fuel power plants/ Leachate treatment/ Toxicity/ Water pollution/ Ash disposal ponds/ Brassica juncea/ Eichhornia crassipes/ Fly ash leachates/ Fly ash/ coal/ metal/ coal/ developing country/ fly ash/ industrial emissions/ metal contaminants/ pollution/ pollution incidence/ power station/ air monitoring/ air pollution/ electric power plant/ fly ash/ India/ leaching/ nonhuman/ plant growth/ soil/ turbidity/ vegetation/ water pollution/ India, Delhi

Abstract: Indraprastha Power Station (IPP Stn) and Rajghat Power House (RPH), owned by Delhi Electric Supply Undertaking, are both coal-fired power stations located on Ring Road in New Delhi. Ash content of the coal used ranges between 38-47%. The ash is collected in electrostatic precipitators which have an efficiency of 99.3% (IPP station), and 99.7% (RPH). There are instances of major dust pollution around the power stations from fly ash dispersal. The main method of disposal of fly ash from the power stations is by mixing with water, the resultant slurry is pumped through pipes to ash disposal ponds. The supernatant from these ponds is discharged into River Yamuna. Field studies have revealed large quantities of fly ash being deposited into the river. Local populations of *Eichhornia crassipes* have reduced dramatically between 1987-1995, with a marked reduction in the year 1994-1995. Field studies, conducted in January, 1995 have investigated the impact of fly ash dispersal in the Delhi region with particular reference to metal contamination. Elemental concentrations for a range of elements are determined by ICP-AES in fly ash and top soils along four transects from the power stations up to a distance of 8 km. The effects of fly ash leachates from the ash settling ponds on the river are determined by analyzing river overbank soils and vegetation for their elemental contents. It is concluded that fly ash dispersal from the stacks are a source of alkali, alkaline-earth and to some extent heavy metals in soils in the vicinity of the power stations, and enrichment of elements in river overbank soils are a result of discharge of fly ash leachates from ash disposal ponds. However, the impact from both these sources of metal contamination is not large enough to give cause for concern. Marked reduction in populations of *Eichhornia crassipes* downstream of the river where it receives leachates from the ash disposal ponds are attributed to turbidity of the ash pond leachates and metal toxicity. Elemental enrichment in the floodplain soils, as a result of fly ash particle deposition during monsoons, may enhance the horticultural value of these soils as is shown by a healthy cultivated crop of *Brassica juncea*.
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318. Impact of fly ash from the "Dolna Odra" power plant on firmness and physico-chemical properties of light silty loam.

Mynkowiak, W.; Snieg, M.; Tomaszewicz, T.; and Dawidowski, J. B.

Inzynieria Rolnicza 5(2): 237-243. (2001)

NAL Call #: 381 J8223 S671 .A372; ISSN: 1429-7264.

Notes: Original title: Wplyw dawki popioow lotnych z elektrowni "Dolna Odra" na zwiezosc i fizykochemiczne wasciwosci gliny lekkiej pylastej.

Descriptors: barley/ calcium/ exchangeable calcium/ exchangeable magnesium/ firmness/ fly ash/ liming materials/ loam soils/ magnesium/ rye/ silty soils/ soil amendments/ soil chemical properties/ soil mechanics/ soil pH/ soil physical properties/ soil structure/ triticale/ wheat/ chemical properties of soil/ engineering properties of soil/ mechanical properties of soil/ physical properties of soil

Abstract: A study was conducted in a light silty loam soil in Poland to determine the effect on soil firmness and on changes in other soil physical properties of applying fly ash for the production of four winter cereals (wheat, triticale, barley and rye). It was found that introducing ash into the soil resulted in a decrease in firmness. The dose of 100

tonnes/ha appeared to be optimal for majority of experimental plots. An increase in soil reaction [pH] and exchangeable calcium and magnesium contents was observed that may be recognized as being a positive effect on the structure-forming capacity of the soil. Reproduced with permission from the CAB Abstracts database.

319. Impact of fly ash on hatching: Penetration and development of root-knot nematode.

Tarannum, A.; Khan, A. A.; Diva, I.; and Khan, B.

Nematologia Mediterranea (Italy) 29(2): 215-218. (2001)

NAL Call #: QL391.N4N42; ISSN: 0391-9749.

Notes: Original title: Meloidogyne javanica [Cicer arietinum L.]: Impatto della cenere di carbone su schiusa-penetrazione e sviluppo del nematode galligeno delle radici. 3 tables. Summary (En). Citation Notes: IT (Italy).

Descriptors: fly ash/ egg hatching/ root-knot nematode

Abstract: Fly ash extract significantly impaired the hatching of *Meloidogyne javanica* juveniles, the inhibition in hatching being proportional to the concentration of the extract. Soil application of fly ash in different doses (0.0%, 25%, 50% and 100%) inhibited root penetration by juveniles, with penetration being inversely related to fly ash ratios. Penetration was completely suppressed at 100% concentration. All the rates suppressed the development of juveniles in chickpea roots. At lower levels (25%, 50%) of mixtures, low numbers of J2 developed to the mature female stage.

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320. Impact of fly-ashes from the "Dolna Odra" power plant on firmness and physicochemical properties of light silty loam.

Mlynkowiak, W.; Snieg, M.; Tomaszewicz, T.; and Dawidowski, J. B.

Inzynieria Rolnicza (Poland) 2: 237-243. (2001)

NAL Call #: 381 J8223 S671 .A372; ISSN: 1429-7264.

Notes: Original title: Wplyw dawki popioow lotnych z elektrowni "Dolna Odra" na zwiezosc i fizykochemiczne wasciwosci gliny lekkiej pylastej. 3 fig., 2 tables; 11 ref. Summaries (En, Pl). Citation Notes: PL (Poland).

Descriptors: fly ash/ power plants/ soils/ silty loam

Abstract: Measurement results of firmness and changes in physicochemical properties of light silty loam supplied with the fly-ashes were presented. Investigations were carried out under four winter cereal crops: wheat, triticale, barley and rye. It was found that introduction of fly-ashes into soil decreased its firmness. The rate of 100 t/ha appeared to be optimal on majority of experimental plots. Moreover, increased soil pH and contents of exchangeable calcium and magnesium forms were observed what may be recognized as a factor positively affecting the structure forming capacity of soil.

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321. Impact of flyash, light and shade environments on growth and chemical response of *Albizia procera* and *Acacia nilotica*.

Sadhna Tripathi and Ashutosh Tripathi

Journal of Environmental Biology 19(1): 33-41. (1998)

NAL Call #: QH540.J65 ; ISSN: 0254-8704

Descriptors: chemical composition/ fly ash/ growth/ light/ multipurpose trees/ pot experimentation/ shade/ soil amendments/ solar radiation/ trees/ woody plants/ sunlight

Abstract: Albizia procera and Acacia nilotica seeds were sown in pots (5 per pot) containing field soil amended with 10, 20 and 30% fly ash. After establishment of the seedlings, the most healthy seedling in each pot was retained and either set in the shade or kept in the sun. The seedlings were watered regularly and the physical and chemical properties of the plants were measured after 6 months. Results indicated that lower concentrations of flyash favoured the growth of Albizia procera and Acacia nilotica, however, higher concentrations had adverse effects. On the basis of storage substances, ascorbic acid, proline, phenol and amino acids in both the species, it was concluded that Acacia nilotica can survive in shade as well as light. Albizia procera, however, exhibited higher values for storage substances only in light-exposed plants; plants in shade areas were under stress. Reproduced with permission from the CAB Abstracts database.

322. Impact of industrial particulate pollutants applied to soil on growth and yield of tomato.

Deepali Raghav and Khan, A. A.

Thai Journal of Agricultural Science 35(2): 187-194. (2002); ISSN: 0049-3589

Descriptors: bricks/ cement dust/ crop yield/ dust/ fly ash/ growth/ kilns/ pollutants/ polluted soils/ soil pollution/ tomatoes

Abstract: The study was conducted to observe the impact of industrial particulate pollutants (fly ash, cement dust, and brick kiln dust) applied to soil on plant growth and yield of tomato (cv. Pusa Ruby). It was observed that all the ratios of fly ash amended soil (5, 10, 15, 20, and 25%) increased the plant growth and yield compared to the control except 50% fly ash, where plant growth and yield were reduced. Growth and yield were maximum at 20% levels. In the cement dust experiments, it was seen that growth and yield of tomato were inversely proportional to the levels of cement dust. Brick kiln dust showed an increment in growth and yield of plants at lower levels and the maximum was observed in 15% concentration. Among three particulates, fly ash and brick kiln dust were found beneficial for plant growth and yield at lower levels. The ideal levels were 15 and 20% for brick kiln and fly ash respectively. However, cement dust was very harmful to plant at all the levels. Reproduced with permission from the CAB Abstracts database.

323. Impact of inorganic fertilizers and organic manures on soil properties and crop yields under soybean-wheat system.

Ravankar, H. N.; Patil, R. T.; and Sarap, P. A.

Research on Crops 4(3): 301-304. (2003); ISSN: 0972-3226

Descriptors: crop yield/ farmyard manure/ fly ash/ gypsum/ lopping/ manures/ NPK fertilizers/ soil fertility/ soil ph/ soil properties/ soyabeans/ straw/ urea fertilizers/ wheat/ wheat straw/ zinc sulfate/ FYM/ soybeans/ zinc sulphate

Abstract: A field study was conducted in Akola, Maharashtra, India, to evaluate the influence of different fertility management practices involving organic and inorganic fertilizers on trends in productivity and fertility status under soyabeans-wheat cropping sequence. The 12 treatment combinations include: T1 - control (no manure or

fertilizer); T2 - recommended dose of NPK (S free), urea, DAP and MOP; T3 - recommended dose of NPK+S (Gypsum) + zinc sulfate; T4 - recommended dose of NPK+zinc sulfate; T5 - recommended dose of NPK+S (Gypsum); T6 - recommended dose of NPK+S+zinc sulfate (50% N through fertilizer and 50% N through Leucaena loppings); T7 - recommended dose of NPK+S+zinc sulfate (50% N through fertilizer and 50% through FYM); T8 - recommended dose of NPK+S+zinc sulfate (N is to be added through wheat straw produced in the plot+rest of N through fertilizer); T9 - recommended dose of NPK+S+zinc sulfate (50% N through Leucaena loppings + 25% N through wheat straw); T10 - 150% recommended dose of NPK+S (Gypsum) + zinc sulfate; T11 - recommended dose of NPK through urea, SSP and MOP; and T12 - recommended dose of NPK (S free)+fly ash 10 tonnes/ha. Application of fertilizers in inorganic, organic forms and their combinations significantly increased the grain yield of both soyabean and wheat over control. Highest yield was recorded with the application of 150% recommended dose of NPK in combination with S and Zn. Continuous application of FYM for four years reduced the soil pH from initial level of 8.2 in 1997 to 7.9 in 2000-01. The contents of organic carbon, available N, P and K were favourably influenced by increasing rate of fertilizer application. Reproduced with permission from the CAB Abstracts database.

324. Impact of lignite fly ash on the performance of groundnut and residual soil fertility in loamy sand soil (Typic udipsamments).

Poonkodi, P. 22(1): 15-17. (2003); ISSN: 02578050

[PORSD]

Descriptors: Groundnut/ Lignite fly ash/ Soil fertility/ crop yield/ fly ash/ soil amendment/ soil fertility/ Arachis hypogaea/ Fraxinus

Abstract: The present investigation deals with the impact of lignite fly ash on the yield performance of groundnut cv VRI 2 and the residual soil fertility status. The results revealed that the application of lignite fly ash significantly increased the pod and haulm yield of groundnut. The physico-chemical analysis of soil after harvest reveals that the application of lignite fly ash increased the pH and EC of soil. It also improved the available N, P, K, Ca, Mg and S status of the soil. The optimum dose of lignite fly ash was found to be 4t ha⁻¹.

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325. Impact of soil application of fly ash on growth and yield of wheat.

Yavarzadeh, M. R.; Gavali, R. S.; and Dhumal, K. N.

Journal of Maharashtra Agricultural Universities 33(2): 158-160. (2008); ISSN: 0378-2395

Descriptors: crop yield/ flag leaf/ fly ash/ leaf area/ nitrogen/ phosphorus/ photosynthesis/ plant height/ potassium/ soil fertility/ spikes/ tillers/ trace elements/ wheat/ yield components/ carbon assimilation/ carbon dioxide fixation/ microelements

Abstract: In experiments conducted during rabi 2006, in Maharashtra, India, FA3 (fly ash at 40 t ha⁻¹) was better than other treatments for height of plant, photosynthetic rate, flag leaf area, weight of 1000 grains, and grain yield. The grain yield was higher by 28% over control. Similarly,

the treatment FA4 (20 t ha⁻¹ FA) was the best for number of tillers plant⁻¹, number of grains spike⁻¹ and length of spike over control and other treatments. Fly ash also maintained available N, P, K, and micronutrients in soil. Reproduced with permission from the CAB Abstracts database.

326. Impacts of fly-ash on soil and plant responses.

Gupta, D. K.; Rai, U. N.; Tripathi, R. D.; and Inouhe, M. *Journal of Plant Research* 115(6): 401-409. (2002); ISSN: 0918-9440

Descriptors: bioremediation/ fly ash/ leaves/ metal tolerance/ nitrogen fixation/ nutrient availability/ photosynthesis/ pollution/ soil amendments/ soil chemical properties/ soil fertility/ soil physical properties/ transpiration/ carbon assimilation/ carbon dioxide fixation/ chemical properties of soil/ environmental pollution/ physical properties of soil

Abstract: Coal combustion produces carbon dioxides, SO_x, NO_x and a variety of byproducts, including fly-ash, flue gas and scrubber sludge. Fly-ash consists of minute glass-like particles and its deposition on leaves inhibits the normal transpiration and photosynthesis of plants. Fly-ash also affects the physicochemical characteristics of soil because it is generally very basic, rich in various essential and non-essential elements, but poor in both nitrogen and available phosphorus. The massive fly-ash materials have been a potential resource for the agricultural activities as well as the other industrial purposes. Practical value of fly-ash in agriculture as an 'effective and safe' fertiliser or soil amendment can be established after repeated field experiments. Here remains to be disclosed the biological processes and interactions due to 'lack and excess' of the fly-ash exposures along with abiotic and biotic factors. These may involve the symbiotic fixation of nitrogen and the biological extraction of metals following immobilisation of toxic heavy metal ions, as well as other neutralization and equilibration processes during weathering. Nitrogen-fixing plants with an apparent heavy metal-tolerance can be helpful as the early colonisers of fly-ash dumps and nearby areas.

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327. Implications of fly ash application to soil for plant growth and feed quality.

Hammermeister, A. M.; Naeth, M. A.; and Chanasyk, D. S. *Environmental Technology* 19(2): 143-152. (1998) NAL Call #: TD1.E59; ISSN: 0959-3330

Descriptors: application to land/ barley/ boron/ calcium/ chromium/ crop yield/ fly ash/ growth/ lucerne/ molybdenum/ phosphorus/ potassium/ quality/ selenium/ sodium/ soil/ strontium/ trace elements/ alfalfa/ land application/ microelements/ Mo

Abstract: Fly ash was applied to reclaimed mine soil near Edmonton, Alberta, Canada, at rates of 0, 25, 50, 100, 200, and 400 t/ha. Total and water soluble concentrations of selected elements were determined from soil samples collected at 0 to 15 cm. Growth, development, and elemental uptake of barley (*Hordeum vulgare*), brome (*Bromus inermis*), and lucerne (*Medicago sativa*) were measured at select stages of development. Water soluble concentrations of B, Mo, Ca, Cr, K, Mg, Na, P, Se, and Sr variably increased with increasing fly ash rate. Boron concentration in plant tissue increased significantly to toxic

levels with symptoms evident at early stages of barley development and increasingly severe at later stages. Toxicity symptoms were less severe for brome and lucerne. The Cu:Mo ratio of vegetation decreased with increased fly ash rate to levels which could cause Cu deficiency in livestock. Yield of barley silage was significantly increased at intermediate rates of fly ash application, but significantly reduced at 400 t/ha.

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328. Improvement of calcareous expansive soils in semi-arid environments.

Nalbantoglu, Z. and Gucbilmez, E.

Journal of Arid Environments 47(4): 453-463. (2001); ISSN: 0140-1963

Descriptors: calcareous soils/ cation exchange capacity/ clay fraction/ fly ash/ hydraulic conductivity/ land improvement/ lime/ mineralogy/ plasticity index/ semiarid zones/ soil conditioners/ soil types/ stabilizing/ swelling

Abstract: The effect was studied of fly ash treatment on volume change, hydraulic conductivity and mineralogy of expansive calcareous soil in Cyprus, using CEC (cation exchange capacity) values to substantiate the formation of new mineral phases, which are produced as a result of pozzolanic reaction. Soil-fly ash mixtures were prepared with 15 and 25% fly ash by dry weight of the soil and one mixture with 15% fly ash plus an additional 3% lime. Results showed that the plasticity index of the treated soils decreased as clay size content decreased with the increase in fly ash content. The lowest plasticity index and clay size fraction were obtained at 3% lime plus 15% fly ash treatment. The specimen treated with 3% lime plus 15% fly ash gave an initial swell potential of 0.9% and with a curing time of 30 days, this value dropped to zero. Results also indicated an increase in the hydraulic conductivity values with the increase in fly ash content and lime-fly ash treatment. The greatest increase in hydraulic conductivity was obtained for the soil treated with 3% lime plus 15% fly ash. The fly ash and lime-fly ash treated soils gave decreasing CEC values which indicated a change in the mineralogy of the treated soils.

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329. Improving rice productivity and soil quality by coal ash-phosphogypsum mixture application.

Lee, Y. B.; Ha, H. S.; Lee, C. H.; Lee, H.; Ha, B. H.; and Kim, P. J.

Korean Journal of Soil Science and Fertilizer 38(1): 45-51. (Feb. 2005); ISSN: 0367-6315.

Notes: Summary(En). Citation notes: KR (Korea-Republic-of).

Descriptors: rice/ productivity/ soil quality/ coal ash/ phosphogypsum

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330. Increase of Available Phosphorus by Fly Ash Application in Paddy Soils.

Lee, C. H.; Lee, H.; Lee, Y. B.; Chang, H. H.; Ali, M. A.; Min, W.; Kim, S.; and Kim, P. J.

Communications in Soil Science and Plant Analysis 38(11-12): 1551-1562. (2007)

NAL Call #: S590.C63; ISSN: 0010-3624

Descriptors: Oryza sativa/ rice/ paddy soils/ fly ash/ soil amendments/ phosphorus/ nutrient availability/ soil fertility/ grain yield/ application rate/ silicon/ pH/ phosphates/ silicates/ soil pH/ acid soils/ buffering capacity/ flooded conditions/ Korea Republic/ ion interactions

Abstract: Fly ash from the coal-burning industry may be a potential inorganic soil amendment to increase rice productivity and to restore the soil nutrient balance in paddy soil. In this study, fly ash was applied at rates of 0, 40, 80, and 120 Mg ha⁻¹ in two paddy soils (silt loam in Yehari and loamy sand in Daegok). During rice cultivation, available phosphorus (P) increased significantly with fly ash application, as there was high content of P (786 mg kg⁻¹) in the applied fly ash. In addition, high content of silicon (Si) and high pH of fly ash contributed to increased available-P content by ion competition between phosphate and silicate and by neutralization of soil acidity, respectively. With fly-ash application, water-soluble P (W-P) content increased significantly together with increasing aluminum-bound P (Al-P) and calcium-bound P (Ca-P) fractions. By contrast, iron-bound P (Fe-P) decreased significantly because of reduction of iron under the flooded paddy soil during rice cultivation. The present experiment indicated that addition of fly ash had a positive benefit on increasing the P availability.

This citation is from AGRICOLA.

331. Increasing bioavailability of phosphorus from fly ash through vermicomposting.

Bhattacharya, S. S. and Chattopadhyay, G. N.
Journal of Environmental Quality 31(6): 2116-2119. (2002)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: bioavailability/ cattle dung/ fly ash/ nutrient availability/ organic matter/ phosphate solubilizing bacteria/ phosphorus/ soil amendments/ soil fertility/ soil invertebrates/ vermicomposting/ waste management / waste utilization/ vermicomposts

Abstract: Due to the environmental problems created by large-scale fly ash generation throughout the world, efforts are being made to recycle these materials. An important component of the recycling effort is using fly ash to improve low-fertility soils. Because availability of many nutrients is very low in fly ash, available ranges of such nutrients must be improved to increase the effectiveness of fly ash as a soil amendment. In the present study, we assessed the possibility of increasing P bioavailability in fly ash through vermicomposting in a yard experiment in West Bengal, India. Fly ash was mixed with organic matter in the form of cow (*Bos taurus*) dung at 1:3, 1:1, and 3:1 ratios and incubated with and without epigeic earthworm (*Eisenia fetida*) for 50 days. The concentration of phosphate-solubilizing bacteria was found to increase many fold in the earthworm-treated series of fly ash and organic matter combinations compared with the series without earthworm. This helped to transform considerable amounts of insoluble P from fly ash into more soluble forms and thus resulted in increased bioavailability of the nutrients in the vermicomposted series. Among different combinations of fly ash and organic matter, P availability in fly ash due to vermicomposting was significantly higher in the 1:1 fly ash to cow dung treatment compared with the other treatments. Reproduced with permission from the CAB Abstracts database.

332. Induction of resistance with organic nutrients in rice for the management of brown plant hopper.

Rani, B. U.; Rajendran, R.; and Suresh, K.
Annals of Plant Protection Sciences 14(2): 374-378. (2006)
NAL Call #: SB950.A1A46; ISSN: 0971-3573

Descriptors: behaviour/ biological development/ eclosion/ farmyard manure/ feeding behaviour/ fly ash/ genotypes/ growth/ induced resistance/ insect pests/ lignite/ longevity/ neem seed cake/ pest resistance/ phosphate solubilizing bacteria/ plant pests/ rice/ behavior/ biofertilizers/ brown planthopper/ feeding behavior/ FYM/ Madras/ neem seed oilmeal/ paddy/ rice brown planthopper

Abstract: In field trials conducted during November 2004-February 2005, in Madurai, Tamil Nadu, India, rice genotypes IR 36, IR 64, TKM 6, MDU 3 and ADT 36 were used as resistance sources, while farmyard manure (FYM), biofertilizers (Azospirillum + phosphobacterium + silicate solubilizing bacteria (SSB)), neem cake and lignite fly ash were used as organic nutrient sources. In addition, a laboratory study was conducted to study the mechanism of resistance in terms of population build up, growth and development, and feeding activity of the brown plant hopper (*Nilaparvata lugens*). Results of the field trial indicated that the hopper population was consistently reduced due to combined effect of IR 64 and FYM, Azospirillum, phosphobacterium, SSB, lignite fly ash and neem cake. Significantly prolonged nymphal duration, lower nymphal survival, lower growth index, lower adult emergence and longevity of hoppers were noticed in the treatment with the cultivars IR 64 and IR 36 treated with FYM, Azospirillum, phosphobacterium, SSB, lignite fly ash and neem cake than in the susceptible control T(N)I. The area of honeydew spot and correspondingly the weight of honeydew were significantly less in the cultivars IR 36 and IR 64 treated with organic nutrients. In addition, number of feeding probes were higher in the above said promising treatments. Reproduced with permission from the CAB Abstracts database.

333. Industrial ecology approach to management of fly ash from fluidized bed combustion; production of slow-release fertilizer and soil conditioner.

Castaneda Munoz, Mario
Puerto Rico: University of Puerto Rico, Mayaguez, Puerto Rico, 2006.

Descriptors: agriculture/ Antilles/ applications/ ash/ Caribbean region/ coal/ combustion/ computer programs/ concentration/ deposition/ environmental analysis/ environmental effects/ fertilizers/ Greater Antilles/ HYDRUS-1D/ pollutants/ pollution/ power plants/ Puerto Rico/ sedimentary rocks/ simulation/ soils/ technology/ temperature/ trace elements/ transport/ tropical environment/ United States/ West Indies/ environmental geology

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334. Infectivity and efficacy of *Glomus aggregatum* and growth response of *Cajanus cajan* (L.) Millsp. in flyash amended sterile soil.

Garampalli, R. H.; Sunanda Deene; and Reddy, C. N.
Journal of Environmental Biology 26(4): 705-708. (2005)
NAL Call #: QH540.J65 ; ISSN: 0254-8704

Descriptors: application rates/ endomycorrhizas/ fly ash/ growth/ mycorrhizal fungi/ mycorrhizas/ pigeon peas/ pot culture/ soil amendments/ use efficiency/ vesicular arbuscular mycorrhizas/ arbuscular mycorrhizas/ Glomaceae

Abstract: A pot culture experiment was conducted using sterile, phosphorus deficient soil to study the effect of fly ash at 3 different concentrations (10, 20 and 30 g fly ash/kg soil) on the infectivity and effectiveness of vesicular arbuscular mycorrhiza (VAM) fungus *Glomus aggregatum* in pigeon pea (*Cajanus cajan* cv. Maruti). Fly ash, applied in all 3 different concentrations, was found to significantly affect the intensity of VAM fungal colonization inside the plant roots and also suppressed the formation of VAM fungal structure (vesicles and arbuscules) completely at higher concentration (30 g fly ash/kg soil). The response of the pigeon pea plants, in terms of dry weight, under the influence of fly ash amendment in VAM fungus infested soils was found to be considerably less (though not significant enough) when compared to the control plants (without fly ash) that have otherwise shown significant increase in growth over the plants without *G. aggregatum* inoculation. However, fly ash amendment without VAM inoculation was also found to enhance the growth of plants as compared to control plants (without fly ash and VAM inoculum).

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335. Influence of certain industrial effluents on growth and metabolism of *Abelmoschus esculentus* (L.) Moench seedlings.

Kumari, J. U.; Ramana, V. V.; and Reddy, K. J. Warangal, India.; pp. 181-186; 2001.

Descriptors: amylases / catalase/ catechol oxidase/ coal mine spoil/ effluents/ enzyme activity/ enzymes/ fly ash/ hypocotyls/ okras/ peroxidase/ seed germination/ seedling growth/ water pollution/ colliery spoil/ erythrocyte catalase

Abstract: The effects of different treatments (coal mine effluent from Manuguru, paper board effluent from ITC, Bhadrachalam, and Kinnerasani water with fly ash deposited from KTPS, all in Andhra Pradesh, India) at different concentrations (25, 50, 75 and 100%) on the germination and activity of certain enzymes were studied in okra (*A. esculentus*). The activity of amylase, catalase and polyphenol oxidase [catechol oxidase] increased, while that of peroxidase decreased at 50% level under mine water treatment which correlated with higher germination percentage, fresh weight and dry weight. No significant change occurred with reference to protein. With ITC effluent, no significant change occurred with any of the parameters studied. On the other hand hypocotyl length, fresh weight and dry weight increased at 100% level. Kinnerasani water flooded with fly-ash deposition from KTPS had decreased hypocotyl length, fresh weight and dry weight. Activity of amylase, catalase and peroxidase decreased while the activity of polyphenol oxidase increased with effluent treatment.

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336. Influence of coal ash on microorganisms and applicability of coal ash to remediate desertified soil in the case of desertified land in Inner Mongolia of China.

Mitsuno, M.; Tazaki, K.; Fyfe, W. S.; Powell, M. A.; Hart, B.; Sun Daishng; and Li ShengRong

Clay Science 11(5): 503-515. (2001); ISSN: 0009-8574

Descriptors: afforestation/ ash/ chemical composition/ coal/ desertification/ porosity/ reclamation/ reservoir soils/ sediment/ soil bacteria/ soil degradation/ Inner Mongolia/ Nei Menggu/ reafforestation/ reforestation/ soil quality

Abstract: Natural cultivation experiments using coal ash, reservoir sediments and Yellow River sediments were carried out to determine the applicability of using these wastes to remediate desertified soil in Inner Mongolia, China. In the experiments, the microorganisms multiplied more when coal ash was applied to the desertified soil. Under optical microscope, abundant bacteria were observed in porous surfaces and inside of coal ash particles thereby indicating that the addition of coal ash to desertified soil hastens the breeding of bacteria, improves soil quality and could be used in afforestation practices. The effects of ash on soil can be explained in two ways: first, in terms of its chemical characteristics (the coal ash contains C, N, P and K); and second, in terms of its micromorphology (it is porous). In natural cultivation experiments, the mixing of reservoir sediments and/or Yellow River sediments with the coal ash helped multiply bacteria. These experiments suggest that coal ash and reservoir sediments can be utilized to help solve some of the most serious environmental issues facing China today. Reproduced with permission from the CAB Abstracts database.

337. Influence of coal combustion gases on metal mobility and plant uptake, Centralia, PA.

Hammit, Sarah Ann

Princeton, NJ, United States: Princeton University, 2004.

Notes: References: 37; illus.

Descriptors: aquifers / atmosphere/ carbon dioxide/ sequestration/ coal mines/ Columbia County Pennsylvania/ fires / gases/ ground water/ metals/ mines/ mobility/ Pennsylvania/ pH/ pollutants/ pollution/ reservoir rocks/ soils/ United States/ weathering/ environmental geology
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338. Influence of cover crops and soil amendments on okra (*Abelmoschus esculentus* L.) production and soil nematodes.

Wang, Q.; Li, Y.; Klassen, W.; and Handoo, Z. 22(1): 41-53. (2007); ISSN: 17421705

Notes: doi: 10.1017/S1742170507001585.

Descriptors: amendments/ biosolids/ coal ash/ composts/ cover crop/ nematode/ okra/ biosolid/ compost/ cover crop/ crop production/ crop yield/ nematode/ population density/ soil amendment/ taxonomy/ *Abelmoschus*/ *Abelmoschus esculentus*/ *Cannabis*/ *Crotalaria*/ *Crotalaria juncea*/ *Meloidogyne*/ *Meloidogyne incognita*/ *Meloidogyne javanica*/ *Nematoda*/ *Sorghum x drummondii*

Abstract: A pot experiment to determine the effects of

summer cover crops and soil amendments on okra yields and population densities of various soil nematode taxa was conducted in two consecutive growing seasons in a subtropical region. Two cover crops, sunn hemp (*Crotalaria juncea*) and sorghum sudangrass (*Sorghum bicolor* var. *sudanense*), were grown and returned to the soil with fallow as a control. As soon as these cover crops were harvested, they were soil incorporated together with one of several organic amendments. These organic amendments were biosolids, N-Viro soil (a 1 : 1 mixture of coal ash and biosolids), coal ash, co-compost (a 3 : 7 mixture of biosolids and yard wastes), and yard waste compost compared with a control (no additional amendment). Other treatments were fumigation with MC-33 (a mixture of 33% of methyl bromide and 67% of chloropicrin) and cover crop removal (harvested and removed cover crops and their residues from the soil). A nematode-susceptible vegetable crop, okra (*Abelmoschus esculentus* L.), was grown under these treatments. Among organic amendments, the application of biosolids produced the highest okra yield and biomass, and greatly suppressed root-knot nematodes, *Meloidogyne incognita*, in the soil. Between these two cover crops, sunn hemp was superior to sorghum sudangrass in improving okra production and in suppressing root-knot nematodes. The result indicates that growing sunn hemp as a cover crop and applying certain organic amendments can improve okra production and suppress root-knot nematodes, which are very damaging to okra plants. Such combined practices show a significant potential for application in organic farming and sustainable agriculture systems in a tropical or subtropical region. — 2007 Cambridge University Press.
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339. Influence of crop residue, flyash and varying starter dosages on growth, yield and soil characteristics in rice (*Oryza sativa*)-wheat (*Triticum aestivum*) cropping system under irrigated conditions of Jammu region.

Dileep Kachroo; Dixit, A. K.; and Bali, A. S.
Indian Journal of Agricultural Sciences 76(1): 3-6. (2006)
NAL Call #: 22 AG83I; ISSN: 0019-5022
Descriptors: application rates/ crop residues/ crop yield/ farmyard manure/ fly ash/ growth/ intercropping/ mineral uptake/ nitrogen/ nutrient uptake/ phosphorus/ plant nutrition/ potassium/ rice/ soil chemical properties/ soil fertility/ soil flora/ soil physical properties/ wheat/ yield components/ chemical properties of soil/ FYM/ Hyphomycetes/ Kashmir/ paddy/ physical properties of soil
Abstract: A field experiment was conducted during rainy (kharif) 2001-winter season (rabi) 2002 at research farm of the University at Jammu to evaluate the influence of residue incorporation on the productivity and soil health in rice (*Oryza sativa* L.)-wheat (*Triticum aestivum* L. emend Fiori & Paol.) cropping system under irrigated conditions. Incorporation of rice residues in wheat and wheat residues in rice not only increased the productivity of system (16.2%) and yield components of rice and wheat but also increased the nutrient uptake (18.5 kg nitrogen, 3.6 kg phosphorus and 19.6 kg potassium/ha) compared to without residue incorporation besides improved the physico-chemical and microbiological properties of the soil. Alternatively the incorporation of flyash and left over stubbles of previous crops as residues were equally found effective in increasing the productivity by 13.5 and 8.1%, respectively and soil

environment in rice-wheat cropping system over without residue incorporation. Application of *Trichoderma viride*+20 kg N/ha or farmyard manure (5 tonnes/ha) as starter dose for quick and better decomposition showed to influence the yield, nutrient uptake, available nutrients status, microbial population and physical properties of the soil significantly than no starter dose application.
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340. Influence of different nitrogenous sources on the growth of *Albizia procera* on fly ash.

Ashish Mishra and Yogeshwar Mishra
Environment and Ecology 17(4): 886-890. (1999)
NAL Call #: TD172.E5; ISSN: 0970-0420
Descriptors: ammonium sulfate/ biomass production/ diameter/ dry matter accumulation/ fly ash/ growth/ height/ nitrogen fertilizers/ seedlings/ trees/ urea/ woody plants/ ammonium sulphate
Abstract: In a study to examine the effects of nitrogen as ammonium sulfate, ammonium chloride and urea on the growth and development of *Albizia procera* seedlings in fly ash, observations were recorded on the influence of different nitrogen sources on extension of growth, diameter, fresh and dry matter accumulation in seedlings of *Albizia procera*. Urea nitrogen was found to result in better growth than other nitrogen sources applied in nutrient solution.
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341. The influence of fertilization with composted mixtures of waste activated sludges with CaO and brown coal ash on the yield of tested plants and effectiveness of nitrogen .

Kalembasa, S. and Wysokinski, A.
Annales Universitatis Mariae Curie Skłodowska Sectio E, Agricultura 59(4): 1899-1904. (2004)
NAL Call #: 512 L96AE; ISSN: 0365-1118.
Notes: Original title: Wpływ nawożenia kompostowaną mieszaniną osadów ściekowych z CaO lub z popiołem z węgla brunatnego na plon roślin i efektywność azotu.
Descriptors: activated sludge/ brown coal/ composts/ crop yield/ dry matter/ fertilizers/ maize/ nitrogen fertilizers/ pot experimentation/ sunflowers / waste utilization/ corn
Abstract: The influence of fertilizer application with composted mixtures of waste activated sludge with CaO or ash from brown coal on yield and effectiveness of 1 g of nitrogen was studied. The yield of the tested plants (ryegrass, maize and sunflower) and the effectiveness of 1 g of nitrogen were higher on objects applied with the mixture of waste activated sludge with brown coal ash than with CaO. The composted mixtures were applied in August and therefore the effectiveness of fertilizer application was higher in the 2nd than 1st year of pot experiment.
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342. The influence of fertilization with composted waste activated sludges with addition of CaO or brown coal ash on the chemical composition of tested plants.

Kalembasa, S. and Wysokinski, A.
Annales Universitatis Mariae Curie Skłodowska Sectio E, Agricultura 59(4): 1891-1897. (2004)
NAL Call #: 512 L96AE; ISSN: 0365-1118.

Notes: Original title: Wpyw nawozenia kompostowanymi osadami sciekowymi z dodatkiem CaO lub popiou z wegla brunatnego na skad chemiczny roslin.

Descriptors: activated sludge/ brown coal/ calcium/ calcium fertilizers/ chemical composition/ composts/ fertilizers/ magnesium/ maize/ nutrient content/ potassium/ sodium/ sunflowers/ waste utilization/ corn

Abstract: The influence of fertilizer application with composted mixtures of waste activated sludges with CaO or ash from brown coal on the content of calcium, magnesium, potassium and sodium in the tested plants (ryegrass, maize and sunflower) was studied. The tested plants harvested from objects applied with CaO contained a higher amount of calcium and lower of magnesium than plants applied only with waste activated sludge or with the mixture of waste activated sludge with addition of brown coal ash. The content of potassium and sodium in the tested plants was not directly dependent on the kind of materials added to waste activated sludge.

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343. Influence of fly ash and FYM on the productivity of rice.

Mulla, S. R.; Prakash, S. S.; and Badnur, V. P.
Karnataka Journal of Agricultural Sciences 13(4): 991-992. (2000)

NAL Call #: S471.I42K37; ISSN: 0972-1061

Descriptors: application rates/ crop yield/ farmyard manure/ fly ash/ nutrient availability/ nutrient uptake/ organic amendments/ rice/ soil properties/ FYM/ Mysore/ paddy

Abstract: Rice was treated with various combination levels of fly ash (0, 10, 20, 30 and 40 t/ha) and farmyard manure (FYM; 0 and 10 t/ha) in a field experiment conducted in Raichur, Karnataka, India during the kharif season of 1997. The highest grain and straw yields resulted from the treatment 40 t fly ash/ha+10 t FYM/ha. Application of increasing rates of fly ash improved soil properties and nutrient availability, as well as the nutrient uptake of the rice.

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344. Influence of fly ash and other amendments on leaching of soil nutrients and metals from a calcareous soil.

Wang, Qingren; Li, Yuncong; and Klassen, Waldemar.
In: Coal Combustion Byproducts and Environmental Issues. Uppsala, Sweden.)
233 Spring Street, New York, NY 10013: Springer; pp. 171-176; 2006.

Notes: 7th International Conference on Biogeochemistry of Trace Elements.; ISBN: 0387258655

Descriptors: pollution assessment control and management/ soil science/ leaching/ fly ash/ calcareous soil/ soil nutrient

Abstract: The influences on the leaching of soil nutrients and heavy metals by separate application to a calcareous soil of fly ash, biosolids, N-viro soil, co-compost, and yard waste compost in comparison to a control without an amendment were determined in a pot experiment. The results showed that the concentration of NO₃-N in leachate

from biosolids was significantly higher than in leachate from other treatments. The levels of heavy metals found in the leachates from all amended soils were so low as to suggest these amendments may be used without risk of leaching significant amounts of these elements. Nevertheless the level of heavy metals in leachate from fly ash amended soil was substantially greater than in leachates from the other treatments. The results suggest that at heavy loading rates of biosolids, leaching of NO₃⁻ can be an important concern. Leaching of inorganic P can be increased significantly by application of both co-compost and biosolids, but significantly decreased by applying fly ash and N-viro soil. Biosolids, N-viro soil and fly ash applications significantly increased Ca and Mg concentrations in leachates. Copper concentration in leachate was increased by application of biosolids, while Fe concentration in leachates was increased by biosolids, fly ash and co-compost applications. The concentrations of Zn, Mo and Co in leachates were increased by application of fly ash. The concentrations of heavy metals in leachates were very low and unlikely to be harmful, although they were increased significantly by fly ash application.

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345. Influence of fly ash mixtures on early tree growth and physicochemical properties of soil in semi-arid tropical Alfisols.

Ramesh, V.; Korwar, G. R.; Mandal, Uttam Kumar; Prasad, Jasti V. N. S.; Sharma, Kishori Lal; Yezzu, S. Ramakrishna; and Kandula, Venkanna
Agroforestry Systems 73(1): 13-22. (May 2008); ISSN: 0167-4366

Descriptors: fly ash/ tree growth/ physicochemical properties/ soil / semi-arid/ Alfisols

Abstract: The beneficial effects of planting mixtures comprising of fly ash at the rate of 66%, 33% and 17% by soil volume were assessed for the early growth of two economic tree species, teak (*Tectona grandis*) and leucaena (*Leucaena leucocephala*) in rainfed Semi-Arid Tropical (SAT) Alfisols in India. Measurements of tree growth were made at six monthly intervals over a 3-year period. Fly ash at 66% by soil volume of the planting pit significantly increased the diameter of teak at breast height (dbh). In leucaena, application of fly ash at 17% by soil volume was found to be effective in increasing dbh during most of the study period. Changes in soil physicochemical properties (bulk density, water retention at 0.033 and 1.5 MPa, profile moisture content, pH, soluble salt content and organic carbon) were simultaneously studied. Among these soil properties, plant available water (PAW) and organic carbon (OC) contents explained variations in diameter at breast height (dbh) in teak during most of the sampling period, while none of the soil properties significantly explained dbh in leucaena. The highest dose of fly ash applied (66% by volume) decreased bulk density (BD) and increased PAW in teak and to an extent in leucaena during the first 2 years of tree growth. Higher profile moisture content was noted in pits treated with 66% fly ash during the dry period of November (after the end of seasonal rainfall which occurred from June to October) during the first and second year after application.

This citation is from AGRICOLA.

346. Influence of fly ash on evaporation reduction from bare soils under high evaporativity.

Singh, C. B.; Grewal, K. S.; and Oswal, M. C.
Journal of the Indian Society of Soil Science 48(2): 373-376. (2000)
 NAL Call #: 56.9 IN2; ISSN: 0019-638X
Descriptors: evaporation/ fly ash/ soil/ soil amendments
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347. Influence of fly ash on physico-chemical properties and fertility status of soil.

Singh, K. K. and Gayatri Verma
Research on Crops 4(1): 63-68. (2003); ISSN: 0972-3226
Descriptors: ammonium nitrogen/ electrical conductivity/ fly ash/ loam soils/ nitrogen/ phosphorus/ potassium/ sandy soils/ soil fertility/ soil pH/ soil types/ ammonia nitrogen
Abstract: The effect of different levels of fly ash (FA) on pH, electrical conductivity (EC) and available major plant nutrients such as nitrogen, phosphorus and potassium (NPK) was investigated in an alkaline loamy sand soil of Agra district, Uttar Pradesh, India. A decrease in soil pH and increase in EC was observed with the increasing doses of FA. The effect on the availability of $\text{NH}_4^{++}\text{-N}$ and K^+ followed the order $7.5 > 5.0 > 2.5 > 0.0 > 10.05 > 12.5 > 15.0 > 30.0 \text{ g kg}^{-1} \text{ soil}$. The available phosphorus increased with the increasing doses upto 7.5 g kg^{-1} and thereafter it decreased with the increasing doses of FA but remained in higher amounts than the control.
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348. Influence of fly ash on productivity rating index of soil under soybean -wheat cropping sequence.

Sanjay Bhojar; Laharia, G. S.; and Rita Thakare
Annals of Plant Physiology 17(1): 102-103. (2003); ISSN: 0970-9924
Descriptors: cropping systems/ fly ash/ indexes of nutrient availability/ NPK fertilizers/ productivity/ soil fertility/ soybeans/ wheat/ soybeans
Abstract: Field experiments were conducted during 1990-92 with the following treatments: F_0, F_1, F_2, F_3 and F_4 for 0, 25, 50, 75 and 100% of the recommended NPK fertilizer level to both soyabean-wheat crops, respectively; and A_0, A_1, A_2 and A_3 to 0, 5, 10 and 15 tonnes/ha fly ash, respectively, applied to kharif soyabean crop only. The productivity rating index (PRI) is the parameter which indicates the productivity of the soil under specific treatments under the specific management practice. The PRI of the control (F_0A_0) was 65.85, which was low for soyabean. It was observed that fertilizer application to crop increased the productivity of the soil, an evident increase of which was observed upon application of 10-15 tonnes fly ash/ha combined with 75 and 100% fertilizer level. PRI was also lower when fly ash was not applied while increased productivity was enhanced upon increasing rates of fly ash and fertilizer application. Among the various fertilizer rates without fly ash, the highest PRI was observed with full rates of NPK. Results revealed that maximum PRI could be achieved upon application of 100% NPK fertilizer level and 10-15 tonnes fly ash/ha.
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349. Influence of fly ash on soil physical properties and turfgrass establishment.

Adriano, D. C. and Weber, J. T.
Journal of Environmental Quality 30(2): 596-601. (2001)
 NAL Call #: QH540.J6; ISSN: 0047-2425
Descriptors: available water/ boron/ bulk density/ dry matter accumulation/ electrical conductivity/ fly ash/ growth/ infiltration/ lawns and turf/ plant height/ rooting depth/ soil amendments/ soil physical properties/ soil temperature/ soil water retention/ water holding capacity/ lawns and sports turf/ physical properties of soil
Abstract: A field study [place not given] (1993-96) assessed the benefits of applying unusually high rates of coal fly ash as a soil amendment to enhance water retention of soils without adversely affecting growth and marketability of the turf species, centipedegrass (*Eremochloa ophiuroides*). A Latin Square plot design was employed that included 0 (control, no ash applied), 280, 560, and 1120 t ha⁻¹ application rates of unweathered precipitator fly ash. The fly ash was spread evenly over each plot area, rototilled, and allowed to weather under natural conditions for 8 months before seeding. High levels of soluble salts, indicated by the electrical conductivity (EC) of soil extracts, in tandem with an apparent phytotoxic effect from boron (B), apparently inhibited initial plant establishment as shown by substantially lower germination counts in treated soil. However, plant height and rooting depth were not adversely affected, as were the dry matter yields throughout the study period. Ash treatment did not significantly influence water infiltration rate, bulk density, or temperature of the soil, but substantially improved water-holding capacity (WHC) and plant-available water (PAW). Enhanced water retention capacity improved the cohesion and handling property of harvested sod.
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350. Influence of flyash application on micronutrient availability and uptake by Sudan grass and oats grown on coal mine spoils.

Ajaya Srivastava and Chhonkar, P. K.
Journal of the Indian Society of Soil Science 48(4): 859-862. (2000)
 NAL Call #: 56.9 IN2; ISSN: 0019-638X
Descriptors: application rates/ availability/ coal mine spoil/ copper/ fly ash/ iron/ manganese/ nutrient uptake/ oats/ plant composition/ soil/ spoil heap soils/ trace elements/ zinc/ chemical constituents of plants/ colliery spoil / microelements/ Mn
Abstract: The impact of fly ash from Dadri, Ghaziabad, Uttar Pradesh, India on the chemical composition of acidic coal mine spoils and on growth and elemental composition of plants grown on these spoils was evaluated. The crops used were Sudan grass (*Sorghum sudanense*) and oats. Plant analysis showed consistently significant reductions in Fe and Mn uptake by both crops. The concentrations of Fe, Mn, Zn and Cu were particularly low in both crops grown in mine spoils amended with 100 g fly ash kg⁻¹ spoil. Addition of fly ash to spoil significantly increased pH and reduced solubility of Fe, Mn, Zn and Cu. By increasing fly ash application to 100 g kg⁻¹, the available Fe, Mn, Zn and Cu

decreased in the spoils and the amount was approximately 25, 30, 35 and 15%, respectively, lower than that in the untreated spoils.
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351. Influence of flyash with and without FYM and fertilizer on physico-chemical properties of sunflower and cotton growing soils.

Malewar, G. U.; Badole, S. B.; Mali, C. V.; Siddiqui, M. B.; and Syed Ismail
Annals of Agricultural Research 21(2): 187-191. (2000)
NAL Call #: S471.I4A56; ISSN: 0970-3179
Descriptors: boron/ bulk density/ cotton/ farmyard manure/ fly ash/ infiltration/ NPK fertilizers/ nutrient availability/ physicochemical properties/ plant nutrition/ porosity/ soil amendments/ soil chemistry/ soil fertility/ soil physical properties/ soil properties/ sunflowers / FYM/ physical properties of soil
Abstract: The results on the effect of fly ash, with and without FYM [farmyard manure] and fertilizer, on the physicochemical properties and soil fertility showed that application of 10 t FYM/ha + recommended doses of NPK were beneficial for soil improvement and nutrient availability. Further uses of fly ash decreased the bulk density and increased porosity, infiltration rate and available boron in sunflower and cotton growing soils. Fertilizer, FYM and fly ash interactions improved soil physical properties.
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352. Influence of nutrient management on growth and yield of sugarcane (var. Co 86032).

Venkatakrishnan, D. and Ravichandran, M.
Plant Archives 7(1): 99-102. (2007); ISSN: 0972-5210
Descriptors: crop yield/ farmyard manure/ fly ash/ growth/ gypsum/ lignite/ mineral uptake/ nitrogen/ organic amendments/ phosphorus/ plant nutrition/ potassium/ rice husks/ soil fertility/ sugarcane/ vermicompost/ zinc sulfate/ FYM/ Madras/ rice hulls/ zinc sulphate
Abstract: A field experiment was conducted in Tamil Nadu, India, at light textured soil to determine the effects of integrated nutrient management (INM) on NPK uptake, cane yield and soil fertility. The treatments were: (T₁) seasoned pressmud 25 t/ha; (T₂) T₁+rice husk ash 2.5 t/ha; (T₃) T₂+ZnSO₄ 37.5 kg/ha; (T₄) T₁+lignite fly ash 25 t/ha; (T₅) T₁+vermicompost 5 t/ha; (T₆) vermicompost 5 t/ha+lignite fly ash 25 t/ha; (T₇) T₆+ZnSO₄ 37.5 kg/ha; (T₈) vermicompost 5 t/ha+lignite fly ash 25 t/ha; (T₉) biocompost 5 t/ha; (T₁₀) T₉+enriched gypsum 1 t/ha; (T₁₁) T₁₀+ZnSO₄ 37.5 kg/ha; (T₁₂) T₉+lignite fly ash 25 t/ha; (T₁₃) FYM 10 t/ha; (T₁₄) recommended dose of NPK fertilizer. The results revealed that yield, NPK uptake and postharvest soil fertility status improved on the addition of seasoned pressmud 25 t/ha+vermicompost 5 t/ha recorded the highest cane yield (168.65 t/ha). Similarly, NPK uptake of stem and tops and trashes were registered 98.29 and 89.12 kg/ha for N, 57.15 and 46.01 kg/ha for P and 233.17 and 169.54 kg/ha for K, respectively, in this treatment. In soil treated with seasoned pressmud 25 t/ha+vermicompost 5 t/ha recorded the highest postharvest soil N of 254 and P of 22.7 kg/ha. With respect to available K content soil treated with seasoned

pressmud 25 t/ha+lignite fly ash 25 t/ha registered the highest value of 133.1 kg/ha.
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353. Influence of plant growth promoting bacteria and its mutant on heavy metal toxicity in Brassica juncea grown in fly ash amended soil.

Kumar, K. V.; Singh, N.; Behl, H. M.; and Srivastava, S.
Chemosphere 72(4): 678-83. (June 2008)
NAL Call #: TD172 .C54; ISSN: 0045-6535 . 18440582
Descriptors: plant growth/ bacteria/ heavy metals/ toxicity/ Brassica juncea/ fly ash/ amended soil
Abstract: In this study a metal tolerant plant growth promoting bacteria, NBRI K28 Enterobacter sp. was isolated from fly ash (FA) contaminated soils. The strain NBRI K28 and its siderophore overproducing mutant NBRI K28 SD1 were found capable of stimulating plant biomass and enhance phytoextraction of metals (Ni, Zn and Cr) from FA by metal accumulating plant i.e. Brassica juncea (Indian mustard). Concurrent production of siderophores, Indole acetic acid (IAA) and phosphate solubilization revealed its plant growth promotion potential. The strain also exhibited 1-aminocyclopropane-1-carboxylic acid (ACC) deaminase activity. In most of the cases mutant of NBRI K28, exerted more pronounced effect on metal accumulation and growth performance of B. juncea plants than wild type.
This citation is from PubMed.

354. Influence of soil pH and application rate on the oxidation of calcium sulfite derived from flue gas desulfurization.

Lee, Y. B.; Bigham, J. M.; Dick, W. A.; Jones, F. S.; and Ramsier, C.
Journal of Environmental Quality 36(1): 298-304. (Jan. 2007-Feb. 2007)
NAL Call #: QH540.J6; ISSN: 0047-2425
Descriptors: calcium: chemistry/ gases: chemistry/ hydrogen ion concentration/ oxidation reduction/ soil / sulfites: chemistry/ sulfur: chemistry
Abstract: Calcium sulfite hemihydrate (CaSO₃·0.5H₂O), a common byproduct of coal-fired utilities, is fairly insoluble and can decompose to release toxic SO₂ under highly acidic soil conditions; however, it can also oxidize to form gypsum. The objective of this study was to examine the effects of application rate and soil pH on the oxidation of calcium sulfite under laboratory conditions. Oxidation rates measured by release of SO₄-S to solution decreased with increasing application rate. Leachate SO₄-S from soils amended with 1.0 to 3.0 g kg⁻¹ CaSO₃ increased over a 21 to 28 d period before reaching a plateau. At 4 g kg⁻¹, maximum SO₄-S release was delayed until Week 7. Oxidation and release of SO₄-S from soil amended with 3.0 g kg⁻¹ calcium sulfite increased markedly with decreasing soil pH. After only 3 d incubation, the concentrations of SO₄-S in aqueous leachates were 77, 122, 170, 220, and 229 mg L⁻¹ for initial soil pH values of 7.8, 6.5, 5.5, 5.1, and 4.0, respectively. At an initial soil pH value of 4.0, oxidation/dissolution did not increase much after 3 d. At higher pH values, oxidation was maximized after 21 d.

These results suggest that autumn surface applications of calcium sulfite in no-till systems should permit ample time for oxidation/dissolution reactions to occur without introducing biocidal effects related to oxygen scavenging. Soil and annual crops can thus benefit from additions of soluble Ca and SO₄ if calcium sulfite is applied in advance of spring planting.
This citation is from PubMed.

355. The influence of the addition of ash from brown coal and CaO to waste activated sludges on the losses of nitrogen from waste and fertilization value of mixture.

Kalembasa, S. and Wysokinski, A.

Folia Universitatis Agriculturae Stetinensis, Agricultura 77(145-150)(1999).

Notes: Original title: Wpływ dodatku do osadów ściekowych popiołu z węgla brunatnego i CaO na straty azotu z osadów i wartość nawozowa mieszaniny.

Descriptors: ash/ brown coal/ crop yield/ fertilizers/ lime/ losses/ maize/ nitrogen/ sewage sludge/ sunflowers/ corn
Abstract: The influence of the addition of brown coal ash from Bechatow mine (power station Patnow) and CaO to waste activated sludges from sewage purification plants at Siedlce and ukow on the losses of nitrogen and fertilizer value of the mixture was studied. The addition of ash and CaO was 1/6, 1/4, 1/3 and 1/2 in relation to the dry matter of sludges. The losses of nitrogen from waste under the influence of the addition of CaO reached 18.8% for sludge from Siedlce and 16.2% from ukow but after the addition of ash losses were 11.0% and 12.2% respectively. The fertilizer value of the mixtures was tested in pot experiments using loamy sand (low in potassium and with 6.3 g N/kg soil). The addition of ash to the sludges significantly increased maize and sunflower yield, but CaO significantly decreased yield.
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356. Insecticide and phytotoxic effects of hard coal fly ash.

Ulrichs, C.; Dolgowski, D.; Mucha, T.; Reichmuth, C.; and Mewis, I.

Gesunde Pflanzen 57(5): 110-116. (2005); ISSN: 0367-4223.

Notes: Original title: Insektizide und phytotoxische Wirkung von Steinkohlenflugasche.

Descriptors: application rates/ coal/ cress/ fly ash/ growth/ herbicidal properties/ insect pests/ insecticidal properties/ mortality/ phytotoxicity/ soil pH/ stored products pests/ substrates/ Capparales/ death rate/ granary weevil
Abstract: Millions of tonnes of coal fly ash are produced annually and its disposal is a major concern. Fly ash is mainly used in civil construction and as landfill. However, these procedures do not utilize the complete amount of ash produced and thus, thermal power stations have to manage its storage. New ways to dispose of fly ash are needed and research on using fly ash in agricultural settings is conducted worldwide. Recent reports from India indicate the possible use of fly ash as insecticides. A series of laboratory experiments were undertaken to validate the insecticidal effect as well as to discover possible phytotoxicity problems. The growth of *Tropaeolum majus* and *Lepidium sativum* plants in substrate with

different fly ash rates was assessed. Test substrate for *L. sativum* contained 1, 5, 10, 20, 50 or 100% fly ash. Over a period of 12 days, fly ash (5, 25 or 50 mg) was applied every 3 days to *T. majus* potted in pots with 8-cm diameter. All experiments were analysed after four weeks. Surface treatments of fly ash had no effect on growth parameters of *T. majus*. In contrast to this length, growth of *L. sativum* was reduced when planted in substrate with 50% or higher fly ash. This effect is most likely caused by a physical and not chemical effect of the substrate. Soil pH increased with increasing percentages of fly ash. Substrate containing 50% fly ash showed a pH of 7.8 and 100% fly ash a pH of 8.7. Insecticidal effects of fly ash were tested on *Plodia interpunctella*, *Tenebrio molitor*, and *Sitophilus granarius*. Larval stages of *P. interpunctella* have been treated with 3, 8, 18.8, and 37.5 mg fly ash in a plastic box with 29 cm² area and kept for two days at 26 degrees C and 50% RH. The larval mortality did not differ from the untreated control. Fly ash treatment (20, 100 or 200 mg fly ash/50 cm²) had also no lethal effect in *T. molitor* larvae and adults after 12 days. In contrast, *S. granarius* beetle mortality increased slightly about two-fold (up to 14%) when treated with 125 mg fly ash/50 cm² after 12 days. Mortality was significant higher (100%) when insects were treated with the same amount of diatomaceous earths. The results show no potential of coal fly ash as effective insecticide in agricultural settings. Additionally, no phytotoxic effects were observed during a four-week period to *T. majus* and *L. sativum* plants. Results are critically discussed in context with recent publications.

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357. Integrated application of humic acid, fly ash and fertiliser on biochemical parameters and soil fertility.

Bama, K. S.; Sellmuthu, K. M.; and Sivakumar, K.

Journal of Ecobiology 17(6): 561-565. (2005)

NAL Call #: QH540.J56 ; ISSN: 0970-9037

Descriptors: alfisols / enzyme activity/ enzymes/ fly ash/ green gram/ humic acids/ nitrate reductase/ nitrogen/ nitrogen fertilizers/ nutrient availability/ phosphorus/ phosphorus fertilizers/ plant nutrition/ plant proteins/ potassium/ soil fertility/ soil types/ mung bean/ phosphate fertilizers

Abstract: To find out the effects of two organic sources such as humic acid (HA) and fly ash (FA) with inorganic fertilizers on green gram, a pot experiment was conducted in Alfisol. Treatments comprised: control, FA at 20 t ha⁻¹, HA at 10 kg ha⁻¹, nitrogen and phosphorus fertilizers (NP) alone, FA+NP, HA+NP, FA+HA+NP with and without blending. Among the treatments, combined application of HA, FA and fertilizer applied by blending recorded the highest soluble protein (203 mg g⁻¹), and nitrate reductase activity (180 NO₂ g⁻¹ h⁻¹) of green gram. The same treatment also recorded the highest available N (228 kg ha⁻¹), available P (24 kg ha⁻¹) and available K (350 kg ha⁻¹).
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358. An integrated approach to control rice blast through nutrients and biocontrol agent.

Karpagavalli, S.; Marimuthu, T.; Jayaraj, J.; and Ramabadran, R.

Research on Crops 2(2): 197-202. (2001); ISSN: 0972-3226

Descriptors: application rates/ biological control/ biological control agents/ carbendazim/ chemical control/ crop yield/ fly ash/ fungicides/ incidence/ lignite/ plant disease control/ plant diseases/ plant pathogenic fungi/ plant pathogens/ potassium fertilizers/ rice/ silica/ biocontrol agents/ biological control organisms/ carbendazol/ Madras/ MBC/ medamine/ paddy/ phytopathogens/ potash fertilizers
Abstract: A field trial was conducted in Aduthurai, Tamil Nadu, India [date not given] to investigate the complementary effect of silica (6 t lignite fly ash (LFA)/ha) and various K fertilizer levels (0, 60 and 45 kg potash/ha), along with a foliar spray of carbendazim and the biological control agent, *Pseudomonas fluorescens*, on the blast [*Magnaporthe grisea*] incidence of rice cultivars IR50 and White Ponni. Foliar spray of carbendazim or *P. fluorescens*, in addition to LFA and 45 kg potash/ha significantly reduced the rice blast incidence and increased crop yield. Reproduced with permission from the CAB Abstracts database.

359. Integrated use of organics and sulphur on the rice yield and sustainable soil health in sulphur deficient soil.

Sriramachandrasekharan, M. V.; Bhuvaneshwari, R.; and Ravichandran, M.
Plant Archives 4(2): 281-286. (2004); ISSN: 0972-5210
Descriptors: application rates/ chlorophyll/ clay loam soils/ crop yield/ farmyard manure/ filter cake/ fly ash/ growth/ leaf area index/ nitrogen / nutrient availability/ panicles/ phosphorus/ plant height/ potassium/ residual effects/ rice/ soil fertility/ sulfur/ sulfur fertilizers/ tillers/ use efficiency/ Vertisols/ yield components/ clarification mud/ elemental sulphur/ FYM/ LAI/ Madras/ paddy/ sulphur/ sulphur fertilizers
Abstract: Field experiments were conducted during kharif (June-September) 2001 and rabi (October-January) 2002 on an S-deficient clay loam soil (Typic Haplustert) at Annamalai, Tamil Nadu, India to evaluate the effects S (0, 20, 40 and 60 kg/ha) and organic fertilizers (*Sesbania aculeata* at 12.5 t/ha, sulfitation pressmud at 10 t/ha, lignite fly ash at 20 t/ha and farmyard manure at 12.5 t/ha), applied alone or in combination, on soil fertility and the yields of the main and succeeding rice crops (residual effect). Data were recorded for plant height, number of productive tillers per hill, leaf area index, chlorophyll content, number of panicles/m², number of grains per panicle, thousand-grain weight, grain yield and straw yield. The contents of N, P, K and S in the soil were also determined. The growth and yield of rice increased with increasing level of S fertilizer up to 40 kg/ha. Among the organic fertilizers, *S. aculeata* recorded the highest values for the growth and yield parameters. The percentage of increase in rice yield was 16-20.7% when S was applied alone, and increased to 25-32% when S and organic fertilizers were combined. S use efficiency was highest with 20 kg S/ha and decreased with increasing S level. The residual effect of the fertilizers was well pronounced. S at 40 kg/ha combined with *Sesbania aculeata* or sulfitation pressmud recorded the highest values for growth and yield parameters and soil nutrient availability. Reproduced with permission from the CAB Abstracts database.

360. Interaction of resistant genotypes/varieties with organic nutrients on the management of rice gall midge.

Rani, B. U.; Suresh, K.; Rajendran, R.; and Rajavel, D. S.
Journal of Plant Protection and Environment 4(1): 24-29. (2007); ISSN: 0973-1717
Descriptors: cultivars/ cultural control/ farmyard manure/ fly ash/ genotypes/ insect pests/ neem seed cake / organic amendments/ pest control/ pest resistance/ phosphate solubilizing bacteria/ plant pests/ rice/ biofertilizers/ cultivated varieties/ FYM/ Madras/ neem seed oilmeal/ paddy
Abstract: Field experiments were conducted during November 2003-February 2004, July-October 2004, and October-January 2005 in Madurai, Tamil Nadu, India, to evaluate the interaction effects of different resistant rice genotypes with organic nutrients for the management of rice gall midge (*Orseolia oryzae*). The resistant sources used in the study were TKM6, MDU 3, MDU5, IR 64, IR 36 and ADT 36 with the susceptible control TN1. The organic nutrients such as farmyard manure (FYM), neem cake, biofertilizers and lignite fly ash were applied uniformly in all treatments. The present study indicated that gall midge incidence was significantly less in cv. MDU 3 treated with FYM, *Azospirillum*, phosphobacterium, silicate solubilizing bacteria, lignite fly ash and neem cake. In the present investigation, the consistent reduction of gall midge infestation was due to the combined effect of varietal resistance as well as induced resistance through the application of organic nutrients. Reproduced with permission from the CAB Abstracts database.

361. Interdependence between presence of chemical elements in filtered material from soil fertilised with different doses of coal ash.

Wojcieszczuk, T.; Niedzwiecki, E.; and Sowinska, M.
Journal of Elementology 9(4): 847-855. (2004); ISSN: 1044-2296.
Notes: Original title: Wzspozaleznosc wystepowania skadnikow chemicznych w przesaczach z gleby nawozonej zroznicowanymi dawkami popiou z wegla kamiennego.
Descriptors: application rates/ ash/ calcium/ carbon/ chloride/ hydrogen/ losses from soil/ magnesium/ nitrogen/ potassium/ salts in soil/ sodium/ losses from soil systems
Abstract: A laboratory experiment was conducted to determine the quantities of chemical elements (Ca, Mg, K, Na, Cl, H, C, N, total concentration of salt) washed out from soil during 13 sprinkling treatments from 1994 to 2000. The soil was previously fertilized with different doses of ash (0; I=15; II=60; III=120 tonnes ha⁻¹), a by-product of coal burning at the Dolna Odra power plant, Poland. The results of chemical analyses of the soil filtered material served as a basis for computing correlation coefficients for all pairs of chemical elements as well as regression and determination coefficients for the pairs generating significant correlation. Chemical elements added to soil with coal ash modify quantitative and qualitative relationships between elements depending on a dose of ash used, which has been confirmed by the correlation and regression coefficients obtained in the experiment. Reproduced with permission from the CAB Abstracts database.

362. Investigations on pyrite oxidation in mine spoils of the Lusatian lignite mining district.

Meyer, G.; Waschkes, C.; and Huttel, R. F.

Plant and Soil 213(1/2): 137-147. (1999)

NAL Call #: 450 P696; ISSN: 0032-079X

Descriptors: composts / control/ fertilizers/ fly ash/ lignite/ mine spoil/ mining/ organic wastes/ oxidation / pyrites/ reclamation/ sewage/ sewage sludge/ sludges/ treatment/ wastes/ weathering/ mine wastes/ mining spoil/ mining wastes

Abstract: The impact of organic waste material and fly ash on microbial and chemical pyrite oxidation was investigated in a field experiment in Germany, and in column tests under laboratory conditions. For the field experiment, pyritic mine spoil was ameliorated with fly ash and treated either with mineral fertilizer, with sewage sludge or with compost. Independent of treatment, during the 18 months following application, the pyrite-S contents decreased steadily in the top spoil (0-30 cm depth). However, high variations of the pyrite-S content were observed. Compared to other pyrite oxidation studies, the pyrite content of the mine spoil at the experimental site was low. Therefore, a model spoil with a higher pyrite content, derived from Tertiary strata of the overburden sequence in the same open-cast mine, was used for the column experiments. For the first column experiment, the model spoil was mixed with fly ash and mineral fertilizer, reflecting the common reclamation practice in the Lusatian open-cast lignite mining district. Columns with this spoil were either inoculated with different cell numbers of autochthonous acidophilic bacteria, isolated from the model spoil, or with a commercial strain of *Thiobacillus ferrooxidans*. The ratio of sulphate-S to total S was used as a measure for the degree of pyrite oxidation. The sulphate-S:total S ratio increased within 28 days of incubation. The increase was related to the inoculated cell numbers of bacteria, but independent of the origin of the bacteria. It can be stated, that autochthonous bacteria from the model spoil oxidised pyrite at a similar rate as did the commercial *T. ferrooxidans* strain. For the second column test, mineral fertilizer, sewage sludge or compost were applied to the model spoil. The columns were inoculated with autochthonous bacteria, isolated from the model spoil. Application of sewage sludge and compost seemed to promote the weathering of pyrite, as the sulphate-S:total S ratio increased more rapidly in these treatments compared to control or mineral fertilizer application. Both experiments showed an increase of cell numbers of inoculated bacteria, independent of the sulphate-S:total S ratio. Reproduced with permission from the CAB Abstracts database.

363. A kind of mixed media composed of fly ash and acid residue of furfural for land reclamation and its leaching requirement.

Zhang LeiNa; Feng YongJun; and Wang ZhaoFeng

Transactions of the Chinese Society of Agricultural Engineering 20(4): 268-272. (2004)

NAL Call #: S671.N8; ISSN: 1002-6819

Descriptors: fly ash/ furfural/ leaching/ leaching requirement/ nutrient deficiencies/ polluted soils/ reclamation/ salts in soil/ soil amendments/ soil fertility/ soil pH/ soil pollution/ soil salinity/ soil toxicity/ soil types/ subsidence/ water holding capacity/ toxic soils

Abstract: Filling subsided lands with fly ash is currently the dominant land reclamation method in coal mine areas. To avoid some disadvantages of fly ash to soil, such as nutrient deficiency, high pH value, poor water holding capacity and harmful toxic element, a new kind of land media for land reclamation composed of different proportion of fly ash and the acid residue of furfural was developed based on pot tests. Results indicated that the properties of the fly ash was improved after the addition of the acid residue of furfural and this new medium was helpful for the plants growing in the area. The optimum proportion of acid residue of furfural in this new medium was 5-20%. It was also found that salt may be the main factor restraining plants from normal growth. To keep suitable salt content, salt washing for this new medium, in an example case, is needed and the washing amount is suggested to be $\sim 4.39 \times 10^3 \text{ m}^3/\text{hm}^2$. Reproduced with permission from the CAB Abstracts database.

364. Land Uses of Coal Fly Ash: Benefits and Barriers.

Smith, Irene

London: IEA Clean Coal Centre, 2005. 30p.

Notes: ISBN: 92-9029-411-6.

http://www.iea-coal.org.uk/publishor/system/component_view.asp?PhyDocId=5627&LogDocId=81241

Descriptors: fly ash/ land application/ coal

Abstract: This report focuses on three major sectors of fly ash utilisation: soil stabilisation, mine backfill and agriculture. Requirements are generally less rigorous than for use of fly ash in the cement and concrete industries. The benefits of using fly ash are investigated for each sector. These include improvements over use of cement or lime alone at lower cost, more effective land reclamation using less primary materials, and enhanced fertility of soils. Stabilisation of soils and aggregates with fly ash is a successful, high volume use, especially in road construction. Unbound fly ash as structural fill, for example in mines and road subbase, gives high volume, beneficial use of conditioned, stockpiled and lagoon fly ash. In agriculture, studies have shown that crop yields increase and water consumption may be reduced by using fly ash as soil amendment. Fly ash is complemented well by biosolids such as treated sewage sludge and acts synergistically with organic matter in improving plant growth. Barriers to utilisation of coal fly ash on land occur in marketing, transport, and through the potential for leachates containing trace elements from fly ash. These are being overcome by various means in the utilisation sectors. It is essential to follow best engineering practices to ensure there is no environmental risk. Potential long-term effects in agriculture are under investigation.

365. Leachability of trace metals from sandy or rocky soils amended with coal fly ash.

Li, Yuncong and Chen, Jianjun.

In: *Coal Combustion Byproducts and Environmental Issues*. Uppsala, Sweden.)

New York, NY: Springer; pp. 105-113; 2006.

Notes: 7th International Conference on Biogeochemistry of Trace Elements.; ISBN: 0387258655

Descriptors: Pollution Assessment Control and Management/ Soil Science/ soil column: laboratory equipment/ coal fly ash soil amendment: applied and field techniques/ Spodosol/ Entisol/ Alfisol

Abstract: Application of coal fly ash as a soil amendment for Florida sandy or rocky soils is an alternative to disposal of coal fly ash and also will improve soil physical and chemical properties and increase crop production.

However, environmental fate of trace metals in coal fly ash is a major concern. The objective of this experiment was to evaluate movement of trace metals in coal fly ash amended soil columns. Three soils were collected from south Florida to represent Alfisols, Entisols, and Spodosols. Each of three representative soil was packed into separate columns (32.5 cm long and 7.5 cm inner diameter), amended with coal fly ash at rates of 0, 40, 80 Mg ha⁻¹ and leached with 10 pore volumes of water, which is equivalent to 113.8 cm rainfall. Leachates were analyzed for Zn, Cu, Mn, Fe, Cd, Pb, and Ni. There was no detectable Cd in leachate from any of the soil columns. The maximum concentrations of Zn from all three soils with or without coal fly ash amendment were below the Maximum Contamination Level (MCL) for drinking water. High concentrations of Fe, Pb and Mn in leachate were more closely related to the background concentrations of these metals in three soils than to the coal fly ash application. Application of 80 Mg ha⁻¹ coal fly ash to Riviera soil elevated Cu concentration in leachate above MCL. After completion of leaching, soil columns were divided into five sections (5 cm each) and analyzed for total concentrations of selected metals. The results showed that application of coal fly ash increased all of the trace metals measured in soils at top 5 cm or 5-10 cm depth after leaching. Concentrations of Zn, Cu, Mn, and Cd were also elevated in soil depths from 5 to 25 cm of Riviera soils mainly because the soil has very sandy texture and low organic carbon.

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366. Leachate composition and soil quality assessment in coal fly ash amended soils.

Vageesh, T S and Siddaramappa, R
17th World Congress of Soil Science, Bangkok, Thailand, 14-20 August 2002. 2002; 343(2002)

Descriptors: application rates/ boron/ cadmium/ chemical composition/ chromium/ fly ash/ heavy metals/ leachates/ lead/ nickel/ salts/ soil amendments/ soil fertility/ soil pollution/ soil quality

Reproduced with permission from the CAB Abstracts database.

367. Leachate concentrations from water leach and column leach tests on fly ash-stabilized soils.

Bin Shafique, S.; Benson, C. H.; Edil, T. B.; and Hwang, K. H.

Environmental Engineering Science 23(1): 53-67. (2006)
NAL Call #: TD811.5.H39; ISSN: 1092-8758

Descriptors: cadmium/ cation exchange capacity/ chromium/ fly ash/ heavy metals/ leachates/ leaching/ pH/ polluted soils/ selenium/ silver/ soil pollution/ soil types/ transport processes/ hydrogen ion concentration/ potential of hydrogen/ soil transport processes/ transport processes in soil systems

Abstract: Batch water leaching tests (WLTs) and column leaching tests (CLTs) were conducted on coal-combustion fly ashes, soil, and soil-fly ash mixtures to characterize

leaching of Cd, Cr, Se, and Ag. The concentrations of these metals were also measured in the field at two sites where soft fine-grained soils were mechanically stabilized with fly ash. Concentrations in leachate from the WLTs on soil-fly ash mixtures are different from those on fly ash alone and cannot be accurately estimated based on linear dilution calculations using concentrations from WLTs on fly ash alone. The concentration varies nonlinearly with fly ash content due to the variation in pH with fly ash content.

Leachate concentrations are low when the pH of the leachate or the cation exchange capacity (CEC) of the soil is high. Initial concentrations from CLTs are higher than concentrations from WLTs due to differences in solid-liquid ratio, pH, and solid-liquid contact. However, both exhibit similar trends with fly ash content, leachate pH, and soil properties. Scaling factors can be applied to WLT concentrations (50 for Ag and Cd, 10 for Cr and Se) to estimate initial concentrations for CLTs. Concentrations in leachate collected from the field sites were generally similar or slightly lower than concentrations measured in CLTs on the same materials. Thus, CLTs appear to provide a good indication of conditions that occur in the field provided that the test conditions mimic the field conditions. In addition, initial concentrations in the field can be conservatively estimated from WLT concentrations using the aforementioned scaling factors provided that the pH of the infiltrating water is near neutral.

Reproduced with permission from the CAB Abstracts database.

368. Leaching of heavy metals from fly ash stabilized soils.

Bin-Shafique, M. Sazzad

Madison, WI, University of Wisconsin at Madison, 2002.

Descriptors: ash/ atmospheric precipitation/ Darcy's law/ experimental studies/ heavy metals/ highways/ laboratory studies/ leachate/ leaching/ lysimeters/ numerical models/ pH/ pollution/ soils/ environmental geology

© American Geological Institute

369. Leaching of metals from soils amended with fly ash and organic byproducts.

Alva, Ashok K.; Bilski, J. J.; Sajwan, Kenneth S.; and van Clief, D.

In: Fourth international conference on the biogeochemistry of trace elements. Berkeley, CA, United States.) Sajwan, Kenneth S.; Alva, Ashok K.; and Keefer, Robert F (eds.); 1999.

Descriptors: ash/ clastic sediments/ Florida/ geochemistry/ granulometry/ hydrology/ leachate/ leaching/ metals/ nutrients/ organic compounds/ porosity/ rainfall/ sand/ sediments/ soil treatment/ soils/ United States/ geochemistry of rocks, soils, and sediments

© American Geological Institute

370. A life cycle comparison of disposal and beneficial use of coal combustion products in Florida. Part 1: Methodology and inventory of materials, energy, and emissions.

Babbitt, C. W. and Lindner, A. S.

International Journal of Life Cycle Assessment 13(3): 202-211. (2008); ISSN: 0948-3349

Descriptors: case studies/ coal/ combustion/ comparisons/ concrete/ emission/ environmental assessment/ environmental impact/ fly ash/ public health/ raw materials/

recycling/ road construction/ roofs/ soil amendments/ wallboard/ waste disposal/ waste utilization/ environmental effects/ life cycle assessment/ United States of America

Abstract: Background, Goal, and Scope. Currently, only 40%, or 44.5 million metric tons, of coal combustion products (CCPs) generated in the United States each year by electric utilities are diverted from disposal in landfills or surface impoundments and recycled. Despite promising economic and environmental savings, there has been scant attention devoted to assessing life cycle impacts of CCP disposal and beneficial use. The objective of this paper is to present a life cycle inventory considering two cases of CCP management, including the stages of coal mining and preparation, coal combustion, CCP disposal, and CCP beneficial use. Six beneficial uses were considered: concrete production, structural fills, soil amendments, road construction, blasting grit and roofing granules, and wallboard. Methods. Primary data for raw material inputs and emissions of all stages considered were obtained from surveys and site visits of coal-burning utilities in Florida conducted in 2002, and secondary data were obtained from various published sources and from databases available in SimaPro 5.1 (PRe Consultants, Amersfoort, The Netherlands). Results. Results revealed that 50 percent of all CCPs produced, or 108 kg per 1,000 kg of coal combusted, are diverted for application in a beneficial use; however, the relative amounts sold by each utility is dependent on the process operating parameters, air emission control devices, and resulting quality of CCP. Diversion of 50% of all CCPs to beneficial use applications yields a decrease in the total raw materials requirements (with the exception of gravel and iron) and most emissions to air, water, and land, as compared to 100% disposal. Discussion. The greatest reduction of raw materials was attributed to replacing Portland cement with fly ash, using bottom ash as an aggregate in concrete production and road construction in place of natural materials, and substituting FGD gypsum for natural gypsum in wallboard. The use of fly ash as cementitious material in concrete also promised significant reductions in emissions, particularly the carbon dioxide that would be generated from Portland cement production. Beneficial uses of fly ash and gypsum showed reductions of emissions to water (particularly total dissolved solids) and emissions of metals to land, although these reductions were small compared to simply diverting 50% of all CCPs from landfills or surface impoundments. Conclusions. This life cycle inventory (LCI) provides the foundation for assessing the impacts of CCP disposal and beneficial use. Beneficial use of CCPs is shown here to yield reductions in raw material requirements and various emissions to all environmental compartments, with potential tangible savings to human health and the environment. Recommendations and Perspectives. Extension of this life cycle inventory to include impact assessment and sensitivity analysis will enable a determination of whether the savings in emissions reported here actually result in significant improvements in environmental and human health impacts. Reproduced with permission from the CAB Abstracts database.

371. Liming acid forest soils with flue gas desulfurization by-product: Growth of northern red oak and leachate water quality.

Crews, J. T. and Dick, W. A.
Environmental Pollution 103(1): 55-61. (1998)
 NAL Call #: QH545.A1E52; ISSN: 0269-7491
Descriptors: acid soils/ aluminium/ boron/ burning/ calcium/ chromium/ copper/ desulfurization/ fly ash/ forest soils/ iron/ lead/ lime/ lime requirement/ liming/ magnesium/ manganese/ metals/ phosphorus/ potassium/ recycling/ soil amendments/ soil types/ sulfur/ titanium/ toxicity/ Ultisols/ water quality/ zinc/ aluminum/ desulphurization/ elemental sulphur/ flaming/ Mn/ northern red oak/ sulphur/ United States of America/ water composition and quality
Abstract: Flue gas desulfurization (FGD) by-product is created when a dolomitic lime $[\text{CaMg}(\text{CO}_3)_2]$ is used to remove SO_2 during the burning of high sulfur coal in electricity generating power plants. This study evaluated growth of Northern red oak (*Quercus rubra* L.) in an acid forest soil (Rayne silt loam - a fine loamy, mixed, mesic, Typic Hapludult) and water leachate quality when FGD by-product was applied topically or mixed within the A horizon at rates equivalent to 0.25, 0.50, 1.0, 1.5, 2.0 and 2.5 times the soil's lime requirement. Soils were leached with deionized water on a monthly basis and the leachate samples were analysed for pH, conductivity, P, S, B and metals (Al, Ca, Cr, Cu, Fe, Mn, K, Mg, Pb, Ti and Zn). Tree growth significantly increased ($p \leq 0.05$) when soil was treated with FGD and the greatest growth (75% increase over the untreated control) occurred when FGD was applied at 1.5 times the lime requirement rate. Boron toxicity symptoms were observed in plant tissue when FGD by-product was applied at two times (or higher) the lime requirement rate. Sulfur concentration increased from <10 mg/litre (control soil) to 234 mg/litre (soil treated with FGD at 2.5 times the lime requirement) in the leachate four months after treatment. Boron also approached toxicity concentrations (~ 1 mg/litre) in the leachate from soil treated at the highest rate during the initial leachings, but concentrations tended to decline with time. Applying FGD by-product onto acid forest soils has the potential to provide growth benefit to a commercially important tree species (red oak) but care will need to be taken to avoid using FGD materials that may release toxic levels of B. Reproduced with permission from the CAB Abstracts database.

372. Low -cost way to pave feedlots.

Suszkiv, J.
Agricultural Research 47(1): 22-23. (Jan. 1999); ISSN: 0002-161X [AGREA5].
Notes: Also available via remote access.
Descriptors: feedlots / fly ash/ cattle/ Internet resource
 This citation is from AGRICOLA.

373. Management of lignite fly ash for improving soil fertility and crop productivity.

Ram, L. C.; Srivastava, N. K.; Jha, S. K.; Sinha, A. K.; Masto, R. E.; and Selvi, V. A. 40(3): 438-452. (2007); ISSN: 0364152X [EMNGD].
Notes: doi: 10.1007/s00267-006-0126-9.

Descriptors: Groundnut/ Heavy metals/ Lignite fly ash/ Maize/ Press mud/ Productivity/ Radioactivity/ Sun hemp/ Crops/ Cultivation/ Fertilizers/ Heavy metals/ Lignite/ Nutrients/ Productivity/ Radioactivity/ Soils/ Sugar (sucrose)/ Crop productivity/ Humic acids/ Lignite fly ash/ Soil fertility/ Fly ash/ calcium sulfate/ fertilizer/ heavy metal/ humic acid/ lignite/ trace metal/ crop production/ crop yield/ fly ash/ groundnut/ heavy metal/ humic acid/ lignite/ maize/ radioactivity/ soil amendment/ soil fertility/ soil improvement/ soil quality/ crop production/ environmental management/ fly ash/ gamma radiation/ maize/ organic waste/ peanut/ plant growth/ plant nutrient/ plant yield/ radioactivity/ soil fertility/ soil quality/ sugar industry/ Agriculture/ Carbon/ Crops, Agricultural/ Fertilizers/ Hydrogen-Ion Concentration/ Metals, Heavy/ Particulate Matter/ Soil/ Soil Pollutants/ Zea mays/ Cannabis sativa/ Zea mays

Abstract: Lignite fly ash (LFA), being alkaline and endowed with excellent pozzolanic properties, a silt loam texture, and plant nutrients, has the potential to improve soil quality and productivity. Long-term field trials with groundnut, maize, and sun hemp were carried out to study the effect of LFA on growth and yield. Before crop I was sown, LFA was applied at various doses with and without press mud (an organic waste from the sugar industry, used as an amendment and source of nutrients). LFA with and without press mud was also applied before crops III and V were cultivated. Chemical fertilizer, along with gypsum, humic acid, and biofertilizer, was applied in all treatments, including the control. With one-time and repeat applications of LFA (with and without press mud), yield increased significantly (7.0-89.0%) in relation to the control crop. The press mud enhanced the yield (3.0-15.0%) with different LFA applications. The highest yield LFA dose was 200 t/ha for one-time and repeat applications, the maximum yield being with crop III (combination treatment). One-time and repeat application of LFA (alone and in combination with press mud) improved soil quality and the nutrient content of the produce. The highest dose of LFA (200 t/ha) with and without press mud showed the best residual effects (eco-friendly increases in the yield of succeeding crops). Some increase in trace- and heavy-metal contents and in the level of γ -emitters in soil and crop produce, but well within permissible limits, was observed. Thus, LFA can be used on a large scale to boost soil fertility and productivity with no adverse effects on the soil or crops, which may solve the problem of bulk disposal of fly ash in an eco-friendly manner. © 2007 Springer Science+Business Media, LLC. © 2009 Elsevier B.V. All rights reserved.

374. Management of mine spoil for crop productivity with lignite fly ash and biological amendments.

Ram, L. C.; Srivastava, N. K.; Tripathi, R. C.; Jha, S. K.; Sinha, A. K.; Singh, G.; and Manoharan, V.

Journal of environmental management 79(2): 173-187. (2006)

NAL Call #: HC75.E5J6 ; ISSN: 0301-4797

Descriptors: application to land/ chemical composition/ crop yield/ fertilizers/ filter cake/ fly ash/ green gram/ green manures/ gypsum/ hemp/ humic acids/ lignite/ mine spoil/ nutrient content/ productivity/ rice/ soil amendments/ soil fertility/ soil texture/ biofertilizers/ clarification mud/ land application/ Madras/ mine wastes/ mining spoil/ mining wastes/ mung bean/ paddy

Abstract: Long-term field trials using lignite fly ash (LFA)

were carried out in rice crops during the period 1996-2000 at Mine I, Neyveli Lignite Corporation, Tamil Nadu. LFA, being alkaline and endowed with an excellent pozzolanic nature, silt loam texture, and plant nutrients, has the potential to improve the texture, fertility, and crop productivity of mine spoil. The rice crops were the first, third, fifth, and sixth crops in rotation. The other crops, such as green gram (second) and sun hemp (fourth), were grown as green manure. For experimental trials, LFA was applied at various dosages (0, 5, 10, 20, 50, 100, and 200 t/ha), with and without press mud (10 t/ha), before cultivation of the first crop. Repeat applications of LFA were made at the same dosages in treatments of up to 50 t/ha (with and without press mud) before cultivation of the third and fifth crops. Press mud, a lightweight organic waste product from the sugar industry, was used as an organic amendment and source of plant nutrients. Also, a recommended dosage of chemical fertilizer, along with gypsum, humic acid, and biofertilizer as supplementing agents, was applied in all the treatments, including control. With one-time and repeat applications of LFA, from 5 to 20 t/ha (with and without press mud), the crop yield (grain and straw) increased significantly ($p < 0.05$), in the range from 3.0 to 42.0% over the corresponding control. The maximum yield was obtained with repeat applications of 20 t/ha of LFA with press mud in the third crop. The press mud enhanced the yield in the range of 1.5-10.2% with various dosages of LFA. The optimum dosage of LFA was 20 t/ha for both one-time and repeat applications. Repeat applications of LFA at lower dosages of up to 20 t/ha were more effective in increasing the yield than the corresponding one-time applications of up to 20 t/ha and repeat applications at 50 t/ha. One-time and repeat applications of LFA of up to 20 t/ha (with and without press mud), apart from increasing the yield, evinced improvement in the texture and fertility of mine spoil and the nutrient content of crop produce. Furthermore, some increase in the content of trace and heavy metals and the level of γ -emitters in the mine spoil and crop produce was observed, but well within the permissible limits. The residual effect of LFA on succeeding crops was also encouraging in terms of eco-friendliness. Beyond 20 t/ha of LFA, the crop yield decreased significantly ($p < 0.05$), as a result of the formation of hardpan in the mine spoil and possibly the higher concentration of soluble salts in the LFA. However, the adverse effects of soluble salts were annulled progressively during the cultivation of succeeding crops. A plausible mechanism for the improved fertility of mine spoil and the carryover or uptake of toxic trace and heavy metals and γ -emitters in mine spoil and crop produce is also discussed.

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375. Management of pulse beetle, *Callosobruchus chinensis* L. (Coleoptera: Bruchidae) in stored chickpea using ashes, red soil powder and turpentine oil.

Shaheen, F. A. and Abdul Khaliq

Pakistan Entomologist 27(2): 19-24. (2005); ISSN: 1017-1827

Descriptors: bark/ chickpeas/ essential oils/ farmyard manure/ fecundity/ fly ash/ insect pests/ insecticidal properties/ mortality/ stored products pests/ turpentine/ death rate/ FYM

Abstract: Fly ash, cow dung ash, acacia bark ash, red soil powder and turpentine oil as postharvest grain protectants were tested for their insecticidal potency against pulse beetle (PB) attacking stored chickpea. The results revealed that fly ash at 1.0 g per 50 g of grains showed the minimum days (5.06) to 100% mortality of released adults, minimum fecundity (0.86 eggs per grain), minimum holes (0.41 per grain), lowest number (3.14) of F_1 adults emerged, maximum inhibition (78.62%) of F_1 adults, minimum weight loss (9.63%) and the minimum of 2.86 days to 100% mortality of F_1 adults. Fly ash and turpentine oil were the most effective at all application rates compared to other materials and the control. However, fly ash proved to be the best in managing PB infestation to lower levels followed by turpentine oil and cow dung ash while red soil powder and kinkar ash were less effective and were similar to the control at their lower application rates. Reproduced with permission from the CAB Abstracts database.

376. Mass production of VAM fungi using different substrates and hosts.

Seema Sharma; Ashok Aggarwal; Vipin Parkash; and Dipti Sharma

Journal of Mycopathological Research 43(1): 51-56. (2005)
NAL Call #: QK600.J68 ; ISSN: 0971-3719

Descriptors: endomycorrhizas/ farmyard manure/ fly ash/ host plants/ maize/ mycorrhizal fungi/ mycorrhizas/ production/ sand/ vesicular arbuscular mycorrhizas/ Acaulospora lacunosa/ Acaulosporaceae/ arbuscular mycorrhizas/ corn/ FYM/ Gigasporaceae/ Glomaceae/ Glomus reticulatum/ Sclerocystis/ Sclerocystis coremioides
Abstract: The influence of soil: farmyard manure, soil: fly ash and soil: sand on the VAM fungi i.e., Glomus mosseae, Glomus fasciculatum and mixed inoculum (composite spores of Glomus geosporum, G. reticulatum, Gigaspora gigantea, Sclerocystis coremioides, Acaulospora lacunosa and A. laevis) were examined using different hosts maize (Zea mays), bajra (Pennisetum glaucum) and jowar (Sorghum bicolor). Among the substrates, soil: farmyard manure gave best results of VAM mass production. Different hosts showed positive mycorrhizal associations in different substrates but the degree varied. Reproduced with permission from the CAB Abstracts database.

377. Measurement and prediction of resilient modulus of lime fly ash stabilized cohesive subgrade soils.

Lee, Yong-Woong

Columbus, OH: Ohio State University, 2003.

Notes: Features: References: 83; illus. incl. 40 tables

Descriptors: ash/ cohesive materials/ engineering properties/ experimental studies/ laboratory studies/ lime/ numerical models/ prediction/ resilient modulus/ soil mechanics/ soils/ strength/ subgrade materials/ engineering geology
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378. Mechanisms controlling soil carbon turnover and their potential application for enhancing carbon sequestration.

Jastrow, J. D.; Amonette, J. E.; and Bailey, V. L.

Climatic Change 80(1/2): 5-23. (2007); ISSN: 0165-0009

Descriptors: adsorbents/ aggregates/ calcium/ carbon/ carbon sequestration/ charcoal/ exchangeable calcium/ exchangeable cations/ fly ash/ mineral soils/ modification/ organic carbon/ organic soils/ organomineral complexes/ physicochemical properties/ pores/ soil amendments/ soil chemical properties/ soil enzymes/ soil pH/ soil physical properties/ soil structure/ soil types/ sorption/ stabilization/ chemical properties of soil/ physical properties of soil
Abstract: In addition to increasing plant C inputs, strategies for enhancing soil C sequestration include reducing C turnover and increasing its residence time in soils. Two major mechanisms, (bio)chemical alteration and physicochemical protection, stabilize soil organic C (SOC) and thereby control its turnover. With (bio)chemical alteration, SOC is transformed by biotic and abiotic processes to chemical forms that are more resistant to decomposition and, in some cases, more easily retained by sorption to soil solids. With physicochemical protection, biochemical attack of SOC is inhibited by organomineral interactions at molecular to millimeter scales. Stabilization of otherwise decomposable SOC can occur via sorption to mineral and organic soil surfaces, occlusion within aggregates, and deposition in pores or other locations inaccessible to decomposers and extracellular enzymes. Soil structure is a master integrating variable that both controls and indicates the SOC stabilization status of a soil. One potential option for reducing SOC turnover and enhancing sequestration, is to modify the soil physicochemical environment to favor the activities of fungi. Specific practices that could accomplish this include manipulating the quality of plant C inputs, planting perennial species, minimizing tillage and other disturbances, maintaining a near-neutral soil pH and adequate amounts of exchangeable base cations (particularly calcium), ensuring adequate drainage, and minimizing erosion. In some soils, amendment with micro- and mesoporous sorbents that have a high specific surface - such as fly ash or charcoal - can be beneficial. Reproduced with permission from the CAB Abstracts database.

379. Metal accumulation and growth performance of Phaseolus vulgaris grown in fly ash amended soil.

Gupta, A. K.; Dwivedi, S.; Sinha, S.; Tripathi, R. D.; Rai, U. N.; and Singh, S. N.

Bioresource Technology 98(17): 3404-3407. (Dec. 2007)

NAL Call #: TD930.A32 ; ISSN: 0960-8524

Descriptors: agricultural soils/ fly ash/ soil amendments/ soil pollution/ heavy metals/ phytoremediation/ soil properties/ physicochemical properties/ electrical conductivity/ cation exchange capacity/ soil organic carbon/ soil organic matter/ Phaseolus vulgaris/ beans/ plant growth/ biomass/ photosynthesis

Abstract: Phytoextraction of heavy metals from fly ash (FA) contaminated soil was evaluated using Phaseolus vulgaris var. T55. The results showed that electrical conductivity (EC), cation exchange capacity (CEC), organic carbon (OC) and organic matter (OM) of different amendments decreased with the addition of FA in the soil. The level of diethylene triaminepenta acetic acid (DTPA) extractable metals increased with increase in FA amendments up to 25%. However, Cr was found below detection limit in both the amendments. The metal accumulation in the plant

tissues was found in the order of Fe > Zn > Mn > Co > Ni > Pb > Cu > Cd at 25% FA. Accumulation of Fe, Mn, Ni, Cu and Co was found more in the roots while Zn, Pb and Cd were more in the aerial parts.
This citation is from AGRICOLA.

380. Metal content in soil fertilized with brown coal fly ash.

Gibczynska, M.; Meller, E.; Stankowski, S.; and Wooszyk, C.

Agronomy Research 4(2): 509-516. (2006); ISSN: 1406-894X

Descriptors: aluminium/ brown coal/ chemical composition/ cobalt/ copper/ fly ash/ industrial wastes/ iron/ lime/ magnesian limestone/ manganese/ mineral content/ nickel/ soil acidity/ soil amendments/ soil composition/ soil pH/ aluminium/ magnesium limestone/ Mn

Abstract: Studies were conducted evaluate the brown coal ash produced by Power Plant Group Patnow-Adamow-Konin for agricultural purposes, and estimate the influence of fly ash applied to light soil on the metal content of soils (aluminium, iron, manganese, copper, nickel and cobalt). The field experiment was conducted on light soil at the area of the Agricultural Experimental Station in Lipnik, Poland. The study consisted of testing 7 variants (controlburned lime (CaO) dolomite lime CaCO₃ MgCO₃, ash from 1st electrofilter zone, from 2nd electrofilter zone, from 3rd electrofilter zone and mixture of ashes from three electrofilter zones). Lime fertilizers and ashes were applied in a dose corresponding to 1.0 hydrolytic soil acidity expressed in cmol H⁺ kg⁻¹ of soil. Brown coal fly ash produced by Power Plants ZE PAK S.A., used as soil fertilizer, did not contribute to changes of content of the following metals: iron, zinc, copper, nickel, lead and cobalt in the tested soil. Soil-incorporated brown coal fly ash significantly increased the content of manganese. However, the obtained results did not exceed the allowable standard. In the soil of all fertilizer variants, where brown coal ash was applied, the content of mobile aluminium diminished. When brown coal ash produced by Power Plants ZE PAK S.A. was applied in the experiment, soil reaction changed from acid to neutral and its hydrolytic acidity decreased by ca 50%.

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381. Microbial responses to coal fly ash under field conditions.

Schutter, M. E. and Fuhrmann, J. J.

Journal of Environmental Quality 28(2): 648-652. (1999)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: alkaline phosphatase/ alkalinity/ arylsulfatase/ biological activity in soil/ coal/ denitrification/ enzyme activity/ enzymes/ fly ash/ liming/ maize/ microorganisms/ mineralization/ nitrification/ nutrients/ phosphoric monoester hydrolases/ responses/ rotations/ soil/ soil amendments/ soil enzymes/ stress/ tillage/ trace elements/ wheat/ alkaline phosphomonoesterase/ arylsulphatase/ corn/ crop rotation/ Festuca elatior/ micro organisms/ microelements/ phosphatases/ rotational cropping/ soil cultivation/ United States of America

Abstract: Field plots in Delaware, USA, received 0 or 505 t fly ash ha⁻¹ (incorporated by conventional tillage to a depth

of 40 cm) and were subsequently cropped to a fallow-maize-wheat rotation or continuous fescue (*Festuca arundinacea*). Twenty months later, during the wheat phase of the rotation, the plots were sampled (0-15 cm) and assayed for activity of soil enzymes (dehydrogenase, alkaline phosphatase, arylsulfatase, and denitrifying enzymes); numbers of aerobic heterotrophs, ammonium oxidizers, denitrifiers, and Bradyrhizobia; and N mineralization, nitrification, and denitrification potentials. Nitrification potentials doubled in fly ash-amended soils, and numbers of denitrifiers were 200-fold higher in fescue-cropped, fly ash-amended soils relative to fescue-cropped, non-amended soils. No other large differences in microbial populations or activities were found. The lack of detrimental effects on microorganisms in the field was possibly due to reductions in fly ash soluble salt and trace element concentrations with time, the mild alkalinity of the fly ash used, and the positive responses of crops to fly ash amendment.

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382. Microscopic single particle characterization of zeolites synthesized in a soil polluted by copper or cadmium and treated with coal fly ash.

Terzano, R.; Spagnuolo, M.; Medici, L.; Dorrine, W.; Janssens, K.; and Ruggiero, P.

Applied Clay Science 35(1/2): 128-138. (2007)

NAL Call #: TA455.C55; ISSN: 0169-1317

Descriptors: analysis / ash/ cadmium/ characterization/ chemical composition/ coal/ composition/ contamination/ copper/ fly ash/ formation/ heavy metals/ ions/ metals/ minerals/ pollution/ soil/ structure/ structures/ X radiation/ X ray diffraction/ zeolites/ environmental pollution/ remediation/ X rays

Abstract: In the perspective of the development of new soil remediation technologies, zeolites can be directly synthesized in soil from fused coal fly ash to reduce heavy metal mobility and availability. Such a process promotes the formation of metal hydroxide/oxide precipitates which can be also occluded inside the structure of the forming minerals. In this study, different types of zeolites (zeolite X, P, and A) were synthesized by treating soil samples, artificially contaminated by high concentrations of Cu or Cd ions, with fused coal fly ash at 30 and 60 degrees C. The formed zeolites were characterized for their amount, structure, chemical composition and size. To accomplish this survey, besides quantitative X-ray diffraction analyses (XRD), an automated single particle analysis (ASPA) method using electron probe X-ray microanalysis (EPXMA) was employed for the first time for direct zeolite characterization in soil samples. The obtained results provide new information for assessing the role of heavy metals in zeolite crystallization in coal fly ash-treated soils. Heavy metal contamination, while not significantly hindering the zeolite formation process, can influence crystal size and preferentially drive zeolite synthesis toward the formation of sodalite unit-based zeolite X and zeolite A, even at 60 degrees C. The presence and nature of metal precipitate occlusions inside the forming zeolite minerals might have also favoured the preferential synthesis of certain zeolitic structures.

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383. Mineral acquisition by maize grown in acidic soil amended with coal combustion products.

Clark, R. B.; Zeto, S. K.; Ritchey, K. D.; and Baligar, V. C. *Communications in Soil Science and Plant Analysis* 32(11-12): 1861-1884. (2001)

NAL Call #: S590.C63; ISSN: 0010-3624 [CSOSA2]

Descriptors: zea mays / fly ash/ trace element fertilizers/ coal/ combustion/ gypsum/ nutrient uptake/ nutrient content/ mineral content/ shoots/ nutrient deficiencies/ phytotoxicity/ acid soils/ calcium carbonate/ calcium sulfate/ application rate/ sulfites (salts)/ mineral nutrition/ mineral uptake/ fluidized bed wastes/ fluidized bed combustion products/ flue gas desulfurization products/ calcium sulfite

Abstract: Large amounts of coal combustion products (CCPs) are produced when coal is burned for generation of electricity. Some of these CCPs could potentially be used as soil amendments, and information about their effects on plant mineral nutrition is needed. Glasshouse experiments were conducted to test the effects of different levels of 15 CCPs and chemical grade CaCO₃, CaSO₄, and CaSO₃ added to acidic soil (Umbric Dystrochrept) on shoot calcium (Ca), sulfur (S), phosphorus (P), potassium (K), magnesium (Mg), manganese (Mn), iron (Fe), zinc (Zn), copper (Cu), and aluminum (Al) concentrations of maize (*Zea mays* L.). The CCPs consisted of two fly ashes (FAs), one CaO material, three fluidized bed combustion products (FBCs), three "non-stabilized" flue gas desulfurization products (FGDs), three "stabilized" FGDs, and three "oxidized" (FGD gypsum) FGDs. Level of CCP added to soil ranged from beneficial to detrimental effects on plants. Differences in shoot mineral element concentrations were related to kind and amount of CCP added and soil pH. Plants grown in unamended (pH 4) soil had symptoms of P and Mg deficiencies and Al toxicity. High concentrations of Ca, S, Mg, and Mn accumulated when plants were grown with some CCPs, but most mineral nutrients were at concentrations considered normal for maize. Shoot concentrations of P, K, Zn, Mn, Fe, and Al decreased when soil pH became high (>7). Even though detrimental mineral element acquisition effects were imposed on plants at high levels of CCP application, shoot element concentrations were usually normal when applied at levels near those commonly used as soil amendments.

This citation is from AGRICOLA.

384. The mineralogical characteristics of coal ash, reservoir sediments and sewage sludge and the significance for soil improvement; an example from Baotou City, Inner Mongolia, China.

Shen, J.; Li, S.; Sun, D.; and Parsons, Ian.

In: Abstracts of the ... General Meeting of the International Mineralogical Association. Edinburgh, United Kingdom.; Vol. 18.; pp. 178; 2002.

Notes: 18th general meeting of the International Mineralogical Association.

Descriptors: agriculture/ arid environment/ ash/ Asia/ Baotou China/ biochemistry/ biogenic processes/ China/ clay mineralogy/ crystal structure/ Far East/ geochemistry/ Inner Mongolia China/ lacustrine environment/ lake sediments/ nutrients / reservoirs/ sediments/ semi-arid environment / sewage sludge/ soil treatment/ soils/ solid waste/ terrestrial environment/ waste disposal/ Soils/ Environmental geology

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385. Mitotic study of radish grown on flyash amended soil.

Mishra, P. K.; Das, R. K.; and Mehta, U. C.

Cruciferae Newsletter 21: 49-50. (1999); ISSN: 0263-9459

Descriptors: cell division/ chromosome aberrations/ fly ash/ mitosis/ mutagens/ radishes/ root crops/ soil amendments/ Capparales/ chromosome abnormalities / karyokinesis

Abstract: Fly ash generated from thermal power plants is a potential pollutant, but has been suggested for use as a soil amendment. Here, information is tabulated on mitotic indices of 2 radish (*Raphanus sativus*) cultivars (Japanese White and Pusha Himani) grown on soil amended with 10 to 50% fly ash. Fly ash treatment increased the mitotic index of the radish varieties, with the 30% treatment giving the greatest number of dividing cells in both varieties. At the higher concentrations of flyash, clastogenicity and clumping of chromosomes was observed during mitotic division. Reproduced with permission from the CAB Abstracts database.

386. Mixtures of coal ash and compost as substrates for highbush blueberry.

Black, B. L. and Zimmerman, R. H.

Journal of the American Society for Horticultural Science 127(5): 869-877. (2002); ISSN: 0003-1062

Descriptors: ash/ blueberries/ chemical composition/ clay loam soils/ coal/ composts/ culture media/ fertilizers/ pH/ plant composition/ sandy soils/ chemical constituents of plants/ hydrogen ion concentration/ potential of hydrogen

Abstract: Bottom ash from a coal-fired power plant and two composts were tested as components of soil-free media and as soil amendments for growing highbush blueberry (*Vaccinium corymbosum*). Combinations of ash and compost were compared to Berryland sand, and Manor clay loam, and compost amended Manor clay loam. The pH of all treatment media was adjusted to 4.5 with sulfur at the beginning of the experiment. In 1997, plants of 'Bluecrop' and 'Sierra' were planted in 15-dm³ pots containing the pH-adjusted treatment media. The first substantial crop was harvested in 1999. At the end of the 1999 season, one half of the plants were destructively harvested for growth analysis. The remaining plants were cropped again in 2000. Yield and fruit size data were collected in both seasons, and leaf and fruit samples were collected in 1999 for elemental analysis. The presence of coal ash or composted biosolids in the media had no detrimental effect on leaf or fruit elemental content. Total growth and yield of both cultivars was reduced in clay loam soil compared to Berryland sand, whereas growth and yield of plants in coal ash-compost was similar to or exceeded that of plants in Berryland sand.

Reproduced with permission from the CAB Abstracts database.

387. Mobility and bioavailability of selected heavy metals in coal ash and sewage sludge amended acid soil.

Chaudhuri, D.; Tripathy, S.; Veeresh, H.; Powell, M. A.; and Hart, B. R.

Environmental Geology 44(4): 419-432. (July 2003)

NAL Call #: QE1.E5; ISSN: 1073-9106 [ENG0E9]

Descriptors: acid soils/ soil amendments/ fly ash/ sewage sludge/ liming/ peanuts/ *Arachis hypogaea*/ bioavailability/ chemical constituents of plants/ India/ acid lateritic soils/ coal fly ash

Abstract: A sequential extraction procedure has been used to study the changes in the distribution and mobility of Cd, Cr, Cu, Ni, Pb and Zn in an acid lateritic soil amended with alkaline coal ash and neutral sludge individually and with their mixture of equal proportions at 25, 50 and 75 Mg/ha application rates and grown in a crop with peanuts. A separate set of experiments consisting of the same treatments was repeated with the addition of lime at 2 Mg/ha. Increases in total heavy-metal levels with application of various amendments were mainly associated with increases in the insoluble and less mobile forms of metals except for Cd, which showed an increase in its exchangeable form. An increase in pH of the amended soil restricted the metal mobility in their labile forms and was more pronounced after liming the treatments. Positive yield responses were observed in the amended soil, the magnitude being higher in only sludge-applied treatments. The vegetative plant parts showed maximum accumulation of metals indicating a physiological barrier in the transfer of metals from the root to the kernel. Linear relationships of total concentrations of heavy metals in soil with that in the crop were observed. Lime addition to the treatments further reduced the transfer and accumulation of metals from the soil to the plant, even though the relationship remained linear.

This citation is from AGRICOLA.

388. The mobility of chosen pollutants from ash-sludge mixtures.

Rosik Dulewska, C.; Gowala, K.; Karwaczynska, U. ; and Szydo, E.

Polish Journal of Environmental Studies 15(6): 895-904. (2006); ISSN: 1230-1485

Descriptors: calcium/ contaminants/ fly ash/ heavy metals/ magnesium/ nitrogen/ nitrogenous compounds/ phosphorus/ pollutants/ sewage sludge/ soil amendments/ waste utilization/ waste water

Abstract: Both sewage sludge and fly ash are wastes. Their granulation can decrease their adverse effect. Due to the contents of biogens in the sewage sludge the granulates will have fertilizing and soil-forming properties. The aim of this study was to find such proportion of components used for production of ash-sludge granulates that would decrease the volume of extracted contaminants to meet the requirements of regulation preserving their amendment properties. Two types of fly ash were mixed in various proportions with municipal stabilized sewage sludge, i.e., fly ash from lignite combustion the aziska Power Plant and sewage sludge from the Zabrze-Srodmiestcie Municipal Wastewater Treatment Plant in Poland. The obtained granulates were subjected to one- and three-stage elution tests. In the eluates the concentration of nitrogen compounds, phosphorus, magnesium, calcium and heavy metals was determined. The mixture with the same share of sewage sludge and fly ash proved to be of high fertilizing value at the same time. Reproduced with permission from the CAB Abstracts database.

389. Modulation of flyash-induced genotoxicity in *Vicia faba* by vermicomposting.

Kavindra Jain; Jitendra Singh; Chauhan, L. K. S. ; Murthy, R. C.; and Gupta, S. K.

Ecotoxicology and Environmental Safety 59(1): 89-94. (2004); ISSN: 0147-6513

Descriptors: bioassays/ bioremediation/ cattle manure/ chemical analysis/ chromium/ copper/ cytogenetics/ faba beans/ fly ash/ genotoxicity/ heavy metals/ lead/ modulation/ nickel/ polluted soils/ root meristems/ roots/ seedlings/ soil pollution/ soil types/ toxicity/ vermicomposting/ zinc/ broad beans/ fava beans/ field beans/ horse beans/ tic beans

Abstract: Cytogenetic effects of pre- and postvermicomposted flyash samples were evaluated on the root meristem cells of *Vicia faba*. Seedlings of *V. faba* were directly sown in flyash and cow dung-soil mixtures (20%, 40%, 60%, and 80%) and the lateral roots grown in these test mixtures were sampled at 5 days. Negative control was run parallel in cow dung-soil (CS) mixture alone. One set of flyash-cow dung-soil (FCS) mixture was subjected to vermicomposting by introducing *Eisenia foetida* species of earthworms for 30 days and the cytogenetic effects were reinvestigated through *V. faba* root meristems. Chemical analysis carried out prior to vermicomposting revealed high concentrations of heavy metals such as Cr, Cu, Pb, Zn, and Ni in FCS samples. CS samples also showed the presence of these metals. Cytogenetic examinations of root meristems exposed to the FCS mixtures showed significant inhibition of mitotic index (MI), induction of chromosome aberrations (CA), and a significantly increased frequency of mitotic aberrations (MA). The increase of the aberrations was dependent on the flyash concentrations. Roots grown in CS samples also showed chromosomal and MAs; however, the percentage was lower than that observed with FCS and also statistically nonsignificant. Cytogenetic analysis of vermicomposted samples of FCS revealed a 15-45% decline in the aberration frequencies whereas chemical analysis showed a 10-50% decline in the metal concentrations, viz. Cr, Cu, Pb, Zn, and Ni, which indicates *E. foetida* a potential accumulator of heavy metals and the decline in metal concentrations may be the cause of the decrease in aberration frequencies. The present study indicates the genotoxicity potential of flyash and also the feasibility of vermicomposting for cleanup of metal-contaminated soil to mitigate the toxicity/genotoxicity. Reproduced with permission from the CAB Abstracts database.

390. Native grass facilitates mycorrhizal colonisation and P uptake of tree seedlings in two anthropogenic substrates.

Enkhtuya, B.; Poschl, M.; and Vosatka, M.

Water, Air and Soil Pollution 166(1/4): 217-236. (2005) NAL Call #: TD172 .W36; ISSN: 0049-6979

Descriptors: coal mine spoil/ colonization/ degraded land/ fly ash/ fungal spores/ growth/ mycelium/ mycorrhizal fungi/ mycorrhizas/ nutrient uptake/ phosphorus/ revegetation/ roots/ seedlings/ substrates/ vesicular arbuscular mycorrhizas/ arbuscular mycorrhizas/ colliery spoil/ microcosm

Abstract: Two microcosm experiments were conducted to study the role of extraradical mycelium (ERM) of arbuscular mycorrhizal fungi (AMF) in establishment and growth of tree species used for revegetation in anthropogenic substrates. Inoculated or non-inoculated *Acer pseudoplatanus*, *Alnus glutinosa* or *Salix purpurea* seedlings were grown with *Calamagrostis epigejos* (a grass spontaneously colonizing degraded ecosystems) in two substrates (fly ash and coal mine spoil) either in direct root contact or in rhizoboxes with interaction only via ERM network. In both

experiments, inoculation with AMF mostly had a positive effect on the growth of trees and increased the aggregation of fly ash. When plants grew in direct root-to-root contact, grass presence negatively affected tree growth, but it significantly improved mycorrhizal development (colonization of tree seedlings, spore number and ERM length). When grass and tree roots interacted via the ERM network, tree seedlings were successfully colonized by the ERM spreading from the *C. epigejos* roots. Mechanical disturbance of the ERM links between plants reduced AMF development and tree height in both substrates, but tree shoot biomass was not affected. In fly ash, inoculated, non-disturbed treatments showed significant transfer of 32P from the grass to the tree seedlings. It can be concluded that roots of *A. pseudoplatanus*, *A. glutinosa* or *S. purpurea* seedlings can be colonized from the ERM network radiating from quickly growing grasses, which can act as important agents for AMF distribution and facilitate mycorrhization of planted trees. In particular for willow, grass seems to be an essential nurse plant to achieve successful root colonization.

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391. Numbers of microorganisms and enzymatic activity in soil polluted by coal ash.

Kuczynska, L.

Roczniki Gleboznawcze (Poland) 54(1-2): 99-106. (2003); ISSN: 0080-3642.

Notes: Original title: Liczebność drobnoustrojów i aktywność enzymatyczna gleby skażonej popiołem z węgla kamiennego. 4 fig., 3 tables; 22 ref. Summary (En). Citation notes: PL (Poland).

Descriptors: microorganisms/ enzymatic activity/ soils/ coal ash

Abstract: The effects of soil pollution with coal ash on the number and enzymatic activity of soil microorganisms were investigated. Soil samples were treated with three different rates of ash and two rates of nitrogen fertilization. Coal fly ash pollution resulted in increase of soil fungi and cellulolytic microorganisms and the simultaneous decrease of *Azotobacter* spp. Coal ash enhances the urease activity in the soil whereas phosphatases activity remains unaffected. The nitrogen level determines the yield of the studied plants but not presence of coal ash.

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392. Nutrient dynamics, dehydrogenase activity, and response of the rice plant to fertilization sources in an acid lateritic soil.

Rautaray, S. K.

Acta Agriculturae Scandinavica: Section B, Soil and Plant Science 55(3): 162-169. (2005)

NAL Call #: 11 Ac82 ; ISSN: 0906-4710

Descriptors: acid soils/ ammonium nitrogen/ application methods/ application rates/ crop growth stage/ crop yield/ enzyme activity/ flooded rice/ flooding/ fly ash/ green manures/ lateritic soils/ microbial activities/ NPK fertilizers/ nutrient availability/ nutrient content/ nutrient uptake/ organic carbon/ organic fertilizers/ oxidoreductases/ phosphorus / plant nutrition/ potassium/ rice/ rice straw/ sandy loam soils/ soil enzymes/ soil organic matter/ soil pH/ soil types/ straw/ use efficiency/ ammonia nitrogen/ flooded conditions/ organic matter in soil/ paddy/ redox enzymes

Abstract: Rice variety IR 36, grown under flooding, was

studied during June-October 1998 at the experimental farm of the Indian Institute of Technology, Kharagpur (West Bengal, India) to determine the effects of fly ash, organic, and inorganic fertilizers on changes in pH and organic carbon, release of nutrients ($\text{NH}_4^{+}\text{-N}$, Bray's P, and $\text{NH}_4\text{OAc K}$), and dehydrogenase activity in an acid lateritic (sandy loam) soil at 15-day intervals. Application of fly ash at 10 t ha^{-1} alone did not improve the availability of $\text{NH}_4^{+}\text{-N}$, or P, as well as the rice grain yield. Availability of $\text{NH}_4^{+}\text{-N}$ ($35.3\text{-}36.9\text{ mg kg}^{-1}$), and P ($12.3\text{-}14.6\text{ mg kg}^{-1}$) at 15 days after transplanting, and rice grain yields ($48.0\text{-}51.7\text{ g per pot}$) were similar under the various fertilizer application sources such as inorganic fertilizer alone, inorganic fertilizer+fly ash or inorganic fertilizer+green manure (with *Sesbania rostrata*)+fly ash. Mean dehydrogenase activity was the highest ($8.47\text{ micro g triphenyl formazon g}^{-1}\text{ 24 h}^{-1}$) under the mixed fertilizer application treatments with green manure. At the end of the cropping season (75 days after transplanting), pH, organic carbon, and dehydrogenase activity were higher under the mixed fertilizer application treatments involving green manure by 3, 15 and 154%, respectively, compared with the inorganic fertilizer alone.

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393. Nutrient flux in a submerged rice soil amended with organics and industrial wastes: An incubation study.

Bhuvaneswari, R.; Sriramachandrasekharan, M. V.; and Ravichandran, M.

Journal of Interacademia 10(2): 197-202. (2006); ISSN: 0971-9016

Descriptors: application rates/ clay loam soils/ electrical conductivity/ electrochemistry/ farmyard manure/ filter cake/ fly ash/ green manures/ industrial wastes/ nitrogen/ nutrient availability/ nutrients/ nutritional state/ organic amendments/ organic carbon/ phosphorus/ potassium/ rice soils/ soil amendments/ soil fertility/ soil pH/ soil types/ sulfur/ Vertisols/ wetland soils/ clarification mud/ elemental sulphur/ FYM/ Madras/ nutritional status/ pressmud/ sulphur

Abstract: An incubation experiment was conducted in a clay loam soil (Kondal series; Typic Haplusterts) to investigate the nutrient flux from press mud, fly ash, green manure and farmyard manure (FYM) incorporated in rice soil over 60 days period. Soil samples were collected from the wetland farm of Annamalai University, Tamil Nadu, India. All wastes were incorporated at the rate of 12.5 t/ha and samples were drawn in duplicate at 15, 30, 45 and 60 days after incubation (DAI). Results revealed that soil pH and available sulfur increased up to 45 DAI, electrical conductivity, organic carbon and available K increased up to 60 DAI while available N and P increased up to 30 and 15 DAI, respectively. Farmyard manure recorded higher soil pH and EC. While pressmud recorded higher release of organic carbon, available N, P, K and S followed by green manure and fly ash.

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394. Nutrient management in paddy through low cost inorganic sources in a sodic soil.

Dinesh Kumar and Sharma, K. N.

Annals of Agri Bio Research 12(2): 145-150. (2007); ISSN: 0971-9660

Descriptors: application rates/ crop yield/ electrical conductivity/ fertilizers/ fly ash/ gypsum/ mineral content/ nitrogen/ nutrient content/ phosphorus/ potassium/ reclamation/ rice/ sodic soils/ soil amendments/ soil fertility/ soil pH/ soil types/ paddy

Abstract: A greenhouse experiment was conducted at Ludhiana, Punjab, India, for three years to explore the feasibility of using coal fly ash for reclamation of sodic soils and determine the effect of duration of pre-submergence on the yield and mineral composition in paddy crop. The treatments comprised three levels of fly ash (F_0 , $F_{4.0}$ and $F_{8.0\%}$), two pre-submergence periods (S_0 and S_1) and two levels of basal rates of fertilizers (R_{100} and $R_{120\%}$ of the recommended). There was a slight reduction in soil pH. Soil electrical conductivity decreased significantly with the addition of fly ash. The sodium adsorption ratio of the soil decreased with increasing fly ash levels, while one week pre-submergence considerably added to its favourable effects. Fly ash application increased the available elemental status of N and K, but decreased P in the soil. Application of fly ash also increased the concentration of elements except P in the seeds and straw of paddy. Application of fly ash (4%) with one week pre-submergence period increased the yield attributing characters as well as yield of paddy. At one week pre-submergence period, no significant difference in the yield and its attributing characters occurred between 100 and 120% of recommended basal rate of fertilizer application. The results indicated that gypsum could possibly be substituted with the addition of 4% acidic fly ash with one week pre-submergence period for the reclamation of waterlogged sodic soil. Reproduced with permission from the CAB Abstracts database.

395. Nutrient uptake by blackgram as influenced by integrated use of inorganic fertilisers and industrial wastes.

Deepa, B. and Poonkodi, P.

Advances in Plant Sciences 17(1): 243-245. (2004)

NAL Call #: QK1.A38; ISSN: 0970-3586

Descriptors: agrichemicals/ horticulture: agriculture/ nutrition/ soil science/ Leguminosae: angiosperms, dicots, plants, spermatophytes, vascular plants/ clay loam soil/ recommended dose

Abstract: A field experiment was conducted on a clay loam soil to study the effect of inorganic fertilizers, lignite fly ash (LFA) and press mud (PM) on nutrient uptake of blackgram. The results revealed that application of 100% recommended dose of fertilizers (RDF) along with LFA @ 5t ha⁻¹ and press mud @ 6t ha⁻¹ significantly enhanced the nutrient uptake and yield in blackgram. This was followed by 75% RDF. But 100 and 75% RDF were comparable with each other when applied along with LFA @ 5t ha⁻¹ and 6t ha⁻¹ on benefit : cost ratio basis.

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396. Nutrient use efficiency of sabai grass-legumes intercropping system grown under integrated nutrient management.

Manisha Basu; Bhadoria, P. B. S.; Mahapatra, S. C.; and Das, S.

Environment and Ecology 25S(Special 4): 1065-1067. (2007)

NAL Call #: TD172.E5; ISSN: 0970-0420

Descriptors: acid soils/ black gram/ cropping systems/ farmyard manure/ fly ash/ groundnuts/ intercropping/ lateritic soils/ legumes/ lime/ nitrogen/ NPK fertilizers/ nutrients/ phosphorus/ plant nutrition/ potassium/ soil types/ use efficiency/ FYM/ peanuts

Abstract: Effect of integrated nutrient management on nutrient use efficiency (NUE) of sabai grass-legumes intercropping system was studied for three years (2003-2005) on the acid lateritic uplands of West Bengal in eastern India under rainfed condition. Chemical fertilizers (CF) at 50:25:25 kg NPK/ha respectively alone and in conjunction with farmyard manure (FYM), along with lime and fly ash (FA) were tested on sole sabai grass, sabai grass-groundnut and sabai grass-blackgram intercropping system. Results revealed that NUE for N, P and K was higher under sabai grass-legume intercropping system as compared to sole sabai grass. Integrated use of CF, FYM and FA resulted in maximum NUE, which was comparable with FYM + lime + CF.

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397. Occurrence of trace elements in coal ash and sludge amended soils in India.

Datta, S.; Hart, B.; Powell, M. A.; Fyfe, W. S.; and Tripathy, S.

In: Ninth annual V. M. Goldschmidt conference. Cambridge, MA, United States.) Agee, C.; Bowers, T.; Bowring, S. A.; Frey, F. A.; Hayes, J. M.; Holland, H.; Jacobsen, S. B.; McDonough, W. F.; Murray, R.; Rudnick, R. L.; Shimizu, N.; Schrag, D. P.; and Van Baalen, M. (eds.)

Report: LPI-CONTRIB-971: LPI Contribution; pp. 66-67; 1999.

Descriptors: ash/ Asia/ geochemistry/ India/ Indian Peninsula/ laterites/ monitoring/ pH/ pollution/ sampling/ sludge/ soil pollution/ soils/ spectra/ toxicity/ trace metals/ waste disposal/ X-ray diffraction data/ X-ray photoelectron spectra/ Geochemistry of rocks, soils, and sediments/ Soils/ Environmental geology

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398. Optimizing fly-ash dose for better tree growth and nutrient supply in an agroforestry system in semi-arid tropical India.

Ramesh, V.; Korwar, G. R.; Mandal, U. K.; Sharma, K. L.; and Venkanna, K.

Communications in Soil Science and Plant Analysis 38(19-20): 2747-2766. (2007)

NAL Call #: S590.C63; ISSN: 0010-3624

Descriptors: fly ash/ Alfisols/ soil fertility/ tree growth/ agroforestry/ nutrient availability/ plant nutrition/ plant micronutrients/ minerals/ heavy metals/ composts/ *Leucaena leucocephala*/ *Tectona grandis*/ phosphorus/ potassium/ calcium/ sodium/ exchangeable aluminum/ India

Abstract: Research on fly-ash utilization in dryland Alfisols in semi-arid tropical India may help successful establishment of agroforestry systems. A field study was conducted during 2001-2004 with the objective of evaluating fly-ash using different levels (0, 17, 33, and 66% v/v) in tree microsites along with compost and tank silt mixtures. Specifically, the focus was to find the optimum dose of fly-ash mixtures for tree growth and nutrient release with time of both essential and heavy elements in fly-ash and soil: phosphorus (P), potassium (K), calcium (Ca), sodium (Na), aluminium (Al), zinc (Zn), and cadmium (Cd)

and their effect on plant tissues with respect to copper (Cu), Zn, Cd, nickel (Ni), chromium (Cr), and lead (Pb). The changes in plant-available or extractable status of elements and the growth of two major tree species viz., teak (*Tectona grandis*) and leucaena (*Leucaena leucocephala*) were monitored at 6-month intervals during 2002-2004 in an agrisilvicultural system. Pit mixtures with 66% fly-ash by volume of pit significantly increased the tree growth of teak throughout the study period. For leucaena, it positively influenced the growth at initial stages. The dose increased the status of available P, K, Ca, and Na during the study period. The exchangeable Al and available Zn content of microsites corresponding to the dose significantly increased during 2001 - 2003 but the levels were less than the toxic limits. The available Cd content showed an increase only during the initial stage of the study period. The variation in heavy-metal content (Cu, Cd, Cr, Ni, Pb, and Zn) in plant tissues among the different treatments was found to be nonsignificant.

This citation is from AGRICOLA.

399. Particulate and dissolved phosphorus chemical separation and phosphorus release from treated dairy manure.

Dao, T. H. and Daniel, T. C.

Journal of Environmental Quality 31(4): 1388-1398. (2002)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: aluminium/ aluminium sulfate/ animal wastes/ cattle manure/ electrical conductivity/ fly ash/ immobilization/ iron/ nitrogen/ organic amendments/ phosphorus/ polymers/ soil acidity/ soil types/ suspended solids/ Ultisols/ waste treatment/ aluminium sulphate/ aluminum / aluminum sulfate/ livestock wastes

Abstract: In confined animal feeding operations, liquid manure systems present special handling and storage challenges because of the large volume of diluted wastes. Water treatment polymers and mineral phosphorus (P) immobilizing chemicals [$\text{Al}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}$, $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$, and Class C fly ash] were used to determine particulate and dissolved reactive phosphorus (DRP) reduction mechanisms in high total suspended solid (TSS) dairy manure and the P release from treated manure and amended soils. Co-application exceeded the aggregation level achieved with individual manure amendments and resulted in 80 and 90% reduction in metal salt and polymer rates, respectively. At marginally effective polymer rates between 0.01 and 0.25 g litre⁻¹, maximal aggregation was attained in combination with 1 and 10 g litre⁻¹ of aluminium sulfate (3 and 30 mmol Al^{3+} litre⁻¹) and iron chloride (3.7 and 37 mmol Fe^{3+} litre⁻¹) in 30 g litre⁻¹ (TSS30) and 100 g litre⁻¹ TSS (TSS100) suspensions, respectively. Fly ash induced particulate destabilization at rates ≥ 50 g litre⁻¹ and reduced solution-phase DRP at all rates ≥ 1 g litre⁻¹ by 52 and 71% in TSS30 and TSS100 suspensions, respectively. Aluminium and Fe salts also lowered DRP at rates ≤ 10 g litre⁻¹ and higher concentrations redispersed particulates and increased DRP due to increased suspension acidity and electrical conductivity. The DRP release from treated manure solids and a Typic Paleudult amended with treated manure was reduced, although the amendments increased Mehlich 3-extractable P. Therefore, the synergism of flocculant types allowed input reduction in

aggregation aid chemicals, enhancing particulate and dissolved P separation and immobilization in high TSS liquid manure.

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400. Performance of seed germination and growth of *Vicia faba* L. in fly ash amended soil.

Rai, U. N.; Gupta, D. K.; Akhtar, M.; and Amit Pal

Journal of Environmental Biology 24(1): 9-15. (2003)

NAL Call #: QH540.J65 ; ISSN: 0254-8704

Descriptors: application rates/ faba beans/ fly ash/ growth stages/ metal tolerance/ seed germination/ seedling growth/ soil amendments/ survival/ toxic substances/ broad beans/ fava beans/ field beans/ horse beans/ poisons/ tic beans

Abstract: This study was conducted to assess the feasibility of growing *Vicia faba* in soils amended with fly ash. The difference between the growth performance and tolerance of *V. faba* under different fly ash concentrations were compared. Results showed that amending the soil with fly ash at low concentration improved growth during the initial stage but inhibit growth at higher concentration. Although no difference was observed in survival rates, the seedling growth was low in control plants. Fly ash delayed the nodulation, and less nodules were recorded at higher concentration. It is suggested that *V. faba* can be grown in areas contaminated with fly ash.

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401. Permissible concentrations of arsenic and lead in soils based on risk assessment.

Dudka, S. and Miller, W. P.

Water, Air and Soil Pollution 113(1-4): 127-132. (July 1999)

NAL Call #: TD172 .W36; ISSN: 0049-6979 [WAPLAC]

Descriptors: soil pollution/ polluted soils/ arsenic/ lead/ land application/ fly ash/ sewage sludge/ silt loam soils/ wheat soils/ risk assessment/ children/ environmental exposure/ biosolids/ corn soils

This citation is from AGRICOLA.

402. Persistency of bacterial indicators in biosolids stabilization with coal fly ash and lime.

Wong, J. W. C.; Fang Min; and Jiang RongFeng

Water Environment Research 73(5): 607-611. (2001)

NAL Call #: TD419.R47 ; ISSN: 1061-4303

Descriptors: application to land/ biological activity in soil/ biological indicators/ bioremediation/ coal/ coliform bacteria/ fly ash/ lime/ liming/ pathogens/ pH/ sewage sludge/ soil amendments/ soil bacteria/ stabilization/ hydrogen ion concentration/ land application/ microbial communities/ potential of hydrogen

Abstract: Alkaline coal fly ash and lime were tested for their effectiveness in pathogen removal from biosolids at different time intervals and temperatures. Coal fly ash at 10 and 35% w/w was mixed with dewatered biosolids and then the ash-biosolids mixture was mixed separately with 0, 1.1, 2.2, 4.4, 8.5, 11, and 18% calcium oxide (w/w on a dry weight basis) with and without heating to 55 degrees C. Total bacteria, Salmonella, and total coliforms were monitored at various time intervals. Both ash-biosolids mixtures with or without lime amendment had a significantly

lower total bacterial population than the biosolids control, but the residual indigenous bacterial flora in the ash and lime stabilized biosolids still maintained a population of greater than 10^4 g⁻¹ dry biosolids. Alkaline-stabilized biosolids with a lime amendment rate greater than 8.5% could maintain pH greater than or equal to 12 for more than 2 hours, which effectively removed total coliforms and Salmonella in the mixture. Heat treatment to 55 degrees C and a storage time of 14 days provided an added advantage resulting in a further reduction in pathogens for all treatments. It is recommended that 10% ash-biosolids mixture should be amended with a minimum of 8.5% lime on a dry weight basis for at least 2 hours to achieve acceptable levels of Salmonella and total coliforms to ensure no pathogenic risk following land application. Reproduced with permission from the CAB Abstracts database.

403. Petroleum coke circulating fluidized bed combustion product as a sulfur source for alfalfa.

Chen, L.; Kost, D.; and Dick, W. A.

Communications in Soil Science and Plant Analysis 39(13-14): 1993-2008. (2008)

NAL Call #: S590.C63; ISSN: 00103624 [CSOSA].

Notes: doi: 10.1080/00103620802134826.

Descriptors: alfalfa/ flue gas desulfurization/ nickel/ plant sulfur nutrient/ soil sulfur/ trace elements/ vanadium/ alfalfa/ combustion/ environmental impact/ nickel/ nutrient/ petroleum/ soil pollution/ sulfur/ trace element/ vanadium/ medicago sativa

Abstract: Petroleum coke circulating fluidized bed (CFB) combustion product is created when petroleum coke is combusted with limestone in a circulating fluidized bed boiler. The CFB product contains high concentrations of sulfur (S), nickel (Ni), and vanadium (V). Using it as a S source is encouraged, but little information is available related to plant responses and environmental impact. The CFB product was applied at rates of 0, 11, 33, and 110 kg S ha⁻¹ to two agricultural soils (Canfield silt loam and Wooster silt loam). Dry weight of alfalfa (*Medicago sativa* L.) and S in plant tissue was increased by the S treatments. Concentrations in alfalfa of V were increased but did not reach environmental concern levels. Concentrations in alfalfa of Ni were not increased. In the soils, only total S and plant available S were increased by these materials. No soil contamination problems were observed when CFB product was used as an S source. Copyright © Taylor & Francis Group, LLC.

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404. [Phosphate adsorption and desorption characteristics of several fly ashes].

Feng, Y.; Hu, R.; Zhang, Y.; Zou, Y.; Huang, Y.; Wang, C.; and Li, F.

Ying Yong Sheng Tai Xue Bao 16(9): 1756-60. (Sept. 2005); ISSN: 1001-9332 .

Notes: Original language of article: Chinese.

Descriptors: adsorption/ carbon: chemistry/ coal/ incineration/ particulate matter: chemistry/ phosphates: chemistry

Abstract: Through adsorption-desorption experiment and incubation test, this paper studied the phosphate adsorption and desorption characteristics of several fly ashes. The test fly ashes contained 0.545 - 4.540 g x kg⁻¹

of total P and 19.55 - 163.0 mg x kg⁻¹ of available P, which were significantly higher than those in soils. The P adsorption capacity of fly ashes increased with increasing added P, while their P adsorption rate was in adverse. Fly ashes had a higher P adsorption rate but a lower P desorption rate than soils, mainly because fly ashes had more P adsorption sites and stronger bound energy. In this study, Langmuir, Freundlich, and Temkin equations were fit to the measured data, and the MBC value in Langmuir equation, a value in Freundlich equation, and k₂ value in Temkin equation could be used as a comprehensive index to characterize the potential phosphate adsorptivity of fly ashes. The larger these values were, the stronger the P adsorptivity was. The MBC, a and k₂ value of 5 fly ashes collected from different locations was in order of Xiangtan power factory (5 167.7, 4 056.2 and 831.5) > Yueyang paper factory (1 650.7, 2803.4 and 711.9) > Huaneng power factory (303.0, 1677.6 and 368.7) > Zhuzhou power factory (34.7, 413.48 and 213.8) > Dongting nitrogen fertilizer factory (34.7, 413.48 and 213.8). The P fixation by fly ashes generally increased with their increasing water content, and their phosphate adsorption was mainly specific adsorption and chemical precipitation, suggesting that the P fixation and the water content of fly ashes should be considered when fly ash was used as soil amendment or as compound fertilizer filling substance.

This citation is from PubMed.

405. Phosphorus adsorption characteristics in a flyash amended Vertisol.

Veeresh, H.; Patil, C. V.; Vishwanath, J.; and Doyel Chaudhuri

Journal of the Indian Society of Soil Science 49(2): 255-259. (2001)

NAL Call #: 56.9 IN2; ISSN: 0019-638X

Descriptors: adsorption/ application rates/ desorption/ fly ash / phosphorus/ soil amendments/ soil chemical properties/ Vertisols/ chemical properties of soil

Abstract: A laboratory experiment was conducted to study the adsorption of added phosphorus in a Vertisol amended with different rates of wet and dry fly ashes (0-30% w/w). The adsorption data were fitted to Langmuir isotherm. The phosphorus (P) adsorption maxima (b) varied greatly with the type of soil-ash mixture. Among fly ashes, dry fly ash had more effect on P adsorption than wet fly ash. Fly ashes had little effect on P desorption except at higher ash rates (20% or more). The soil-ash mixtures even though had high P adsorption capacity, because of very low bonding energy, most part of the adsorbed P was easily desorbable. Supply parameter value varied with the type of soil-ash mixture and also with the equilibrating P concentration. Reproduced with permission from the CAB Abstracts database.

406. Physical and chemical properties of fragipan horizon materials amended with fluidized bed combustion ash.

Rhoton, F. E; Edwards, J. H; and Norton, L. D

Soil Science 166(7): 465-474. (July 2001)

NAL Call #: 56.8 So3; ISSN: 0038-075X.

Notes: References: 22; illus. incl. 5 tables.

Descriptors: Alfisols / alkaline earth metals/ amendments/ amorphous materials/ ash/ chemical properties/ fragipans/ Fraglossudalfs/ Gulf Coastal Plain/ Holly Springs

Mississippi/ magnesium/ Marshall County Mississippi/
metals/ Mississippi/ pedogenesis/ pH/ physical properties/
regression analysis/ silica/ silicon/ slaking/ soil
management/ soil treatment/ soils/ statistical analysis/
strength/ United States/ Soils
© American Geological Institute

407. Physical and chemical properties of Koradi fly ash of Maharashtra for its utilization in agriculture.

Dubey, P. N.; Sangal, S. P.; Sen, T. K.; Chatterji, S.; Murali, S.; and Patil, V. P.

Agropedology (India) 9(1): 71-76. (June 1999); ISSN: 0971-1570.

Notes: 5 tables, 2 ref. Summary (En); Citation Notes: In (India); NBSS&LUP, Nagpur 440010, India.

Descriptors: physical properties/ chemical properties/ fly ash/ agriculture

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408. Physico-chemical properties of vertisols as affected by fly ash and fym under sweet potato.

Birajdar, R. R.; Chalwade, P. B.; Badole, S. B.; Shelage, B. S.; and Hangarge, D. S.

Journal of Soils and Crops 11(1): 63-65. (2001); ISSN: 0971-2836

Descriptors: bulk density/ electrical conductivity/ farmyard manure/ fly ash/ infiltration/ physicochemical properties/ porosity/ sweet potatoes/ Vertisols/ water holding capacity/ FYM

Abstract: The effect of fly ash and farmyard manure on physicochemical properties of Vertisols were evaluated under sweet potato cultivation in Maharashtra, India. Bulk density, porosity and infiltration rate were improved significantly with increasing doses of fly ash from 5-15 t/ha. The application of farmyard manure also indicated that significant decreased in bulk density from 1.28 g/cm³ in control to 1.91 g/cm³ due to application of farmyard manure at 10 and 15 t/ha, respectively. Increasing level of farmyard manure increased porosity, water holding capacity, electrical conductivity and organic carbon content in soil. Reproduced with permission from the CAB Abstracts database.

409. Physiological responses of certain ornamental plants to sludge and artificial topsoils derived from flyash, sludge, and Rengam series subsoil.

Tan, L. P.; He, J.; and Lee, S. K.

Journal of Plant Nutrition 22(6): 987-999. (1999)

NAL Call #: QK867.J67 ; ISSN: 0190-4167 [JPNUDS]

Descriptors: ornamental plants/ plant physiology/ fly ash/ subsoil/ topsoil/ heavy metals/ chemical composition/ chlorophyll/ fluorescence/ symptoms/ phytotoxicity/ soil organic matter/ metal tolerance/ species differences/ sludges

Abstract: In this study, four artificial topsoil mixtures were produced by mixing incinerator flyash, sewage sludge, and subsoil (from granite origin) in various proportions. Each mixture had a different heavy metal content. Both sludge and the artificial topsoils were used to grow certain ornamental plants, namely, *Bougainvillea spectabilis*, *Ixora coccinea*, and three *Heliconia* taxa: *H. psithacorum* x *H. spathocircinata* cv. "Golden Torch", *H. rostrata* and *H. psithacorum* cv. "Tay". Their physiological responses were monitored using chlorophyll fluorescence Fv/Fm ratio and their general appearance was also recorded. All the five

plants grown in sludge were observed to show no symptoms of heavy metal toxicity. However, it was found that *I. coccinea* and all three *Heliconias* were susceptible to heavy metal toxicity when grown in all the four mixtures of artificial topsoil. *Bougainvillea spectabilis* is capable of tolerating the heavy metal present in the artificial topsoil with the least amount of heavy metals but they showed different levels of toxicity symptoms when grown at the other three mixtures with higher heavy metal content. These findings indicate that *B. spectabilis* is the most tolerant plant to heavy metals among the tested plants grown in the different artificial topsoils. This citation is from AGRICOLA.

410. Plant and soil responses to field-applied flue gas desulfurization residue.

Sloan, J. J.; Dowdy, R. H.; Dolan, M. S.; and Rehm, G. W. 78(2): 169-174. (1999); ISSN: 00162361 [FUELA]

Descriptors: alfalfa/ boron/ FGD residue/ molybdenum/ sulfur/ boron/ crops/ cultivation/ desulfurization/ flue gases/ molybdenum/ silt/ soils/ sulfur/ flue gas desulfurization (FGD)/ waste utilization

Abstract: The objective of this study was to document the availability of flue gas desulfurization (FGD) residue-borne boron (B), sulfur (S), and molybdenum (Mo) for alfalfa (*Medicago sativa* L.) uptake when applied at agronomic rates to marginally B deficient soils. The FGD residue was applied at rates of 0, 0.46 and 3.75 Mg ha⁻¹ on a silt loam soil immediately prior to alfalfa seeding. Alfalfa yields were unaffected by these rates of residue applications, but shoot concentrations of B and S in the second cutting, and B, S, and Mo in the third cutting were increased by residue applications. Hence, FGD residue is a readily available B source, particularly later in the growing season when native soil B availability decreased. _ 1998 Elsevier Science Ltd. © 2009 Elsevier B.V. All rights reserved.

411. Plant growth response in experimental soilless mixes prepared from coal combustion products and organic waste materials.

Bardhan, Sougata; Watson, Maurice; and Dick, Warren A. *Soil Science* 173(7): 489-500. (July 2008)

NAL Call #: 56.8 So3; ISSN: 0038-075X

Descriptors: soil amendments/ coal fly ash/ composted manure/ cattle manure/ yard waste composts/ biosolids composts/ soilless media/ soilless culture/ water content/ pH/ gypsum/ peat/ perlite/ plant growth/ *Lolium perenne*/ *Cupressus sempervirens*/ coal combustion products/ bottom ash

This citation is from AGRICOLA.

412. Plant nutrient availability from mixtures of fly ashes and biosolids.

Schumann, A. W. and Sumner, M. E.

Journal of Environmental Quality 28(5): 1651-1657. (1999)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: adsorption/ analysis/ application rates/ chemical analysis/ deficiency/ extraction/ fly ash / maize/ manures/ mixtures/ nutrient availability/ nutrient balance/ nutrient deficiencies/ nutrition/ phytotoxicity/ plant nutrition/ poultry manure/ sewage/ sewage sludge/ sludges/ soil fertility/ wastes/ corn/ poultry litter

Abstract: Two greenhouse experiments were established using 24 different fly ashes with sewage sludge and poultry manure to estimate nutrient availability and imbalances to

maize. The maximum maize growth attained with fly ash amendment of 80 t ha⁻¹ was significantly less (50%) than a fertilized control treatment. The additional growth improvements obtained from mixtures with sewage sludge or poultry manure ranged from 30 to 49% and 30 to 71%, respectively. Organic materials applied alone achieved only 54 and 62% of the maximum potential, while growth on poultry manure mixtures was up to 94% of the best performing fertilized treatment. Results of foliage and soil analyses suggest that P and K were the main nutrient deficiencies, while B phytotoxicity and an imbalance in the K:Ca:Mg ratio also were likely causes of plant growth reduction. Fly ashes did not contribute significant P or K to correct soil and plant deficiencies, but more often exacerbated the imbalances by precipitation or adsorption of soil P. Sewage sludge mixed at 26% and poultry manure at 13% (DM [dry matter]) with fly ash had negligible effect on availability of phytotoxic fly ash B, but were good sources of P (both) and K (poultry manure). Good agreement between plant nutrition in pot experiments and previous laboratory extraction studies implies that chemical analysis, efficient formulation and optimized application rates may overcome nutrient limitations for use of wastes as fertilizer substitutes.

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413. Plant uptake of selenium arsenic and molybdenum from soil treated with coal combustion byproducts.

Codling, E. E. and Wright, R. J.

Fresenius Environmental Bulletin 7(1/2): 118-125. (1998); ISSN: 1018-4619

Descriptors: arsenic/ byproducts/ coal/ combustion/ fly ash/ molybdenum/ plant composition/ risk assessment/ selenium/ soil/ uptake/ chemical constituents of plants/ Mo
Abstract: Three coal combustion byproducts, fly ash (FA), scrubber sludge (SS) and gypsum (G), added to soil at rates of 0, 20, 40 and 80 g/kg only limited annual ryegrass (*Lolium multiflorum*) growth at the 80 g/kg rate. FA and SS increased selenium (Se), arsenic (As) and molybdenum (Mo) concentrations in ryegrass but only Se from FA would present a potential food chain risk. G did not significantly increase ryegrass concentrations of Se, As and Mo and should not produce elevated trace element levels in plant material or the environment when added to soil at high rates.

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414. Plasticity and density-moisture-resistance relations of soils amended with fly ash.

Mapfumo, E. and Chanasyk, D. S.

Environmental Technology 19(6): 543-554. (1998)

NAL Call #: TD1.E59; ISSN: 0959-3330

Descriptors: bulk density/ clay loam soils/ fly ash/ loam soils / plasticity/ sandy loam soils/ soil amendments/ soil compaction/ soil types/ soil water content

Abstract: The impact of fly ash amendments on the plasticity, water retention and penetration resistance-density-moisture relationships of sandy loam, loam and clay loam soils in Alberta, Canada, was studied to determine the potential compaction of soil/fly ash mixtures if they were worked at different moisture ranges. For all soils the addition of fly ash decreased the plasticity index, but slightly increased the Proctor maximum density. This implies that

fly ash amendments reduce the range of moisture within which soils are most susceptible to compaction. However, for the sandy loam and loam textured soils amended with fly ash, cultivation must be avoided at moisture contents close to field capacity since maximum densification occurs at these moisture contents. In all three soils the addition of fly ash increased water retention, especially in the sandy loam. Correlation analysis showed significant ($P \leq 0.05$) positive correlation between critical moisture content and field capacity, critical moisture content and plastic limit, and plastic limit and field capacity. Fly ash amendments increased penetration resistance of the clay loam, but decreased penetration resistance of the sandy loam. For the loam there was an inconsistent response of penetration resistance to fly ash additions. Regression analysis showed that penetration resistance of sandy loam/fly ash mixtures and loam/fly ash mixtures was significantly ($P \leq 0.05$) dependent on bulk density. For the clay loam/fly ash mixtures penetration resistance was significantly ($P \leq 0.05$) dependent on bulk density and volumetric moisture content. Reproduced with permission from the CAB Abstracts database.

415. Pollution character analysis of filling reclaimed soil with fly ash in subsided land; a case study in Henan, China.

Hu Zhenqi; Wei Zhongyi; and Qin Ping

China Environmental Science 24(3): 311-315. (2004); ISSN: 1000-6923.

Notes: Language: Chinese. References: 7; illus. incl. 4 tables. Original journal title: Zhonggou Huanjing Kexue.
Descriptors: ash/ Asia/ case studies/ China/ Far East/ geologic hazards / heavy metals/ Henan China/ land subsidence/ pollution/ properties/ reclamation/ soils/ environmental geology

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416. Possibility of using flyash as a source of silica for increasing rice productivity on a reclaimed alkali soil.

Mongia, A. D.; Chhabra, R.; and Khajanchi Lal

Journal of the Indian Society of Soil Science 51(1): 89-91. (2003)

NAL Call #: 56.9 IN2; ISSN: 0019-638X

Descriptors: Alfisols/ alkaline soils/ crop yield/ fly ash/ leaching/ nutrient availability/ nutrient uptake/ plant nutrition/ reclaimed soils/ reclamation/ rice/ rice straw/ silica/ soil amendments/ soil types/ straw/ paddy

Reproduced with permission from the CAB Abstracts database.

417. Possible incentive to diffuse desulfurization equipment in China.

Nitta, Y.; Sadakata, M.; Matsumoto, S.; and Yoshioka, K. 85(3): 191-196. (2006); ISSN: 09168753 [NENGE].

Notes: Language of Original Document: Japanese.

Descriptors: Gypsum/ Soil remediation/ Briquetting/ Byproducts/ Coal combustion/ Coal fired boilers/ Flue gases/ Gypsum/ Soil pollution control/ Alkaline soil/ Bio-briquette/ Soil degradation/ Soil remediation/ Desulfurization

Abstract: This paper describes our challenge to diffuse desulfurization equipments such as flue gas desulfurization (FGD) plants or bio-briquettes in Shenyang, China. Gypsum, which is a major material in by-product from the desulfurization process or burnt ash of the bio-briquettes, is

a key material to remediate alkaline soil. Since alkaline soil is found in typical soil degradation in dry land agriculture, gypsum production from coal combustion has a potential to contribute agriculture land remediation in China. Almost eight years of our efforts confirmed that FGD gypsum can remediate heavily eroded alkaline soil and that the ash of the bio-briquettes can also do it although it contains gypsum only about ten percents. A simple but well performed FGD plant was constructed and attached to an old coal firing boiler. The gypsum from the plant was also confirmed to have high performance in alkaline soil remediation.

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418. Potassium kinetics in solid wastes amended vertisols of north eastern arid zone of Karnataka.

Yeledhalli, N. A.; Prakash, S. S.; Patil, C. V.; Ravi, M. V.; and Rao, K. N.

Karnataka Journal of Agricultural Sciences 20(3): 518-523. (2007)

NAL Call #: S471.I42K37; ISSN: 0972-1061

Descriptors: application to land/ arid zones/ buffering capacity/ fly ash/ kinetics/ nutrient availability/ potassium/ sewage sludge/ soil amendments/ soil fertility/ soil types/ solid wastes/ Vertisols/ waste disposal/ waste management/ waste utilization/ arid regions/ land application/ Mysore

Abstract: Laboratory equilibration studies were undertaken to evaluate the effect of solid wastes application individually or in co-application on Q/I relationship and soil properties. Amending the soil, with fly ash/sewage sludge with or without 50 ppm K increased the equilibrium activity ratio (AR_{eq}) values, decreased the labile pool (-K_o) K and Gibb's free energy (- ΔG) values in vertisols. Whereas, potential buffering capacity (PBCK) values decreased. Prolonged equilibration of soils for 50 days decreased the AR_{eq} values, - ΔK_o values and PBCK values. Application of fly ash and sewage sludge as soil amendment increased the immediate availability of potassium, labile pool and PBCK to a greater extent in vertisols. Reproduced with permission from the CAB Abstracts database.

419. Potassium silicate fertilizer using Chinese fly ash and a fertilizer response test.

Goto, S.; Aoki, M.; Long, C. de; Takada, C.; Hayashi, H.; and Chino, M.

Japanese Journal of Soil Science and Plant Nutrition 71(3): 378-384. (2000); ISSN: 0029-0610

Descriptors: absorption/ analysis/ calcination/ chemical analysis/ comparisons/ controlled release/ fertilizer analysis/ fertilizers/ fly ash/ mixtures/ nutrients/ potassium/ potassium fertilizers/ potassium silicates/ power stations/ responses/ silicon fertilizers/ slow release fertilizers/ temperature/ uptake / wheat/ potash fertilizers/ slow release

Abstract: The effects of the potassium silicate fertilizers, made of fly ash from Chinese power stations, on the growth and absorption of nutrients (K, Si and others) were compared with those from Japanese fly ash. Three types of fly ash mixture were prepared for calcination: (1) Japanese fly ash mixed with KOH and Mg(OH)₂ (Japanese ash); (2) Chinese fly ash mixed with KOH and Mg(OH)₂ (Chinese ash I); and (3) Chinese fly ash mixed with KOH, Ca(OH)₂ and Mg(OH)₂ (Chinese ash II). Each fly ash mixture was

calcined at 750, 850 or 950 degrees C for 30 min., respectively. Chemical analysis of these nine potassium silicate fertilizer samples showed that six samples calcined at 850 or 950 degrees C almost cleared the Japanese official standard for commercial fertilizer, but those calcined at 750 degrees C did not. Wheat plants were grown in pots for 55 d using these potassium silicate fertilizers. Dry weight and K uptake of the plants grown with the fertilizers prepared from Chinese ash I and II calcined at 850 degrees C were greater than those grown with the fertilizers prepared from Japanese ash or ordinary chemical fertilizer. The weights of the ears and polished grains of the plants grown with potassium silicate fertilizer prepared from Chinese ash II calcined at 750 or 850 degrees C were greater than those of the control plot. In this case, the K uptake in the whole plant was almost equal to that of the control plot. In conclusion, the potassium silicate fertilizer prepared from Chinese ash II calcined at 850 degrees C was effective as a silicate fertilizer as well as a slow-release potassium fertilizer. It is also presumed that Chinese ash I calcined at 850 degrees C is also effective. Reproduced with permission from the CAB Abstracts database.

420. Potential error associated with measurement of carbon mineralization in soil treated with coal combustion byproducts.

McCarty, G. W.; Siddaramappa, R.; and Wright, R. J.

Soil Biology and Biochemistry 30(1): 107-109. (Jan. 1998)

NAL Call #: S592.7.A1S6; ISSN: 0038-0717 [SBOAH]

Descriptors: soil analysis/ carbon/ mineralization/ measurement/ microbial activity/ carbon dioxide/ coal/ combustion/ byproducts/ fly ash/ ash/ soil amendments/ gas production/ fluidized beds/ respiration/ determination/ errors/ microbial respiration

This citation is from AGRICOLA.

421. Potential of Eisenia foetida for sustainable and efficient vermicomposting of fly ash.

Gupta, S. K.; Anamika Tewari; Richa Srivastava; Murthy, R. C.; and Saurabh Chandra

Water, Air and Soil Pollution 163(1/2/3/4): 293-302. (2005)

NAL Call #: TD172 .W36; ISSN: 0049-6979

Descriptors: cattle dung/ chemical analysis/ copper/ feeds/ fly ash/ heavy metals/ lead/ liveweight gain/ nickel/ sustainability/ toxicity/ vermicomposting/ waste management/ waste utilization/ zinc/ liveweight gains/ reactors

Abstract: Vermicomposting of fly ash has been attempted, using red earthworm, *Eisenia foetida*. Fly ash, which was obtained from thermal power station, was mixed with cowdung in different proportions (20,40, 60 and 80%). These mixtures were used as feed for earthworms, and after 30 days, vermicast recovery, worm zoomass and numbers of juveniles produced were recorded. A total of six runs each of 30 days were conducted during the whole study. Concentrations of heavy metals in different mixtures of fly ash-cowdung, before and after vermicomposting and in the earthworms used in the study were also estimated. Results show maximum output of vermicasts and maximum number of juveniles produced was in reactors with 40% fly ash while maximum weight gain by earthworm was in 20% fly ash vermireactors. Performance of vermireactors up to 60% fly ash was more or less similar but at 80% fly ash, there is a marked reduction in overall performance of the

reactors. Chemical analysis of different samples of fly ash-cowdung mixtures prior to vermicomposting revealed high concentrations of zinc, chromium, lead, nickel and copper. Chemical analysis of vermicomposted samples showed 30-50% reduction in heavy metals up to 60% fly ash and 10-30% reduction in 80% fly ash. Metal analysis of earthworms revealed considerable bioaccumulation of heavy metals in their body. The Present study indicates the feasibility of *E. foetida* for mitigating the toxicity of metals and up to 60% fly ash-cowdung mixtures can be used for sustainable and efficient vermicomposting. Reproduced with permission from the CAB Abstracts database.

422. Potential of fly ash and organic wastes for uses as amendments to agricultural soils: A review.

Ghuman, G. S.; Sajwan, K. S.; and Paramasivam, S. In: 7th International Conference on Biogeochemistry of Trace Elements. Coal Combustion Byproducts and Environmental Issues. Uppsala, SWEDEN.; pp. 216-224; 2006. ISBN: 0387258655

Descriptors: Pollution Assessment Control and Management/ Soil Science/ Agronomy: Agriculture/ Waste Management: Sanitation/ agricultural soil amendment: applied and field techniques / Fly Ash/ Organic Waste

Abstract: Among the naturally available resources, coal plays a predominant role as a source of energy. It was estimated that by the year 2000, the production of coal in the United States would reach 1.91×10^9 tons(1). The coal excavated from different parts of the country or of the world such as lignite, bituminous, subbituminous and Australian hard and soft brown coals are different in their chemical composition and physical characteristics. Increased use of coal in power plants has resulted in the accumulation of vast quantities of coal residues of which fly ash is the major fraction. Approximately 63 million tons of fly ash is generated annually in the U.S. Of this amount, about 66% is discarded in lagoons or landfills. Half of the utilized fly ash is used in concrete as pozzolanic material because it contains constituents that combine with lime at ordinary temperatures and in the presence of water form cementitious compounds(3). A great deal of research has been done to find the proper utilization and disposal of waste products of coal-fired power plants 4,5,6. Fly ash is commonly used in landfilling, in construction industry, as filler in asphalt mix, stabilizer for road bases, thermal insulation, and deodorization of animal wastes 7. Fly ash usually contains high concentrations of Ca, K, Na, Mg, B, Ni and Mn. Earlier reports indicated that the elements present in crude coal are partitioned not only among the different types of coal ash residues but also among particles of different sizes in fly ash (8,9). Fly ash consists of particles of all sizes ranging from 2 to 1000 μ m in diameter. Much of the earlier work conducted to utilize fly ash was centered on efforts to amend the soil characteristics for proper vegetation growth. Fly ash usually contains high concentrations of Ca, K, Na, Mg, B, Ni and Mn. Alkaline fly ash due to the presence of oxides has been used to neutralize acidity(10). Furr et al.(11) studied the uptake of several elements by vegetables grown in potted soil amended with 10% by weight of fly ash and found that As, B, Ca, Cu, Fe, Hg, I, K, Mg, Mo, Ni, Sb and Se were higher in concentration in the edible portions of at least three of the crops grown on fly ash amended soil as compared to control crops. Massive applications are usually associated

with adverse effects to soils and growing plants. The effect of fly ash amended compost application to agricultural crops was not investigated in earlier studies. Adriano et al.(12) suggested that the use of coal residues in conjunction with other materials such as sewage sludge, peat and animal manures needs to be explored. Menon et al.(13) studied the utilization of fly ash to amend the characteristics of organic compost for agricultural use in acid soil. Menon et al.(14) studied the effects of coal fly ash-amended composts on the yield and elemental uptake by plants. Ghurnan et al.(15) studied the up take of multielements by corn from fly ash-compost amended soil. Compost contains relatively lower concentrations of several elements present in fly ash particularly the Ca, B and Cd. © Thomson Reuters

423. Potential of fly ash as a soil conditioner for desert ecosystem.

Oswal, M. C.; Singh, C. B.; and Grewal, K. S.

In: Recent Advances in Management of Arid Ecosystem. Proceedings of a Symposium. India.; pp. 469-474; 1999.

Descriptors: ash/ capacity/ coal/ crusts/ disposal/ ecosystems/ fly ash/ germination/ grain/ loam soils/ millets / mulches/ particles/ pearl millet/ properties/ responses/ sand/ sandy loam soils/ soil/ straw/ water holding capacity/ yields/ bulrush millet/ mulching materials

Abstract: Laboratory studies showed that fly ash produced by a thermal power plant in Haryana, India had a high water holding capacity and the dominant particles were sand sized. These properties suggest that it may serve as a soil conditioner for crusting soils, mulch for medium to fine textured soils and water retainer for coarse soils. Screen and field experiments indicated that mixing, of fly ash at 2.5, 5.0 and 10.0% (w/w) decreased crust strength in loam and sandy loam soils, while no crust was formed with application of 2.5 cm fly ash as a layer on the soil surface. The germination of pearl millet improved from 30.8 to 80.0% in loam and from 36.3 to 69.3% in sandy loam soil when fly ash was added. Water consumption decreased slightly, while grain and straw yields of pearl millet and water-use efficiency improved substantially in loam, sandy loam and sand soils. The maximum response was observed with application of 2.5 cm fly ash layer. Reproduced with permission from the CAB Abstracts database.

424. Potential uses of fluidised bed boiler ash (FBA) as a liming material, soil conditioner and sulfur fertilizer.

Wang, Hailong; Bolan, Nanthi; Hedley, Mike; and Horne, Dave.

In: Coal Combustion Byproducts and Environmental Issues. Uppsala, Sweden.; Springer; pp. 202-215; 2006. *Notes:* 7th International Conference on Biogeochemistry of Trace Elements.

Descriptors: fluidised bed boiler ash/ liming material/ soil conditioner/ sulfur fertilizers

Abstract: To meet the Clean Air standard, many North American and European power plants have adopted fluidized bed combustion techniques. These systems require lower capital investment, to reduce the sulfur-dioxide (SO₂) emissions in flue gases, than the wet flue gas desulfurization process. In the former system, limestone chip mixed with the fine coal is burnt in a bed suspended by compressed air. Sulfur dioxide released as the coal is burnt, reacts with CaO generated in the furnace

therefore minimizing SO₂ emissions from the stack. The resulting ash from the boiler bed and trapped fly ash, known as fluidized bed boiler ash (FBA), contains CaSO₄ and unreacted CaO. Mixing this ash with water, to overcome dust problems, subsequently converts CaO to Ca(OH)₂. The chemical composition of FBA is highly dependent on the efficiency of the boilers and the nature of the fuel and limestone sources. As many countries including Australia and USA are rich in coal resources, coal plays a significant role in supplying energy. But, some of the coal resources are rich in sulfur (S) and with increasing concern for environmental pollution, low cost techniques, such as fluidized bed combustion, are required to reduce SO₂ emission from the burning of such high S coal.

Consequently, large quantities of FBA or similar by-products would be expected. Although the resulting large volumes of FBA materials are generally disposed of in landfills, limited landfill space and increased costs, however, have stimulated investigations in many countries to develop and demonstrate agricultural and environmentally safe uses for FBAs, thereby reducing the Cost Of SO₂ scrubbing. Agricultural utilization of FBA overcomes a waste problem and at the same time provides a liming material and an inexpensive form of S source. Furthermore, FBA also has potential as a micro-nutrient fertilizer, providing elements such as boron and selenium. In this chapter the chemical characteristics of FBA and its potential uses as a liming material, soil conditioner and S fertilizer are reviewed.

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425. Power station fly ash: A review of value-added utilization outside of the construction industry.

Iyer, R. S. and Scott, J. A. 31(3): 217-228. (2001); ISSN: 09213449 [RCREE].

Notes: doi: 10.1016/S0921-3449(00)00084-7.

Descriptors: Agriculture/ Fly ash/ Materials/ Materials recovery/ Power station/ Utilization/ Waste management/ aluminum/ aluminum oxide/ aluminum silicate/ arsenic/ cadmium/ calcium/ calcium oxide/ cement/ chromium/ fluoride/ glass/ lead/ limestone/ magnesium/ mercury/ molybdenum/ nickel/ selenium/ silicate/ silicon dioxide/ zeolite/ fly ash/ waste disposal/ waste management/ adsorption/ agriculture/ building industry/ fly ash/ review/ waste management

Abstract: The disposal of fly ash from coal-fired power stations causes significant economic and environmental problems. A relatively small percentage of the material finds application as an ingredient in cement and other construction products, but the vast majority of material generated each year is held in ash dams or similar dumps. This unproductive use of land and the associated long-term financial burden of maintenance has led to realization that alternative uses for fly ash as a value-added product beyond incorporation in construction materials are needed. Utilization of fly ash in such areas as novel materials, waste management, recovery of metals and agriculture is reviewed in this article with the aim of looking at new areas that will expand the positive reuse of fly ash, thereby helping to reduce the environmental and economic impacts of disposal. Copyright _ 2001 Elsevier Science B.V.

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426. Principal chemical properties of artificial soil composed of fly ash and furfural residue.

Feng YongJun; Li Fen; Wang XiaoLing; Liu XiMin; and Zhang LeiNa

Pedosphere 16(5): 668-672. (2006)

NAL Call #: S590 .P43 ; ISSN: 1002-0160

Descriptors: agriculture/ fly ash/ furfural/ nitrogen/ nutrient availability/ phosphorus/ potassium/ reclaimed soils/ reclamation/ salts/ soil analysis/ soil chemical properties/ soil organic matter/ soil ph/ soil suitability/ soil types/ chemical properties of soil/ organic matter in soil

Abstract: To solve soil shortage in reclaiming subsided land of coal mines, the principal chemical properties of artificial soil formed by mixing organic furfural residue and inorganic fly ash were examined. The results indicated that the artificial soil was suitable for agriculture use after irrigation and desalination, the available nutrients in the artificial soil could satisfy the growth demand of plants, and the pH tended to the neutrality.

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427. Principal physicochemical properties of artificial soil composed of fly ash, sewage sludge and mine tailing.

Zhang, H.; Sun, L.; Sun, T.; and Ma, G.

Bulletin of Environmental Contamination and Toxicology 79(5): 562-5. (Nov. 2007)

NAL Call #: RA1270.P35A1; ISSN: 0007-4861.

17940713

Descriptors: Carbon: chemistry/ Electric Conductivity/ Environmental Pollutants/ Hydrogen-Ion

Concentration/ Iron/ Mining/ Particulate Matter: chemistry/

Sewage: chemistry/ Soil: analysis/ Time Factors/ Water

This citation is from PubMed.

428. Production of compost from sewage sludge and fly ash and subsequent evaluation of growth enhancement and heavy metal translocation in crops.

Yeledhalli, N. A.; Prakash, S. S.; and Ravi, M. V.

Environment and Ecology 26(1): 64-71. (2008)

NAL Call #: TD172.E5; ISSN: 0970-0420

Descriptors: cadmium/ composting/ composts/ copper/ fly ash/ groundnuts / heavy metals/ lead/ nickel/ NPK fertilizers/ nutrient deficiencies/ nutrient transport/ phytotoxicity/ sewage sludge/ sunflowers/ translocation/ uptake/ zinc/ Mysore/ peanuts

Abstract: The combustion of coal in India produces approximately 99 million tonnes of fly ash annually. This fly ash has to be handled and stored on ash dumps, which in turn have to be rehabilitate, increasing the cost of ash handling. Sewage sludge is classified as a organic toxic waste, which requires some treatments for use in agriculture. This investigation was made to innovate the utilization of these waste products viz. composting, blending/mixing to produce a new product SLASH compost that would enhance economic value or fulfill a predetermined need like, to correct a known nutrient deficiency or aid in remediating a potential phytotoxicity. Different levels of SLASH compost with or without NPK fertilizer were added to soil to determine the effect on productive parameters of sunflower and groundnut. Soil amended with graded levels of SLASH compost showed

significantly enhanced seed/pod/biomass yield with or without recommended dose of NPK fertilizer. The concentration and uptake of potentially toxic elements (Zn, Cu, Ni, Cd, Pb) by crops were similar to those observed with NPK fertilizer control, whereas the values increased significantly with increasing levels of SLASH compost application.

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429. Properties of several fly ash materials in relation to use as soil amendments.

Pathan, S. M.; Aylmore, L. A. G.; and Colmer, T. D. *Journal of Environmental Quality* 32(2): 687-693. (2003)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: bulk density/ cation exchange capacity/ chemical composition/ electrical conductivity/ Entisols/ fly ash/ hydraulic conductivity/ matric potential/ particle density/ particle size distribution/ phosphorus/ Podzols/ sandy soils/ soil amendments/ soil chemical properties/ soil composition/ soil pH/ soil physical properties/ soil types/ Spodosols/ surface area/ trace elements/ water holding capacity/ chemical properties of soil/ microelements/ physical properties of soil

Abstract: Fly ash samples from five power stations in Western Australia and Queensland, and two soils used for horticulture in Western Australia, were evaluated for a series of physical and chemical properties. Soils were comprised primarily of coarse sand-sized particles, whereas most of the fly ashes were primarily fine sand- and silt-sized particles. Hydraulic conductivities in the fly ashes were 105- to 248-fold slower than in the soils. The water-holding capacities of fly ashes at "field capacity" were three times higher than those of the soils. Extractable P in the fly ashes (except Tarong and Callide) were 20- to 88-fold higher than in the soils. The pH showed considerable variation among the different sources of fly ash, with samples from Muja being the most acidic (pH=3.8; 1:5 in CaCl₂ extract) and from Gladstone the most alkaline (pH=9.9). The toxicity characteristic leaching procedure (TCLP) values indicate that the potential for release of trace elements from the fly ashes was well below regulatory levels. When applied at sufficient rates (e.g., to achieve 10% w/w in surface layers) to sandy soils, fly ash altered texture and increased water-holding capacity. Depending on the source of fly ash used, such amendments could also provide P and aid nutrient retention by increasing the phosphorus retention index (PRI) and/or cation exchange capacity (CEC). The considerable variability in physical and chemical properties among the fly ash samples evaluated in the present study supports the notion that field trials are essential to the future development of soil amendment strategies making use of any particular source of fly ash. Reproduced with permission from the CAB Abstracts database.

430. Properties of Urbic Anthrosols from an abandoned shunting yard in the Ruhr area, Germany.

Hiller, D. A. 39(4): 245-266. (2000); ISSN: 03418162 [CIJPD].

Notes: doi: 10.1016/S0341-8162(00)00081-3.

Descriptors: Classification/ Magnetic susceptibility/ Revegetation/ Soil quality/ Urban environment/ abandoned land/ growth/ nutrient cycling/ plant/ railway/ soil property/ Germany

Abstract: The soil conditions of an abandoned shunting yard in the Ruhr area were studied to find the most important factors influencing plant growth and nutrient cycling. The chemical and physical conditions of five Urbic Anthrosols with different development histories were compared with those of a nearby Calcic Cambisol under agricultural use. In the second half of the 19th century, the ground level of the shunting yard site was raised about 2 m. The soils are now mainly Regosols, mostly well drained in the topsoil. The coarse material contents (> 2 mm), which are up to 100% in base layers of railway tracks, and the quality of the man-made substrates (crushed rock, slags, ashes, coke) are the most important factors influencing plant growth. Poor physical structure and low contents of fine fraction (< 2 mm) lead to low water storage. Together with a low available nutrient stock, these properties lead to poor establishment of vegetation. The burning of coal by steam engines produced highly polluted ashes that fill pore spaces in the railway ballast layers. All the investigated fine substrata of the shunting yard layers exhibit a higher magnetic susceptibility than the rural soil. The ashes still contain unburned coal so that, although the total organic C content of the man-made soils reaches 37%, the wide C:N ratio does not indicate the actual quality of humic substances. The acid neutralization potential of the topsoil layers of the shunting yard will be consumed by acidic atmospheric deposition within a few decades, whereas in the surrounding Calcic Cambisols, it will take more than a thousand years. This may cause further problems of groundwater quality, as the heavy metals will become more soluble. The low soil quality makes such sites suitable for vegetation species that cannot compete in the surrounding very eutrophic agricultural landscape. (C) 2000 Elsevier Science B.V.

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431. Quality assessment of compost prepared from fly ash and crop residue.

Gaind, S. and Gaur, A. C.

Bioresource Technology 87(1): 125-127. (Mar. 2003)

NAL Call #: TD930.A32 ; ISSN: 0960-8524 [BIRTEB]

Descriptors: composts / composting

Abstract: Fly ash was co-composted with wheat straw and 2% rock phosphate (w/w) for 90 days and different chemical and microbiological parameters monitored to evaluate its effect on the composting process. Fly ash addition at 20% level resulted in the lowest C/N of 16.4:1 and highest available and total phosphorus. Increasing the addition of fly ash from 40 to 60% (w/w) did not exert any detrimental effect on either C:N or the microbial population. This citation is from AGRICOLA.

432. Quality characteristics of some grass species cultivated on fly ash deposits of a thermal power station.

Maksimovic, S.; Blagojevic, S.; Pivic, R.; and Stanojkovic, A. 17(5): 584-588. (2008); ISSN: 10184619 [FENBE]

Descriptors: Deposits / Fly ash/ Grass/ Macroelements/ Thermal power station/ Trace elements

Abstract: This paper presents data on the content of macronutrients and trace elements in different grass species cultivated for the purpose of forming a grass cover on fly-ash deposits of a thermal power station in Serbia. The purpose of this grass cover is the fixation of the so-called "fly ash" and reduction of environmental pollution.

The thermal power station is situated near Belgrade, and its fly-ash deposits cover a large area (about 400 ha). The chemical composition of fly-ash on these deposits was rather heterogeneous: it had rather different pH values, concentrations of organic matter, as well as different contents of macro- and microelements. The total nitrogen and available phosphorus concentrations in fly-ash were low, that of available Ca and Mg - medium, those of available potassium and some microelements (Fe, Mn and Zn) - elevated, while the total contents of some toxic elements (As, Hg and Ni) were rather high, or even higher than the admissible levels for agricultural soils. In the cultivated grass species, the concentrations of macroelements (N, P, K, Ca and Mg) were favourable, with the expected differences for different species and locations. The concentrations of micronutrients were at normal levels for the cultivated grass species. The same also refers to potentially toxic trace elements, with individual minor increases (above the usual natural levels) for As and Ni. _ by PSP.

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433. Reclamation of spoil and refuse material produced by coal mining using bottom ash and lime.

Tedesco, M. J.; Teixeira, E. C.; Medina, C.; and Bugin, A. 20(5): 523-529. (1999); ISSN: 09593330 [ENVTE]

Descriptors: Heavy metals/ Plants/ Soil/ cadmium/ calcium oxide/ chromium/ lead/ nickel/ sulfur/ coal mining/ land reclamation/ liming/ soil remediation/ spoil heap/ acidity/ ash/ Brazil/ coal mining/ land use/ nonhuman/ oxidation/ plant growth/ waste management

Abstract: Brazil's coal production is about five million tonnes per year, mostly on open mining operations. Mined land reclamation is difficult due to the high acidity generated by the sulphur compounds' oxidation. In order to evaluate the feasibility to use bottom ash and lime for land reclamation of coal mining and processing refuse deposit areas, a field experiment was carried out in a coal waste dumping area over 20 m deep, that was previously leveled off, located on the Butia County Recreio mine, in Rio Grande do Sul state, Brazil in 1992 and 1993. Trenches 10 m width and 50 m length were dug in the coal refuse and filled with bottom ash covered with a layer of soil of different depths. Several summer and winter plant species were grown on 10 x 10 m subplots. A minimum of 0.1 m soil layer over 0.2 m bottom ash with proper liming and fertilization was required to promote plant growth. Low soil pH due to sulphur compounds' oxidation was the most limiting factor for plant growth. Heavy metals Cr, Cd, Ni and Pb concentrations in the plants' shoots were in the range usually determined for plants grown on uncontaminated soils.

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434. Recycling of fly ash in the consolidation of clay soils.

Temimi, M.; Rahal, M. A.; Yahiaoui, M.; and Jauberthie, R. *Resources, Conservation and Recycling* 24(1): 1-6. (1998)

NAL Call #: TP156.R38R47; ISSN: 0921-3449

Descriptors: clay/ clay soils/ coal/ compressibility/ disposal/ economics/ fly ash/ incorporation/ mechanical properties/ properties/ recycling/ soil/ soil amendments/ soil mechanics/ wastes/ engineering properties of soil/ mechanical properties of soil

Abstract: The use of fly ash in the consolidation of clays was shown to have a double advantage: (i) it is a economical way to consolidate soils; and (ii) it contributes to reduce disposal and environmental problems. The incorporation of fly ash in the clay material has a beneficial action on mechanical properties of the clay, such as the compressibility and the consolidation. Reproduced with permission from the CAB Abstracts database.

435. Reduced leaching of nitrate, ammonium, and phosphorus in a sandy soil by fly ash amendment.

Pathan, S. M.; Aylmore, L. A. G.; and Colmer, T. D. *Australian Journal of Soil Research* 40(7): 1201-1211. (2002)

NAL Call #: 56.8 Au7; ISSN: 0004-9573

Descriptors: ammonium / application rates/ desorption/ fly ash/ hydraulic conductivity/ leaching/ nitrate/ nutrients/ phosphorus/ sandy soils/ soil amendments/ soil types/ sorption

Abstract: Low ionic sorption capacities and high hydraulic conductivities of sandy soils contribute to the potential for leaching of nutrients applied to these soils. Batch sorption experiments were used to examine NO_3^- , NH_4^+ , and P sorption/desorption isotherms for Karrakatta sand and Kwinana fly ash from Kwinana Power Station in Western Australia. Column experiments assessed leaching of these nutrients from this sandy soil, when amended with 4 rates (0, 5, 10, and 20%, wt/wt) of fly ash. The sorption of NO_3^- , NH_4^+ , and P was higher for fly ash than the sandy soil. Phosphorus sorption was greatest for unweathered fly ash, followed by weathered fly ash and then the soil; for example, sorption from a solution containing 20 mg/litre P was 90, 28, and 14%, respectively. Desorption of P was much slower in the unweathered fly ash than weathered fly ash or the soil. Leachates collected from columns containing fly ash amended soil (5, 10, and 20%, wt/wt) generally had lower concentrations of NO_3^- and NH_4^+ than leachates from non-amended soil. Prior to adding fertilizer, the concentration of P was greater in leachate from fly ash amended soil than from the native soil, due to fly ash (weathered) itself containing 92.5 mg/kg of extractable P. However, from day 35 onwards, the concentration of P was lower in leachates from soil amended with 10 or 20% fly ash than from non-amended soil. Thus, fly ash amendment retarded NO_3^- , NH_4^+ , and P leaching in the sandy soil and may therefore be a useful tool for improvement of nutrient management in sandy soils.

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436. Reducing phosphorus release from paddy soil by coal ash and phospho-gypsum mixture.

Lee, C. H.; Lee, Y. B.; Lee, H.; Ha, B. Y.; and Kim, P. J. *Korean Journal of Environmental Agriculture* 24(1): 12-16. (Mar. 2005); ISSN: 1225-3537.

Notes: Summary(En). Citation Notes: KR (Korea-Republic-of).

Descriptors: phosphorus/ rice paddy/ soils/ coal ash/ phospho-gypsum

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437. Reducing phosphorus release from paddy soils by a fly ash-gypsum mixture.

Lee, C. H.; Lee, Y. B.; Lee, H.; and Kim, P. J.

Bioresource Technology 98(10): 1980-1984. (July 2007)

NAL Call #: TD930.A32; ISSN: 0960-8524

Descriptors: phosphorus/ rice paddy/ soils/ fly ash/ gypsum

Abstract: A mixture of fly ash and phospho-gypsum (50:50, wt wt-1) was selected to study its potential to supply Ca and Si to rice while reducing B toxicity. We expected that the high Ca content in this mixture might convert water-soluble P to less soluble forms and thereby reduce the loss of soil P to surface runoff. The mixture was applied at rates of 0, 20, 40, and 60 Mg ha⁻¹ in two paddy soils of contrasting textures (silt loam in Yehari and loamy sand in Daegok). The mixture significantly reduced water-soluble phosphate (W-P) in the surface soils by shifting from W-P and iron bound-P (Fe-P) to calcium bound-P (Ca-P) and aluminum bound-P (Al-P) during rice cultivation in both soils. Lancaster and Mehlich 3 extractable P increased significantly with application rate due to high contents of P and Si in the mixture. Mixtures of fly ash and phospho-gypsum should reduce P loss from rice paddy soils and increase soil fertility.

This citation is from AGRICOLA.

438. Reducing soil phosphorus solubility with coal combustion by-products.

Stout, W. L.; Sharpley, A. N.; and Pionke, H. B.

Journal of Environmental Quality 27(1): 111-118. (1998)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: byproducts/ coal/ combustion/ desulfurization/ fluidized bed wastes/ fly ash/ liming materials/ phosphorus/ shale soils/ soil/ solubility/ desulphurization/ United States of America

Abstract: In NE USA, most soil samples analysed for soil test P (STP) in 1990 exceeded P levels needed for plant production. Converting soil P to less soluble forms with applications of materials containing lime or Ca may reduce the release of soil P to runoff. The effect of several coal combustion byproducts on STP (Bray-1 and Mehlich-III), water extractable P, and equilibrium P concentration (EPC₀) of high P soils was investigated in a soil from Pennsylvania, USA. The byproducts used were: fluidized bed combustion fly ash (FBC), flue gas desulfurization byproduct (FGD), and pulverized coal fly ash (PC). In a byproduct type and rate experiment, a shale soil with high STP was incubated for 21 d with each byproduct (0, 10, 20, 40, and 80 g kg/soil). The highest rates of FBC and FGD reduced Mehlich-III P (45%), Bray-I P (50%), water extractable P (72%) and EPC₀ (37%). The PC had no effect on soil P solubility due to the addition of P with this byproduct. For eight soils ranging in physical and chemical properties, FBC at 10 g/kg soil reduced Mehlich-III P 13%, and water-extractable P 71%, while FGD reduced Mehlich-III P 8% and water-extractable P 48%. These reductions resulted from the conversion of readily desorbable soil P to less soluble Ca-bound or Al- and Fe-bound pools. Amending high P soils with FBC or FGD byproducts can reduce P enrichment of runoff by decreasing the solubility of soil P without reducing STP below optimum levels for plant growth.

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439. Reduction of Pb, Zn and Cd availability from tailings and contaminated soils by the application of lignite fly ash.

Stouraiti, C.; Xenidis, A.; and Paspaliaris, I.

Water, Air and Soil Pollution 137(1/4): 247-265. (2002)

NAL Call #: TD172 .W36; ISSN: 0049-6979

Descriptors: bioavailability/ bioremediation/ cadmium/ chemical speciation/ fly ash/ hydroxides/ lead/ lignite/ mine tailings/ oxides/ polluted soils/ soil ph/ soil pollution/ soil toxicity/ sorption/ stabilization/ zinc/ toxic soils

Abstract: The effectiveness of lignite fly ash for stabilization of Pb, Zn and Cd in tailings and contaminated soils was examined. Fly ash was mixed with the contaminated soil or oxidic tailings samples at various doses and pot experiments were performed. The effectiveness of stabilization was mainly evaluated by the standard US EPA TCLP toxicity test. The 5-stage sequential extraction procedure was also applied to determine the form of contaminants in the fly ash amended soil or tailings samples. Complementary EDTA extraction tests were also carried out. The fly ash treatment resulted in the reduction of TCLP solubility of Pb, Zn and Cd to below the respective regulatory limits at 5 and 10% w/w fly ash addition rates in tailings and soil, respectively. Speciation of lead, in the treated soil and tailings samples indicated that there was a significant transition of the heavy metals form from the exchangeable and carbonate fractions to reducible and residual, suggesting that the potential mechanisms of heavy metals retention are, apart from increase of pH, sorption on the oxides and hydroxides surfaces and binding with the hydrated fly ash compounds.

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440. Rehabilitation of red mud ponds at Indal, Belgaum (Karnataka).

Sharma, J. V.; Lhouvum, G.; Suresh Chauhan; Banwari Lal; Singh, T. P.; and Varghese Paul

Indian Forester 130(5): 481-497. (2004); ISSN: 0019-4816

Descriptors: bauxite/ bauxite residues/ clay minerals/ farmyard manure/ fly ash/ gypsum/ mud/ multipurpose trees/ mycorrhizal fungi/ mycorrhizas/ nonclay minerals/ ponds/ rehabilitation/ revegetation/ soil amendments/ trees/ woody plants/ FYM/ Mysore

Abstract: Bauxite residue, also known as red mud, is a by-product of the Bayer Process. Bauxite is composed principally of the monohydrate and trihydrate forms of alumina in varying proportions. The research study was conducted to rehabilitate used red mud ponds of INDAL (Indian Aluminium Company Ltd.), Belgaum, Karnataka, India, by identifying suitable trees, grasses, and legume species as well as amenders, including bacteria and mycorrhizae, to improve the physico-chemical condition of red mud deposits and convert it to a substrate. Amenders such as gypsum, FYM (farmyard manure), fly ash/vegetative dust in different proportions, forming three basic combinations, A, B, and C, were developed. These three combinations were then treated with the bacteria and mycorrhizae both alone, and in combination, to form twelve treatments and one control. The research study showed that there is remarkable change in the physical and chemical properties of red mud after amendment, which provides the platform for plantation growth. The best

combination found for treating red mud ponds was: Red mud+20% FYM+10% Gypsum+15% Fly ash+Bacteria+Mycorrhizae for four tree species, *Prosopis juliflora*, *Acacia nilotica*, *Pangamia pinnata* and *Melia azedarach*, and three grass/legume species *Brachiaria mutica*, *Chloris gayana*, and *Sesbania sesban*. Reproduced with permission from the CAB Abstracts database.

441. Relationship of chemical fractions of heavy metals with microbial and enzyme activities in sludge and ash amended acid lateritic soil from India.

Chaudhuri, D.; Tripathy, S.; Veeresh, H.; Powell, M. A.; and Hart, B. R.

Environmental Geology 45(1): 115-123. (2003)

NAL Call #: QE1.E5; ISSN: 0943-0105

Descriptors: acid soils/ cadmium/ chromium/ copper/ enzyme activity/ fly ash/ heavy metals/ lateritic soils/ lead/ microbial activities/ nickel/ organic carbon/ sewage sludge/ soil amendments/ soil enzymes/ soil types/ zinc/ microbial biomass

Abstract: The influence of metals, Cd, Cr, Cu, Ni, Pb and Zn, on the microbial biomass and enzyme activities of an amended acid lateritic soil were investigated under field conditions receiving a one-time application of 52 t ha⁻¹ of sludge, coal ash and their mixtures at 1:3, 1:1 and 3:1 proportions, and including control and chemical fertilizer treatment at crop-specific recommended doses. Paddies and groundnuts were grown in the experimental plots and soil was sampled twice after 6 months and 1 year after amendment application. The heavy metals in the soil were fractionated using sequential extraction and the increments in their concentrations in amended soil with respect to the control were determined. Concentrations of Cd, Ni and Zn were determined to have increased in their mobile fractions and were more pronounced in soil collected during the second sampling, which was associated with a decrease in soil organic carbon. The size of the microbial biomass carbon and the soil enzyme activities increased with the addition of an amendment and was highest at equal proportions of coal ash and sludge. Further increase in the proportion of sludge resulted in a significant decrease in biomass carbon. Simple correlation revealed significant and strong negative relations of mobile fractions of Cd and Ni with the ratio between microbial biomass C and organic carbon in soil, while the organic carbon content and the pH were positively correlated. The microbial activities were determined to be sensitive to the concentrations of some heavy metals in mobile fractions and therefore indicated possibilities of being useful as indicators for evaluation of toxic effects of sludge-borne metals on soil organisms. Reproduced with permission from the CAB Abstracts database.

442. Relationship of ryegrass growth to extractable phosphorus in acidic soil amended with phosphate rock, coal combustion by product, limestone, and cellulose.

He, Z. L.; Baligar, V. C.; Martens, D. C.; Ritchey, K. D.; and Elrashidi, M. A.

Communications in Soil Science and Plant Analysis 30(3/4): 457-470. (1999)

NAL Call #: S590.C63; ISSN: 0010-3624

Descriptors: acid soils/ application/ cellulose/ coal/ fly ash/ growth/ magnesian limestone/ phosphorus/ rock phosphate/ soil/ soil test values/ magnesium limestone/ phosphate rock

Abstract: Laboratory analyses and greenhouse experiments were conducted to evaluate effects of phosphate rock (PR), coal combustion byproduct (BP), limestone, and cellulose application on the relationship between soil test P and crop growth in acidic soil.

Application of PR, BP, limestone, and cellulose increased soil pH, exchangeable calcium and magnesium, and extractable P, and decreased free aluminium ion in the acid soil. Addition of BP or limestone increased P availability efficiency [PAE, mg dry matter yield (DMY) of plant per mg soil extractable P by Olsen-P procedure] and P utilization efficiency (PUE, mg DMY of plant per mg P in the plant). There was significant positive correlation between the PAE and BP rates applied alone ($r^2 = 0.979$, $P < 0.01$) or with either PR ($r^2 = 0.972$, $P < 0.01$) or PR plus cellulose ($r^2 = 0.985$, $P < 0.01$). The PUE of ryegrass [*Lolium perenne*] was significantly correlated with BP rates alone ($r^2 = 0.957$, $P < 0.01$) or with either PR ($r^2 = 0.906$, $P < 0.01$) or PR plus limestone ($r^2 = 0.699$). The increase in PAE and PUE of ryegrass caused by BP and limestone reflected more plant root growth from increased availability of Ca and Mg and higher soil pH.

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443. Residue-management practices using fly ash and various crop residues for productivity of rice (*Oryza sativa*)-wheat (*Triticum aestivum*) cropping system under limited moisture conditions.

Dileep Kachroo and Dixit, A. K.

Indian Journal of Agronomy 50(4): 249-252. (2005)

NAL Call #: 22 IN235; ISSN: 0537-197X

Descriptors: application rates/ crop production/ crop residues/ crop yield/ cropping systems/ fly ash/ microbial flora/ nutrient uptake/ nutrients/ physicochemical properties/ productivity/ rice/ soil chemical properties/ soil physical properties/ soil water/ stubble/ wheat/ chemical properties of soil/ Hyphomycetes/ Kashmir/ microbial communities/ microflora/ paddy/ physical properties of soil/ soil moisture

Abstract: A field experiment was conducted at the Sher-e-Kashmir University of Agricultural Sciences and Technology, R.S. Pura, Jammu, India, during 2001-03, to evaluate the effect of fly ash and residue incorporation on the productivity and soil health in rice (*Oryza sativa*)-wheat (*Triticum aestivum*) cropping system under limited moisture conditions. Incorporation of residues of rice in wheat and wheat in rice not only increased the yield and yield components of rice and wheat but also increased the nutrient uptake besides improving the physico-chemical and biological properties of the soil which provide better soil environment for growth. Alternatively, the incorporation of fly ash and left-over stubbles of previous crops as residues were found equally effective in increasing the productivity and soil environment in rice-wheat cropping system. For quick and better decomposition the application of *Trichoderma viride* + 20 kg N/ha as starter dose influenced the yield, available nutrients, microbial population and physical properties of the soil significantly compared with no starter dose application.

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444. Response of mustard cultivars when grown in soil amended with fly ash under conditions of induced drought.

Singh, S. and Khan, N. A.

Tests of Agrochemicals and Cultivars 24: 14-15. (2003)

NAL Call #: S587.T47; ISSN: 0951-4309

Descriptors: application rates/ cultivars/ drought/ fly ash/ growth/ Indian mustard/ leaf area/ plant height/ soil amendments/ stress/ stress response/ water stress/ Capparales/ cultivated varieties

Abstract: An experiment was conducted to investigate the effects of fly ash on the growth of Indian mustard (*Brassica juncea* cultivars Alankar, PBM16, Varuna, Pusa Barauni and Pusa Bahar) seeds sown in clay pots under induced drought conditions. Treatments comprised: fly ash mixed with soil in 0, 20, 40, 60 and 80% proportion (w/w), and kept in a greenhouse under natural light (mean 23 degrees C). Two mustard plants per pot for each cultivar and two sets of pots were maintained; one was continuously irrigated and in another, water was withheld for 20 days from 55 days after sowing, to induce drought. Fly ash treatment significantly reduced plant growth under both normal and induced drought conditions. Under 20% fly ash-amended soil, both plant height and leaf area increased compared to their respective controls. Soil nutrient deficiencies were supplemented by the addition of fly ash to the soil. The addition of fly ash at 80% concentration reduced the growth in all cultivars under both normal and induced drought conditions. To avoid the risk of accumulating toxic substances, fly ash at 20% concentration should not be used more than once every three years, whether grown under irrigated or rainfed conditions.

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445. Response of pearl millet (*Pennisetum glaucum*) to fly ash clay and nitrogen levels in loamy sand soil.

Mani Ram; Balai, C. M.; Kumawat, B. L.; and Majumdar, S. P.

Indian Journal of Agricultural Sciences 74(2): 95-97. (2004)

NAL Call #: 22 AG83I; ISSN: 0019-5022

Descriptors: application rates/ clay/ crop yield/ fly ash/ millets/ nitrogen fertilizers/ pearl millet/ returns/ sandy loam soils/ seed weight/ soil types/ stover/ tillers/ yield components/ bulrush millet

Abstract: A field experiment was conducted during the rainy seasons of 1999 and 2000 at a research farm of Jobner, Rajasthan, India, to study the effect of fly ash, clay mixing and nitrogen application on pearl millet (*P. glaucum*). Increasing levels of both fly ash and clay up to 4% significantly enhanced the effective tillers per metre row length, 1000-grain weight, grain and stover yields of pearl millet. The yield attributes (effective tillers and 1000-grain weight) and grain and stover yields of pearl millet increased significantly up to 90 kg N/ha. The combined application of 4% clay+60 kg N/ha recorded significantly higher values of effective tillers, grain and stover yields over other combinations of clay and N. The 2% clay and 60 kg N/ha recorded the significantly highest net returns of Rs 6284 and Rs 7391/ha, respectively.

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446. Restoration of drastically eroded land using coal fly ash and poultry biosolid.

Punshon, T.; Adriano, D. C.; and Weber, J. T.

Science of the Total Environment 296(1/3): 209-225. (2002)

NAL Call #: RA565.S365; ISSN: 0048-9697

Descriptors: application rates/ arsenic/ biomass/ biomass production/ boron/ bulk density/ calcium/ chemical composition/ electrical conductivity/ eroded soils/ erosion/ erosion control/ fly ash / groundwater/ magnesium/ manganese/ nutrient content/ pH/ phosphorus/ plant composition/ plant nutrition/ potassium/ poultry manure/ selenium/ sewage sludge/ soil amendments/ soil density/ soil organic matter/ soil pH/ soil salinity/ soil types/ trace elements/ water holding capacity/ water quality / chemical constituents of plants/ eroded sites/ hydrogen ion concentration/ microelements/ Mn/ organic matter in soil/ *Panicum amarum*/ potential of hydrogen/ poultry litter/ soil quality/ United States of America/ water composition and quality

Abstract: A 3-year field study was conducted at a 12 ha soil-borrow area adjacent to the Columbia Metropolitan Airport, South Carolina to investigate the restorative effects of co-application of coal fly ash (FA) and a poultry biosolid (PB). FA was applied at 0, 22, 280, 560 and 1120 Mg (tonne) ha⁻¹, and PB at 5 and 10 Mg ha⁻¹. The area was seeded with erosion-control species Atlantic Coastal panic grass (*Panicum amarum* var *amarum* L.), sericea (*Lespedeza cuneata* var. *appalaw* [Dumont] G. Don.) and weeping love grass (*Eragrostis curvula* Wolf.). Plant biomass and elemental composition were analyzed in sequential harvests. Soil and groundwater quality characteristics including pH, EC and elemental composition were also monitored throughout the study. In addition, the effect of amendments on the water holding capacity and bulk density of the soil was investigated. Amendment addition significantly increased plant biomass production by a maximum of 26% using 1120 Mg ha⁻¹ FA and 10 Mg ha⁻¹ PB. Application of the highest rate of FA significantly increased the plant tissue concentrations of Mn, As, Se and B. Soil pH was initially increased from 4.6 to 6.1 by amendments. Soil salinity was increased in the initial year only. Amended soils had higher concentrations of Ca, Mg, P and K, higher organic matter content and water holding capacity than unamended soil. Concentrations of plant-essential trace elements (B, Cu and Zn) that were marginally deficient in the unamended eroded soil increased to within typical soil concentrations following amendment with FA and PB. Groundwater quality was unaffected throughout the study. The co-application of FA and PB successfully promoted the revegetation of the eroded borrow area with no apparent adverse environmental side effects.

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447. Results from field trials the use of coal combustion wastes for soil remediation in Orissa, India.

Hart, Brian; Powell, Michael; Fyfe, W. S.; and Tripathy, S.

In: Geological Society of America, 1998 Annual Meeting. Toronto, ON, Canada.; Vol. 30 (7); pp. 341-342; 1998.

Notes: Abstracts with Programs: Geological Society of America.

Descriptors: ash/ Asia/ biomass/ bulk density/ cation exchange capacity/ combustion/ copper/ degradation/ field studies/ forests/ India/ Indian Peninsula/ metals/ nitrogen/ nutrients/ Orissa India/ pH/ remediation/ sewage sludge/ soils/ waste disposal/ water/ zinc/ environmental geology
© American Geological Institute

448. Revegetating fly ash landfills with *Prosopis juliflora* L.: Impact of different amendments and *Rhizobium* inoculation.

Rai, U. N.; Pandey, K.; Sinha, S.; Singh, A.; Saxena, R.; and Gupta, D. K.

Environment International 30(3): 293-300. (2004)

NAL Call #: TD169 .E54; ISSN: 0160-4120

Descriptors: bioavailability/ biomass/ carotenoids/ chemical composition/ chlorophyll/ chromium/ copper/ enzyme activity/ farmyard manure/ filter cake/ fly ash/ growth/ inoculation/ iron/ landfills/ leaves/ manganese/ nitrate reductase/ nitrogen fixation/ nitrogen fixing trees/ nodulation/ nutrient availability/ organic amendments/ phosphorus/ photosynthesis/ phytoremediation/ plant composition/ plant pigments/ polluted soils/ protein content/ revegetation/ root nodules/ soil pollution/ soil types/ stress/ stress response/ sugar factory waste/ tolerance/ trees/ uptake/ woody plants/ zinc/ biofertilizers/ carbon assimilation/ carbon dioxide fixation/ chemical constituents of plants/ clarification mud/ FYM/ Mn/ sugar factory effluent/ tetraterpenoids

Abstract: A revegetation trial was conducted to evaluate the feasibility of growing a legume species, *Prosopis juliflora* L., on fly ash ameliorated with combination of various organic amendments, blue-green algal biofertilizer and *Rhizobium* inoculation. Significant enhancements in plant biomass, photosynthetic pigments, protein content and in vivo nitrate reductase activity were found in the plants grown on ameliorated fly ash in comparison to the plants growing in unamended fly ash or garden soil. Higher growth was obtained in fly ash amended with blue-green algae (BGA) than farmyard manure or press mud (PM), a waste from sugar-processing industry, due to the greater contribution of plant nutrients, supply of fixed nitrogen and increased availability of phosphorus. Nodulation was suppressed in different amendments of fly ash with soil in a concentration-duration-dependent manner, but not with other amendments. Plants accumulated higher amounts of Fe, Mn, Cu, Zn and Cr in various fly ash amendments than in garden soil. Further, inoculation of the plant with a fly ash tolerant *Rhizobium* strain conferred tolerance for the plant to grow under fly ash stress conditions with more translocation of metals to the above ground parts. The results showed the potential of *P. juliflora* to grow in plantations on fly ash landfills and to reduce the metal contents of fly ash by bioaccumulation in its tissues. Reproduced with permission from the CAB Abstracts database.

449. Revegetation of waste fly ash landfills in a semiarid environment.

Pierzynski, G. M.; Heitman, J. L.; Kulakow, P. A.; Kluitenberg, G. J.; and Carlson, J.

Journal of Range Management 57(3): 312-319. (May 2004); ISSN: 0022-409X.

Notes: Summary in Spanish.

Descriptors: land restoration/ landfills/ fly ash/ semiarid zones/ electric power/ industrial byproducts/ soil salinity/

salt tolerance/ endemic species/ *Sporobolus airoides*/ *Bouteloua gracilis*/ *Sorghum bicolor*/ *Andropogon hallii*/ *Bouteloua curtipendula*/ soil chemical properties/ electrical conductivity/ ground cover plants/ conservation plants/ soil amendments/ animal manures/ available water capacity/ seed germination/ biomass/ height/ soil water content/ soil depth/ Kansas

Abstract: This study investigated vegetation strategies for a fly ash landfill in a semi-arid environment. Ten plant species adapted to the local climate were initially evaluated for their germination characteristics in various mixtures of Tivoli fine sand, fly ash, and cattle manure. Alkali sacaton (native, *Sporobolus airoides* (Torr.) Torr.), blue grama (native, *Bouteloua gracilis* (H.B.K.) Lag. Ex Griffiths), a forage sorghum (variety Canex, *Sorghum bicolor* (L.) Moench), sand bluestem (variety Woodward, *Andropogon hallii* Hack.), and sideoats grama (variety El Reno, *Bouteloua curtipendula* (Michx.) Torr.) were selected for further evaluation. Concurrently, mixtures were evaluated to determine the effects of the soil amendments on soil saturated paste electrical conductivity (EC) and pH. The addition of even 50 g kg⁻¹ fly ash increased EC values above 4.0 dS m⁻¹, indicating salt tolerant species may be needed. Six mixtures were selected for use in a greenhouse study and for further study of moisture retention characteristics. Using an X/Y format, where X is fly ash content and Y is manure content (g kg⁻¹) and the balance of the mixture was Tivoli fine sand, those mixtures were 0/0, 200/0, 200/100, 200/200, 100/100, and 300/100. The addition of manure provided ample quantities of plant nutrients. Alkali sacaton was the only plant species not adversely affected by the addition of fly ash. For biomass production, height, vigor and leaf tip burn, all remaining species had significantly better growth or ratings with 0/0 as compared to any other mixture. Soil moisture retention characteristics of the Tivoli fine sand can be significantly changed through amendment with fly ash or manure. Sixty cm of Tivoli sand was estimated to have the same available water holding capacity as 45 cm of 200/0, 39 cm of 200/100, 34 cm of 200/200, 47 cm of 100/100, and 33 cm of 300/100.

This citation is from AGRICOLA.

450. Role of blue green algae biofertilizer in ameliorating the nitrogen demand and fly ash stress to the growth and yield of rice (*Oryza sativa* L.) plants.

Tripathi, R. D.; Dwivedi, S.; Shukla, M. K.; Mishra, S.; Srivastava, S.; Singh, R.; Rai, U. N.; and Gupta, D. K.

Chemosphere 70(10): 1919-1929. (2008)

NAL Call #: TD172 .C54; ISSN: 0045-6535

Descriptors: application rates/ arsenic/ cadmium/ copper/ crop yield/ cysteine/ fly ash/ grain/ growth/ iron/ leaves/ manganese/ nickel/ nitrogen/ nitrogen fertilizers/ nutrient content/ nutrient requirements/ phytotoxicity/ plant nutrition/ rice/ rice husks/ roots/ silicon/ soil amendments/ soil inoculation/ stress/ stress response/ thiols/ zinc/ dietary standards/ food requirements/ mercaptans/ Mn/ nutritional requirements/ paddy/ rice hulls

Abstract: Rice is a major food crop throughout the world; however, accumulation of toxic metals and metalloids in grains in contaminated environments is a matter of growing concern. Field experiments were conducted to analyze the growth performance, elemental composition (Fe, Si, Zn, Mn, Cu, Ni, Cd and As) and yield of the rice plants (*Oryza sativa* L. cv. Saryu-52) grown under different doses of fly-

ash (FA; applied @ 10 and 100 t ha⁻¹ denoted as FA₁₀ and FA₁₀₀, respectively) mixed with garden soil (GS) in combination with nitrogen fertilizer (NF; applied @ 90 and 120 kg ha⁻¹ denoted as NF₉₀ and NF₁₂₀, respectively) and blue green algae biofertilizer (BGA; applied @ 12.5 kg ha⁻¹ denoted as BGA_{12.5}). Significant enhancement of growth was observed in the plants growing on amended soils as compared to GS and best response was obtained in amendment of FA₁₀+NF₉₀+BGA_{12.5}. Accumulation of Si, Fe, Zn and Mn was higher than Cu, Cd, Ni and As. Arsenic accumulation was detected only in FA₁₀₀ and its amendments. Inoculation of BGA_{12.5} caused slight reduction in Cd, Ni and As content of plants as compared to NF₁₂₀ amendment. The high levels of stress inducible non-protein thiols (NP-SH) and cysteine in FA₁₀₀ were decreased by application of NF and BGA indicating stress amelioration. Study suggests integrated use of FA, BGA and NF for improved growth, yield and mineral composition of the rice plants besides reducing the high demand of nitrogen fertilizers. Reproduced with permission from the CAB Abstracts database.

451. Role of CFRI's fly ash soil amendment technology (FASAT) in improving the socio-economic condition of farmers or a improvement in soil fertility and crop productivity.

Srivastava, N. K.; Ram, L. C.; Jha, S. K.; Tripathi, R. C.; and Singh, G. 3(1-2): 127-142. (2003); ISSN: 09724397 [JEOHA]

Descriptors: Environmental Concerns/ Fly Ash/ Soil Amendment/ Solid Waste Management/ Wasteland Reclamation / coal/ fertilizer/ heavy metal/ agriculture/ biotechnology/ Brassica/ climate/ combustion / cotton/ crop/ crop production/ environmental reclamation/ fly ash/ forestry/ fruit growing/ harvest/ India/ landfill/ linseed/ maize/ nonhuman/ peanut/ pond/ radioactivity/ review/ socioeconomics/ soil fertility/ soil treatment/ sugarcane/ wheat/ Arachis hypogaea/ Brassica/ Fraxinus/ Gossypium hirsutum/ Saccharum hybrid cultivar/ Triticum aestivum/ Zea mays

Abstract: During the combustion of coal in thermal power plants (TPPs), huge quantities of fly ash (ca. 100 million tons/annum) from existing 82 TPPs are being generated in India. Despite number of technologies developed/available in the country for bulk use of fly ash/pond ash in different areas, hardly 10-15% of the total fly ash/pond ash is being currently utilised mainly for brick/cement making, land fill etc., and the rest is unutilized. However, the potentialities of bulk use of fly ash in agriculture/forestry sector and for wasteland management has now been well established. In this direction, CFRI has been conducting large scale field demonstration studies on the bulk use of fly ash in agriculture/forestry sector and for wasteland/mine spoil management and bio-reclamation of abandoned ash ponds for the last ten years in different soil types and varied agro-climatic conditions on growth and yield of a variety of crops/forestry species in the vicinity of different TPPs such as Farakka and Bakreshwar TPPs (W. B.), Neyveli TPP (Tamil Nadu), Ramagundam STPP (A.P.), Chandrapur and Bhusawal TPPs (Maharashtra), Anpara, Obra and Harduaganj TPPs (U.P.) etc. Based on these experimentation, CFRI has developed fly ash soil amendment technology (FASAT) through which it is now

possible to use fly ash/pond ash in bulk quantities on sustainable basis for improving the various physico-chemical/biological properties of different agricultural lands/problematic soil/wasteland/mine spoil/abandoned ash pond and increasing the yield (20-60%) of different crops such as wheat, paddy, maize, sugarcane, groundnut, mustard, gram, arhar, cotton, linseed, vegetable crops as also in the growth and yield of different forestry/ornamental and fruit tree species to an appreciable extent. Significant residual effect of pond ash on the yield of succeeding crops at least for a period of six years without any adverse effect due to carry over/uptake of trace heavy metal/radioactivity has also been observed. The results of such investigations have been incorporated and discussed in the present paper. An appraisal has also been made on the possible bulk use of pond ash as soil amendment ranging from 25-200 t/ha; as a source and carrier of in situ plant nutrients; as a liming agent; as a fertiliser additive etc. The cost benefit ratio of pond ash application in agriculture is also discussed. Apart from this, CFRI has played an important role in popularising various beneficial effects of pond ash among the local farmers in the vicinity of different TPPs to improve the fertility status of their field soil and in significantly increasing the yield of various crops to a great extent through various extension programs; personal contacts, pamphlets, audio-visual aids, Kisan Mela/Gosthi etc, involving different concerned organisation. The farmers are now fully convinced of beneficial uses of pond ash and coming forward in utilising it in their fields. Thus in the course of adoption and use of FASAT, the farmers will be greatly benefited and subsequently their socio-economic condition and quality of life is also likely to be improved to a major extent.

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452. Role of soil amendments in improving groundnut productivity of acid lateritic soils.

Manisha Basu; Bhadoria, P. B. S.; and Mahapatra, S. C. *International Journal of Agricultural Research* 2(1): 87-91. (2007); ISSN: 1816-4897

Descriptors: crop yield/ farmyard manure/ fly ash/ green manures/ groundnuts/ lateritic soils/ nitrogen fertilizers/ NPK fertilizers/ phosphorus fertilizers/ potassium fertilizers/ soil amendments/ vermicompost/ FYM/ peanuts/ phosphate fertilizers/ potash fertilizers

Abstract: The present field experiment was conducted in sandy loam acid lateritic soil to study the effect of Fly Ash (FA), organic wastes like farmyard manure (FYM), vermicompost (VC) and green manure (Sesbania rostrata) (GM) and chemical fertilizers on growth and yield of groundnut during rainy season. A uniform fertilizer dose of 20:40:40 kg N:P:K ha⁻¹ was maintained through CF alone or through CF+organic wastes by supplementing 50% of N dose. Nine treatment combinations were tested under completely randomized block design. Application of organic wastes in combination with CF recorded better growth and yield as compared to sole application of CF. Among three organic sources of nutrients GM showed superior performance of the crop over FYM and VC. Integrated application of FA, organic wastes and chemical fertilizers increased the pod yield to the extent of 24.7% over sole application of CF.

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453. Root growth and metal uptake in four grasses grown on zinc-contaminated soils.

Palazzo, A. J.; Cary, T. J.; Hardy, S. E.; and Lee, C. R.
Journal of Environmental Quality 32(3): 834-840. (2003)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: fly ash/ growth/ lime/ nutrient uptake/ plant nutrition/ polluted soils/ roots/ sewage sludge/ shoots/ soil amendments/ soil pollution/ soil types/ survival/ topsoil/ zinc/ *Festuca brevipila*/ *Festuca elatior*

Abstract: Depth and area of rooting are important to long-term survival of plants on metal-contaminated, steep-slope soils. We evaluated shoot and root growth and metal uptake of four cool-season grasses grown on a high-Zn soil in a greenhouse. A mixture of biosolids, fly ash, and burnt lime was placed either directly over a Zn-contaminated soil or over a clean, fine-grained topsoil and then the Zn-contaminated soil; the control was the clean topsoil. The grasses were 'Reliant' hard fescue (*Festuca brevipila* R. Tracey), 'Oahe' intermediate wheatgrass [*Elytrigia intermedia* (Host) Nevski subsp. *intermedia*], 'Ruebens' Canada bluegrass (*Poa compressa* L.), and 'K-31' tall fescue (*Festuca arundinacea* Schreb.). Root growth in the clean soil and biosolids corresponded to the characteristic rooting ability of each species, while rooting into the Zn-contaminated soil was related to the species' tolerance to Zn. While wheatgrass and tall fescue had the strongest root growth in the surface layers (0-5 cm) of clean soil or biosolids, wheatgrass roots were at least two times more dense than those of the other grasses in the second layer (5-27 cm) of Zn-contaminated soil. When grown over Zn-contaminated soil in the second layer, hard fescue (with 422 mg/kg Zn) was the only species not to have phytotoxic levels of Zn in shoots; tall fescue had the highest Zn uptake (1553 mg/kg). Thus, the best long-term survivors in high-Zn soils should be wheatgrass, due to its ability to root deeply into Zn-contaminated soils, and hard fescue, with its ability to effectively exclude toxic Zn uptake.

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454. Root growth and trace element uptake in acid soils treated with coal combustion by-products.

Wright, R. J.; Codling, E. E.; and Wright, S. F.
Chemosphere 36(6): 1463-1474. (1998)

NAL Call #: TD172 .C54; ISSN: 0045-6535

Descriptors: acid soils/ fly ash/ growth/ industrial wastes/ mineral uptake/ plant nutrition/ roots/ scrubber sludge/ sludges/ soil amendments/ trace elements/ uptake/ waste utilization/ wheat/ microelements

Abstract: Root growth of wheat seedlings and trace element levels in ryegrass (*Lolium multiflorum*) were determined in acid soils treated with 1.25 to 80 g kg⁻¹ of eight coal combustion by-products: fly ash (FA), bed ash (BA), cyclone ash (CA), limestone injection residue (LIMB), spray drier residue (SD), scrubber sludge (CS), stabilized scrubber sludge (SS) and gypsum-like material (G). Low application rates of by-products did not inhibit wheat seedling root growth. FA and G did not limit root growth at any application rate while BA, LIMB, SD and CA inhibited root growth at high rates. Ryegrass concentrations of Cu, Zn, Ni, Pb, Cd and Cr were similar in treated and untreated soil. B, Se, As and Mo were increased in ryegrass grown in treated soil, but Se from FA treatments was the only potential food chain risk from a single application of these materials. It is suggested that the G material is the most

benign for land application because it improved root growth without producing elevated trace element levels in plant material or soil solution.

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455. Root penetration of sealing layers made of fly ash and sewage sludge.

Neuschütz, C.; Stoltz, E.; and Greger, M.

Journal of Environmental Quality 35(4): 1260-1268. (July 2006-Aug. 2006)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: root systems/ soil surface sealing/ fly ash/ sewage sludge/ soil penetration resistance/ resistance to penetration/ root growth/ plant growth/ plant stress/ *Betula pendula*/ *Pinus sylvestris*/ *Poa pratensis*/ *Salix viminalis*/ *Phalaris arundinacea*/ *Pisum sativum*/ soil pH/ phytotoxicity/ Internet resource

Abstract: Fly ash and sewage sludge are suggested materials for constructing sealing layers covering mine tailings impoundments. Little is known, however, of their effect on vegetation or resistance to root penetration. We investigate: (i) the ability of different plant species to grow in sealing layers comprising fly ash and sewage sludge, (ii) the impact on plant growth of freshly hardened fly ash compared to aged and leached ash, and (iii) the plant stress response to fly ashes of different properties. A 6-mo greenhouse study using birch (*Betula pendula* Roth.), Scots pine (*Pinus sylvestris* L.), Kentucky bluegrass (*Poa pratensis* L.), and willow (*Salix viminalis* L.) demonstrated that no roots could grow into a compacted layer consisting only of ash, while a 6:4, ash-sludge mixture admitted roots into the upper part and a 1:9, ash-sludge mixture was totally penetrated (to 15 cm in depth) by roots of willow and Scots pine. Freshly hardened ash prevented root growth more effectively than aged ash did, as was observed in tests using reed canarygrass (*Phalaris arundinacea* L.) and pea (*Pisum sativum* L.). Furthermore, extracts of highly alkaline ash were more toxic to pea in a 48-h toxicity test than less alkaline ash was. However, stress responses to diluted ash extracts of lower pH, measured as enzyme capacities in dwarf bean (*Phaseolus vulgaris* L.), were more related to the metal and ion contents. Root penetration of sealing layers is most effectively prevented if little sewage sludge is added, and if ash of high alkalinity is chosen. This citation is from AGRICOLA.

456. Seed germination and growth performance of *Acacia auriculiformis* and *Azadirachta indica* in response to different germination media of flyash.

Kashyap, M. K. and Gupta, R. K.

Vaniki Sandesh 25(2): 22-27. (2001); ISSN: 0972-5598

Descriptors: biomass/ fly ash/ growing media/ growth/ multipurpose trees/ sand/ seed germination/ trees/ woody plants/ neem/ potting composts/ rooting media

Reproduced with permission from the CAB Abstracts database.

457. Selection of suitable substrates for mass multiplication of *Glomus mosseae* and mixed VAM fungi isolated from coal mine overburden.

Chandra, K. K. and Jamaluddin

Biotechnology of Microbes and Sustainable Utilization: 232-238. (2002)

Descriptors: clay minerals/ coal mine spoil/ colonization/

culture media/ endomycorrhizas/ fly ash/ fungal spores/ mycorrhizal fungi/ mycorrhizas/ nutrients/ nutritional state/ polluted soils/ roots/ sand/ soil/ soil organic matter/ soil pollution/ soil types/ sporulation/ substrates/ vermiculite/ vesicular arbuscular mycorrhizas/ Acaulosporaceae/ arbuscular mycorrhizas/ colliery spoil/ Glomaceae/ nutritional status/ organic matter in soil

Abstract: This study was conducted to investigate the suitable substrates for mass multiplication of *Glomus mosseae* and mixed vesicular arbuscular mycorrhizas (VAM, such as *G. intraradices*, *G. mosseae* and *Acaulospora* sp.) isolated from coal mine overburden of Kusmunda, Korba, Madhya Pradesh, India. Different sterilized substrates including soilrite, mixed soilrite, vermiculite, overburden soil, fly ash and their combinations were used in various proportion to compare with the traditional substrate, i.e., sand:soil (1:1). Sand:soil:mixed soilrite (1:1:1) was found to be the best substrate for mass multiplication of both the inocula *G. mosseae* and mixed VAM fungi in *Panicum maximum* trap plants. This exhibited maximum percentage of root colonization and spore population. Mixed soilrite:sand:soil combination having low nutrients and organic matter supported inoculum production, phosphorus status in substrates have played a major role in multiplication of VAM fungi in *P. maximum*. Reproduced with permission from the CAB Abstracts database.

458. Short-term responses of two contrasting species of earthworms in an agricultural soil amended with coal fly-ash.

Muir, M. A.; Yunusa, I. A. M.; Burchett, M. D.; Lawrie, R.; Chan, K. Y.; and Manoharan, V.

Soil Biology and Biochemistry 5(987-992)(May 2007)

NAL Call #: S592.7.A1S6; ISSN: 0038-0717

Descriptors: agricultural soils/ soil pollution/ polluted soils/ heavy metals/ worm casts/ earthworms/ endemic species/ Megascolecidae/ indicator species/ Aporectodea caliginosa/ introduced species/ coal fly ash/ soil amendments/ viability/ mortality/ body weight/ phosphorus/ solubilization/ soil pH/ population density/ New South Wales/ Internet resource

Abstract: With the renewed interest in the use of coal fly-ash for amendment of agricultural soils in Australia, we assessed how earthworms, as indicators of soil health, responded to this ameliorant. We assessed survival, weight, burrowing and elemental concentrations for earthworms of a native unnamed Megascolecid species and of exotic Aporectodea trapezoides in intact soil cores treated with an alkaline fly-ash at rates equivalent to 0, 5 and 25 t/ha over 6 weeks. Fly-ash did not affect survival, growth, number of burrows created or phosphorus solubilisation. Transfer of the earthworms to the new environment having vastly different pH from where they were collected, and possibly overcrowding, caused mortality in the soil cores for all treatments. *A. trapezoides* that had smaller individuals suffered mortality of 12% compared with 23% for the larger earthworms of Megascolecids. Earthworms of Megascolecids each increased their weight by 0.24g (25% of their original weight) while those of *A. trapezoides* lost 0.18g each (21% of their original weight). The difference in growth between the two earthworms was associated with grazing habit and

probably with the large difference in the pH between source soil and that of the core soil. Megascolecids appeared to minimize grazing on ash-tainted soil and so ingested less Zn, which was more abundant in the fly-ash than in the soil, compared with *A. trapezoides* that had elevated concentration of this metal. Extractable P in the soil was increased with both species of earthworms, more so with the exotic species that solubilized 11% more P than the native Megascolecids. The benign influence of fly-ash on survival and growth of worms was associated with the pH of soil remaining unchanged during the six weeks of incubation.

This citation is from AGRICOLA.

459. Silicon-mediated resistance of sugarcane to Eldana saccharina Walker (Lepidoptera: Pyralidae): Effects of silicon source and cultivar.

Keeping, M. G. and Meyer, J. H.

Journal of Applied Entomology 130(8): 410-420. (Sept. 2006); ISSN: 0931-2048

Descriptors: Eldana saccharina/ Saccharum officinarum/ sugarcane/ cultivars/ pest resistance/ varietal resistance/ silicon/ calcium silicate/ fly ash/ soil amendments/ application rate/ soil pH/ nutrient uptake/ crop damage/ silicon content/ Internet resource

Abstract: The effects of four silicon sources - a USA calcium silicate, a local (South African) calcium silicate, Slagment and fly ash - on the resistance of sugarcane cultivars (two resistant and two susceptible) to *Eldana saccharina* Walker (Lepidoptera: Pyralidae) were studied in a potted sugarcane trial. Silicon sources were applied at 5000 or 10 000 kg/ha for the calcium silicates and Slagment; fly ash was applied at 15 000 or 30 000 kg/ha. The greatest increase in plant silicon content (particularly in stalks) was recorded for plants treated with local calcium silicate. Silicon uptake did not vary significantly between the susceptible and resistant cultivars, although the resistant cultivars had inherently higher silicon content than the susceptible ones. Treatment with silicon significantly reduced borer damage and borer performance at the higher treatment level. In general, borer damage and performance decreased with increasing rates of applied silicon and both variables were inversely related with per cent stalk silicon. On average, the higher silicon rate reduced damage by 34% in the susceptible cultivars and by 26% in the resistant cultivars, supporting the argument that susceptible cultivars benefit more from silicon treatments than resistant ones. We propose that calcium silicate amendments could be employed in the integrated, area-wide management of *E. saccharina* and in the management of soil acidity, both of which are widespread problems in the South African sugar industry.

This citation is from AGRICOLA.

460. Sodic soils reclaimed with by-product from flue gas desulfurization: Corn production and soil quality.

Chun, S.; Nishiyama, M.; and Matsumoto, S.

Environmental Pollution 114(3): 453-459. (2001)

NAL Call #: QH545.A1E52; ISSN: 0269-7491.

11584643

Descriptors: Conservation of Natural Resources/ Electrochemistry/ Gases/ Hydrogen-Ion Concentration/ Ion Exchange/ Plant Leaves: chemistry/ Sodium:

pharmacokinetics/ Soil Pollutants: adverse effects/ Sulfur: chemistry/ Trace Elements: analysis: pharmacokinetics/ Zea mays: growth & development: physiology
Abstract: Interest is growing in the use of by-product from flue gas desulfurization (FGD) to reclaim sodic soils by controlling the pH and excessive Na⁺. This study evaluated the effects on corn (Zea mays) production and pH and electrical conductivity (EC) of calcareous sodic soil during four times of cultivation when the by-product was applied once at the first cultivation (Study I) and the impacts on plant and soil quality at first cultivation when the by-product was applied to the soil at 23,000 kg ha⁻¹ (Study II). In Study I, the germination rate and corn production increased by applying the by-product (0, 5,800, 11,600, and 23,100 kg ha⁻¹), and the greatest total amounts of corn production during the four times of cultivation was when the by-product was applied at 23,100 kg ha⁻¹. In Study II, the pH, exchangeable sodium percentage (ESP), clay dispersion and soluble Na⁺ in the soil decreased and soluble Mg²⁺ and soluble K⁺ in the soil increased. The soil pH was reduced from 9.0 to 7.7 by applying the by-product. However, the by-product decreased the concentrations of total N and P in corn leaves in this study. No significant difference in the concentrations of Mo, Zn, Pb, Ni, Cd, Mn, Cr, Cu, and Al in corn leaves and the soil was observed between the by-product addition and the control except for B in the soil and Fe in corn leaves. The concentration of B in the soil was reduced from 28.7 mg kg⁻¹ to 25.4 mg kg⁻¹ and the concentration of Fe in corn leaves increased from 17.5 mg kg⁻¹ to 22.6 mg kg⁻¹ by applying the by-product in our study.

This citation is from PubMed.

461. Soil amendment effects on the yield and terpene contents of the flowerhead of *Chrysanthemum boreale* M.

Lee, K. D. and Yang, M. S.

Agrochimica 50(1/2): 62-71. (2006)

NAL Call #: 385 AG84; ISSN: 0002-1857

Descriptors: chemical composition/ crop quality/ crop yield/ essential oils/ flowers/ fly ash/ lime/ monoterpenoids/ pig manure/ plant composition/ poultry manure/ sesquiterpenes/ soil amendments/ terpenoids/ chemical constituents of plants/ *Chrysanthemum boreale*/ poultry litter/ terpenes

Abstract: We investigated the effects of soil amendments on the growth and essential oil content of *C. boreale*. Plants were cultivated on soil amended with lime, fly ash, poultry manure (PM) or swine manure (SM) at 2, 20, 120 or 120 t ha⁻¹, respectively. PM and SM application increased the flower yields by 37 and 27%, and the essential oil contents by 37 and 39%, respectively, compared with the control. Lime and fly ash, both of which had high calcium contents, increased the contents of germacrene-D content by 44.8 and 38.9%, monoterpenoids by 16 and 15%, and sesquiterpenes by 33 and 28%, respectively, compared to the control. Lime and fly ash also increased the cumambrin A content by 34 and 19%, respectively. Cumambrin A was correlated with calcium content in flowers of *C. boreale* M. The experiment suggests that soil amendments using compost and lime could improve the yields and quality of *C. boreale*.

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462. Soil biochemical activity and growth response of rice *Oryza sativa* in flyash amended soil.

Sarangi, P. K.; Dharitri Mahakur; and Mishra, P. C.

Bioresource Technology 76(3): 199-205. (2001)

NAL Call #: TD930.A32 ; ISSN: 0960-8524

Descriptors: enzyme activity/ fly ash/ growth/ industrial wastes/ pigments/ plant development/ rice/ soil amendments/ soil organic matter/ soil pH/ organic matter in soil/ paddy

Abstract: Soil amended with different proportions of flyash, a solid waste generated from coal-fired thermal power plants, was evaluated as a soil conditioner and nutrient supplement during a field study on the growth of rice, *Oryza sativa*. Generally, pH and organic carbon (OC) content did not increase significantly ($P > 0.05$) in flyash amended soil, but significant increases ($P < 0.05$) in soil conductivity (32%), available phosphorus (48%) and organic matter (OM, 29%) were observed during harvest at the 20 t ha⁻¹ flyash application rate. Amylase, invertase, dehydrogenase and protease activities, and CO₂ evolution increased in flyash amended soil over the control. The pigment (chl-a, chl-b, and carotenoid) content in rice plants did not vary significantly ($P > 0.05$) between different flyash amendments. Total plants biomass and aboveground biomass increased ($P < 0.05$) significantly (17% and 25%, respectively) at the 20 t ha⁻¹ flyash application. However, there was a retarded growth of underground biomass. Grain and straw yield increased by 21% and 18%, respectively, at 17.5 t ha⁻¹ flyash amendment when compared to the control. Although, a significant increase ($P < 0.05$) in plant biomass and grain yield in flyash amended soil is encouraging from the point of waste disposal and management, elucidation of reasons for retarded growth in underground biomass will require additional research based on long-term studies. Reproduced with permission from the CAB Abstracts database.

463. Soil improvement with coal ash and sewage sludge: A field experiment.

Shen, Junfeng; Zhou, Xuewu; Sun, Daisheng; Fang, Jianguo; Liu, Zhijun; and Li, Zhongmin

Environmental Geology 53(8): 1777-1785. (Feb. 2008)

NAL Call #: QE1.E5; ISSN: 0943-0105

Descriptors: sewage sludge/ tree growth/ China/ Sandy soil/ Coal ash/ Soil amelioration/ Internet resource

Abstract: A field experimental study was carried out successfully to improve the quality of the sandy soil by adding coal ash and sewage sludge. One ha of barren sandy soil field was chosen for the experiment in Shanghe County, Shandong Province, China. For soil amelioration and tree planting, two formulas of the mixture: coal ash, sewage sludge and soil, in ratios of 20:10:70 and 20:20:60, respectively, were used. Poplar trees were planted in pits filled with soils with additives (mixture of ash and sludge) as well as in the original sandy soil. In the 19th months after the trees were planted, the soils with additives were sampled and analyzed. The results show that the barren sandy soil was greatly improved after mixing with coal ash and sludge. The improved soils have remarkably higher nutrient concentrations, better texture, smaller bulk density, higher porosity and mass moisture content, and higher content of fine-grained minerals. During the first 22 months after planting, the annual increase in height of the trees grown in the soil with additives (4.78 m per year) was 55%

higher than that of the control group (3.07 m per year), and the annual increase in diameter at the breast height (1.3 m) was 33 % higher (43.03 vs. 32.36 mm). Trees planted in soils with additives appeared healthier and shed leaves later than those in the control group. As the volume of the additives (30-40% in both formulas) is less than that of the sandy soil in and around the tree pits, it appears that the use of coal ash and sludge for tree planting and soil amelioration is environmentally safe even though the additives have relatively high heavy metal concentrations. This citation is from AGRICOLA.

464. Soil microbial community responses to fly ash amendment as revealed by analyses of whole soils and bacterial isolates.

Schutter, M. E. and Fuhrmann, J. J.

Soil Biology and Biochemistry 33(14): 1947-1958. (Nov. 2001)

NAL Call #: S592.7.A1S6; ISSN: 0038-0717 [SBOAH]

Descriptors: Triticum aestivum/ Festuca arundinacea/ soil amendments/ loam soils/ fly ash/ bitumen/ Zea mays/ fatty acid esters/ soil properties/ Arthrobacter/ Gram negative bacteria/ crop rotation/ continuous cropping/ soil bacterial/ microbial physiology/ Delaware/ utilization/ substrates/ aerobic heterotrophic bacteria/ carbon substrate utilization patterns

Abstract: Due to its silty texture and plant nutrient content, coal fly ash may prove a valuable amendment to coarse-textured soils. Its effects on soil chemical and physical properties in the field have been studied, but little is known regarding effects on soil microbial communities. In this study, field plots were amended with fly ash at rates of 0 or 505 Mg fly ash ha⁻¹ and subsequently cropped to a fallow-corn-wheat rotation or continuous fescue. Twenty months later, microbial responses to the fly ash were assessed by analyzing the fatty acid composition and carbon substrate utilization potential of microbial communities and aerobic heterotrophic bacteria isolated from the field plots cropped to wheat and fescue.

Differences in whole-soil fatty acid profiles from amended and non-amended soils were found. Soils amended with fly ash were enriched in fatty acid 16:1(omega)5c, and elevated quantities of 17:0 cy and 16:1(omega)7c were present in fly ash-amended soils cropped to fescue and wheat, respectively. Fatty acid profiles also were affected by cropping system. Extracts from wheat-cropped soils were enriched in 17:1(omega)7c, while those from fescue plots had greater amounts of 18:2(omega)6c and 18:1(omega)9c. Carbon substrate utilization patterns of microbial communities were affected by cropping system but not by fly ash amendment; communities from soils cropped to wheat utilized more carbon substrates than did communities from fescue-cropped soils at the soil dilution tested. Studies of bacterial isolates revealed that Arthrobacter species dominated the culturable, aerobic heterotrophic population, accounting for 25-42% of the total number of isolates recovered from the field plots. Percentages of unidentified isolates also were significant and ranged from 27 to 45% of isolate totals. Effects of fly ash on soil isolates were detected within species of Arthrobacter, with reduced numbers of A. protophormiae in soils amended with fly ash relative to non-amended soils. Overall, the structure of the culturable, aerobic heterotrophic population did not reflect that of the soil community, as fatty acids reported to be markers for Gram-

positive organisms were not the major community fatty acids. Enhanced crop growth and soil texture, pH, and nutrient content as a result of fly ash amendment may explain why no detrimental effects to the microbial community were found. Instead, whole-soil fatty acid data indicates that fly ash amendment may benefit fungi and Gram-negative bacteria relative to other components of the soil microbial community.

This citation is from AGRICOLA.

465. Soil physical and chemical properties as influenced by flyash addition in soil and yield of wheat.

Sharma, S. K.; Naveen Kalra; and Singh, G. R.

Journal of Scientific and Industrial Research 61(8)(2002)

NAL Call #: 475 J82; ISSN: 0022-4456

Descriptors: application rates/ calcium/ chemical composition/ crop yield/ electrical conductivity/ fly ash/ hydraulic conductivity/ macropores/ micropores/ organic carbon/ phosphorus/ pore size distribution/ potassium/ sodium/ soil amendments/ soil chemical properties/ soil composition/ soil pH/ soil physical properties/ soil water retention/ trace elements/ wheat/ wilting point/ yield increases/ chemical properties of soil/ microelements/ physical properties of soil

Abstract: Field experiments were conducted in villages around the National Capital Power Project in Dadri, Uttar Pradesh, and Indian Agricultural Research Institute Farm in New Delhi during 1995-1996 to evaluate the effects of fly ash addition on soil and on the yield of wheat crop. Up to 50 tonnes/ha of fly ash was applied to the soil. Results show that wheat yield increased up to 20 tonne/ha ash addition, and declined thereafter but still higher than the yield from plots not treated with fly ash. Fly ash treated plots had marginally higher uptake of trace elements, reduced soil hydraulic conductivity and soil pH, and improved moisture retention at field capacity and permanent wilting point. The amended soil also showed increased electrical conductivity and organic C and Na content, and decreased P, K and Ca contents. These changes in soil properties might be due to the modifications in the macro- and micropore size distribution which contributed to increased yield of wheat.

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466. Soil properties and crop productivity as influenced by flyash incorporation in soil.

Naveen Kalra; Jain, M. C.; Joshi, H. C.; Chaudhary, R.; Sushil Kumar; Pathak, H.; Sharma, S. K.; Vinod Kumar; Ravindra Kumar; Harit, R. C.; Khan, S. A.; and Hussain, M. Z.

Environmental Monitoring and Assessment 87(1): 93-109. (2003)

NAL Call #: TD194 .E5 ; ISSN: 0167-6369

Descriptors: application rates/ bulk density/ crop production/ crop yield/ electrical conductivity/ fly ash/ growth/ Indian mustard/ lentils/ maize/ productivity/ rice/ silty soils/ soil amendments/ soil chemical properties/ soil density/ soil organic matter/ soil pH/ soil physical properties/ soil types/ soil water retention/ sowing/ transmission/ transplanting/ wheat/ Capparales/ chemical properties of soil/ corn/ organic matter in soil/ paddy/ physical properties of soil/ seed sowing

Abstract: Field experiments were carried out during 1996-97 at Gulawathi, Muthiani and Salarpur Villages, IARI Farm,

New Delhi and NCPP Campus, Dadri to evaluate changes in soil characteristics and growth of wheat (*Triticum aestivum*), mustard (*Brassica juncea*), lentil (*Lens culinaris*), rice (*Oryza sativa*) and maize (*Zea mays*) by varying amounts of flyash addition (up to 50 t ha⁻¹) in soils at sowing/transplanting time of crops. Flyash addition in areas adjoining the NCPP Thermal Power Plant, Dadri, Ghaziabad, Uttar Pradesh, ranged from 5-12 t ha⁻¹ yr⁻¹ in 1995-96. Shoot and root growth and yield of test crops at different locations after flyash incorporation resulted in beneficial effects of flyash addition in most cases. The silt dominant texture of flyash improved loamy sand to sandy loam textures of the surface soils at the farmers' fields. The increased growth in yield of crops with flyash incorporation was possibly due to modifications in soil moisture retention and transmission characteristics, bulk density, physico-chemical characters such as pH and EC and organic carbon content. The response of flyash addition in the soil on soil health and crop productivity needs to be evaluated on long-term sustainable aspects. Reproduced with permission from the CAB Abstracts database.

467. Soil properties and performance of marigold (*Tagetes erecta*) as affected by flyash and distillery effluent.

Anandhkumar, S. P.; Sanjeev Tripathi; Sharma, D. K.; Misra, R. L.; and Joshi, H. C.
Indian Journal of Agricultural Sciences 74(12): 675-677. (2004)

NAL Call #: 22 AG83I; ISSN: 0019-5022

Descriptors: application rates/ carotenoids/ chemical composition/ chlorophyll/ crop yield/ distillery effluent/ flowers/ fly ash/ leaves/ plant composition/ plant height/ soil chemical properties/ soil physical properties/ chemical constituents of plants/ chemical properties of soil/ physical properties of soil/ tetraterpenoids

Abstract: A field experiment was conducted during the winter season of 2002/03 in Uttar Pradesh, India to study the soil properties and the performance of marigold (*Tagetes erecta*) as affected by different doses of mixtures of fly ash and distillery effluent. Incorporation of fly ash and distillery effluent mixture either in 1:1 or 1:2 at 20 tonnes/ha markedly improved the plant height, flower yield, total chlorophyll in leaves and carotenoid content in flowers. Use of these organic wastes in raising the horticultural crops not only improved the physical and chemical soil properties as affected through improvement in qualitative and quantitative characters of marigold but also saved the environment from its degradation through their disposal in nearby vicinity of the distillery.

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468. Soil properties and turf growth on a sandy soil amended with fly ash.

Pathan, S. M.; Aylmore, L. A. G.; and Colmer, T. D.
Plant and Soil 256(1): 103-114. (2003)

NAL Call #: 450 P696; ISSN: 0032-079X

Descriptors: application rates/ fly ash/ growth/ lawns and turf/ leaching/ nitrogen fertilizers/ nutrients/ phosphorus fertilizers/ sandy soils/ soil amendments/ soil properties/ soil types/ soil water content/ uptake/ Bermuda grass/ lawns and sports turf/ phosphate fertilizers

Abstract: Field lysimeters of a sandy soil were amended to a depth of 100 mm with four rates (0, 5, 10 and 20%, wt/wt) of fly ash, and effects on soil water content, nutrient leaching, turf growth and nutrition, and uptake of trace elements by turf were assessed. Measurements were taken for 70 days for lysimeters either planted with rhizomes of *Cynodon dactylon* (L.) Pers., cv. 'Wintergreen', or left bare. When irrigated daily, soil water content increased progressively with increasing rates of fly ash and leachate volumes were decreased by 17-52% for lysimeters containing fly ash amended soil. Fertiliser was applied equivalent to 28.4 g N m⁻² and 10.3 g P m⁻² for the entire 70 days (including pre-plant application). Macronutrient concentrations in leaf tissue were within levels regarded as sufficient. Total dry mass (root plus shoot) decreased when fertiliser application rates were reduced by 25%, irrespective of fly ash treatment. In 'bare' lysimeters containing fly ash amended soil, cumulative leaching of NO₃⁻, NH₄⁺ and P were 0.32-0.88 of the values in non-amended soil. When planted with turf, leaching of those nutrients was minimal (equivalent to 3% of total N applied) and leaching losses did not differ among fly ash rates. Extractable soil P levels were increased 2.5-4.5-fold in the fly ash amended zone, compared with non-amended soil. Root mass in the top 100 mm was 1.2-1.5-fold larger for turf in fly ash amended soil, compared to non-amended soil. The Se concentrations were higher in leaf tissue grown in fly ash amended soil (being at most 0.63 micro g g⁻¹), but there was no effect of fly ash amended soil on As, Ba, B, Cd, Co, Cr, Cu, Pb, Hg, Mn, Ni, Ag or Zn in leaf tissues. Thus, fly ash amendment may be a suitable management option for turf culture on sandy soils, since fly ash improved soil water holding capacity and root growth in the amended zone. Reproduced with permission from the CAB Abstracts database.

469. Soil properties as influenced by fly ash application.

Anjali Deshmukh; Matte, D. B.; and Bharti Bhaisare
Journal of Soils and Crops 10(1): 69-71. (2000); ISSN: 0971-2836

Descriptors: ash/ bulk density/ calcium/ cation exchange capacity/ copper/ electrical conductivity/ fly ash/ iron/ magnesium/ manganese/ NPK fertilizers/ nutrient availability/ soil chemistry/ soil fertility/ soil pH/ soil properties/ trace elements/ water holding capacity/ wheat/ zinc/ microelements/ Mn

Abstract: Application of graded levels of fly ash was studied on the farm of Agriculture College, Nagpur, India, during the rabi season of 1993-94. Wheat CV AKW-381 was grown as test crop. Application of fly ash decreased bulk density and maximum water holding capacity of soil, while no marked effects on pH, EC, CEC and lime content were observed. The available NPK and micronutrients like Cu, Fe, Zn, Mn and exchangeable Ca and Mg increased with fly ash application.

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470. Soil solution chemistry of a fly ash, poultry litter, and sewage sludge-amended soil.

Jackson, B. P. and Miller, W. P.
Journal of Environmental Quality 29(2): 430-436. (2000)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: amendments/ application rates/ arsenic/ carbon/ centrifugation/ chlorine/ coal/ copper/ extraction/ fly ash/ magnesium/ mixtures/ moisture/ moisture content/ molybdenum/ nitrate/ nutrients/ organic wastes/ phosphorus/ pollution/ potassium/ poultry manure/ sandy loam soils/ selenium/ sewage sludge/ sludges/ sodium/ soil/ soil amendments/ soil solution/ sulfate/ trace elements/ treatment/ Ultisols/ wastes/ competition/ environmental pollution/ microelements/ Mo/ poultry litter

Abstract: Mixing coal fly ash (FA) with organic wastes to provide balanced soil amendments offers a potential viable use of this industrial by-product. When such materials are land-applied to supply nutrients for agronomic crops, trace element contaminant solubility must be evaluated. In this study, major and trace element soil solution concentrations arising from application of fly ash, organic wastes, and mixtures of the two were compared in a laboratory incubation. Two fly ashes, broiler poultry litter (PL), municipal sewage sludge (SS), and mixtures of FA with either PL or SS were mixed with a Cecil sandy loam (fine, kaolinitic, thermic Typic Kanhapludult) at rates of 32.3, 8.1, and 16.1 g kg⁻¹ soil for FA, PL, and SS, respectively. Treatments were incubated at 22 degrees C at 17% moisture content and soil solution was periodically extracted by centrifugation over 33 d. Initial soil solution concentrations of As, Mo, Se, and Cu were significantly greater in FA/PL treatments than the respective FA-only treatments. For Cu, increased solution concentrations were attributable to increased loading rates in FA/PL mixtures. Solution Cu concentrations were strongly correlated with dissolved C ($R^2 > 0.96$) in all PL treatments. Significant interactive effects for solution Mo and Se concentrations were observed for the FA/PL and may have resulted from the increased pH and competing anion concentrations of these treatments. Solution As concentrations showed a significant interactive effect for one FA/PL mixture. For the individual treatments, As was more soluble in the PL treatment than either FA treatment. Except for soluble Se from one FA/SS mixture, trace element solubility in the FA/SS mixtures was not significantly different than the respective FA-only treatment. Reproduced with permission from the CAB Abstracts database.

471. Soil solution chemistry of two reclamation sites in the Lusatian lignite mining district as influenced by organic matter application.

Wilden, R.; Schaaf, W.; and Huttel, R. F. *Plant and Soil* 213(1/2): 231-240. (1999)
NAL Call #: 450 P696; ISSN: 0032-079X

Descriptors: acidity/ application rates/ ash/ chemical composition/ composition/ composts/ fly ash/ ions/ lignite/ limestone/ minerals/ mining/ organic amendments/ organic matter/ oxidation/ pyrites/ reclamation/ rehabilitation/ sewage/ sewage sludge/ sludges/ soil solution/ subsoil/ topsoil/ treatment/ weathering

Abstract: A field study was conducted to compare the effects of mineral fertilizer, sewage sludge and compost on soil solution chemistry of both a lignite- and pyrite-containing spoil as well as a lignite- and pyrite-free spoil in Germany. The lignite- and pyrite-containing spoil was ameliorated with fly ash (17-21 t CaO ha⁻¹), whereas the lignite- and pyrite-free site received 7.5 t CaO ha⁻¹ as limestone. Fertilizer application rates were: mineral fertilizer

120 N, 100 P and 80 K kg ha⁻¹. 19 t sewage sludge ha⁻¹ and 22 t compost ha⁻¹ were applied. Soil solution was sampled at 20, 60 and 130 cm depth for 16 months. Solution was collected every fortnight and analysed for pH, electrical conductivity, Ca²⁺, Mg²⁺, K⁺, Na⁺, Fe³⁺, Mn²⁺, Zn²⁺, NO₃⁻, NH₄⁺, SO₄²⁻, Cl⁻, PO₄³⁻, C_{inorg} and dissolved organic carbon. Lignite- and pyrite-containing spoil differed from lignite- and pyrite-free spoil regarding soil solution concentrations and composition. Acidity (H⁺) produced by pyrite oxidation led to enhanced weathering of minerals and, therefore, to at least 10-fold higher soil solution concentrations compared to the lignite- and pyrite-free site. Major ions in solution of the lignite and pyrite-containing site were Ca²⁺, Mg²⁺, Fe³⁺, Al³⁺ and SO₄²⁻, whereas soil solution at the lignite and pyrite-free site was dominated by Ca²⁺, Mg²⁺ and SO₄²⁻. At both sites application of mineral fertilizer led to an immediate but short term increase of NO₃⁻, NH₄⁺ and K⁺ concentrations in soil solution to a depth of 130 cm. Application of sewage sludge caused a long-term (~16 months) increase of NO₃⁻ in the topsoil, whereas NO₃⁻ concentrations in the subsoil were significantly lower compared to the mineral fertilizer plot. Compost application resulted in a strong long-term increase of K⁺ in soil solution, whereas NO₃⁻ concentrations did not increase. Concentrations of PO₄³⁻ in soil solution depend on solution pH and were not correlated with any treatment. Reproduced with permission from the CAB Abstracts database.

472. Soil stabilization in semiarid and arid land agriculture.

Graber, E. R.; Fine, P.; and Levy, G. J. 18(2): 190-205. (2006); ISSN: 08991561.

Notes: doi: 10.1061/(ASCE)0899-1561(2006)18:2(190).

Descriptors: agriculture/ arid lands/ fly ash/ soil stabilization / electrolytes/ flocculation/ fly ash/ gypsum/ ion exchange/ organic polymers/ positive ions/ stabilization/ arid land/ semiarid land/ soil stabilization/ soils/ agriculture/ arid region/ fly ash/ semiarid region/ soil amendment/ soil property/ soil stabilization/ swelling

Abstract: Soil and water conservation is essential for sustaining food production and for preserving the environment. This review considers the potential of four types of soil amendments, namely gypsum, organic polymers, organic matter waste materials, and fly ash, as soil stabilizers. Addition of gypsum to soil can limit clay swelling and dispersion, and thus improve soil structural stability, by both soil solution electrolyte effects and cation-exchange effects. Synthetic organic polymer addition to soil surface aggregates leads to their stabilization, improved bonding between adjacent aggregates, and clay flocculation. Organic matter, also used for promoting aggregate stabilization, enhances soil microbial activity that transforms the newly added organic matter into polysaccharides and long chain aliphatic compounds capable of binding and stabilizing aggregates. Fly ash additives can improve soil physical characteristics including texture, structure, water holding capacity, hydraulic properties, and aeration. However, fly ash has a number of inherent qualities that under certain circumstances may limit its usefulness for soil stabilization, and which may even result in increased erosion and soil loss. _ 2006 ASCE.

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473. Soils and the environment: The past 25 years.

Schoeman, J. L. and Deventer, P. W. van
South African Journal of Plant and Soil 21(5): 369-387.
(2004)

NAL Call #: S596.53.S69; ISSN: 0257-1862

Descriptors: agricultural soils/ bioremediation/ carbon sequestration/ deforestation/ environmental degradation/ environmental impact/ environmental management/ fertilizers/ fires/ fly ash/ housing/ irrigation/ irrigation water/ mine spoil/ natural disasters/ nutrient deficiencies/ organic amendments/ peatlands/ pesticides/ polluted soils/ polluted water/ pollution control/ refuse/ reviews/ sewage sludge/ soil amendments/ soil biology/ soil conservation/ soil degradation/ soil fertility/ soil pollution/ soil types/ urbanization/ environmental effects/ mine wastes/ mining spoil/ mining wastes/ municipal wastes/ soil quality/ soil sodicity/ trash/ watering

Abstract: Local work on selected environmental impacts on soil quality and the role of soils in the attenuation of environmental pollution is reviewed. Examples of negative impacts from mining, industries, urbanization, agriculture and forestry abound. The safe and sustainable use of various waste products may impact positively, but norms and standards are needed. Soil nutrient deficiencies or excesses give rise to nutrition-related disorders in humans and animals. Through bioremediation, soil becomes an ally in restoring environmental health. Harmonization of agricultural production and the environment is a political target towards which science must provide effective decision support. The development and application of a national environmental monitoring and evaluation system is needed for incorporating environmental data, information, norms and standards into a holistic picture. There is a need for improved cross-linking and synergy between various sectors impacting on the environment. The local government level is becoming critical to environmental management. The safe and sustainable use of sewage sludge/fly ash combinations on agricultural soils is suggested to be a highly promising future avenue of environmental R&D.

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474. Soluble arsenic and selenium species in fly ash/organic waste-amended soils using ion chromatography-inductively coupled plasma mass spectrometry.

Jackson, B. P. and Miller, W. P.

Environmental Science and Technology 33(2): 270-275.
(1999)

NAL Call #: TD420.A1E5; ISSN: 0013-936X

Descriptors: analytical methods/ arsenic/ chemical composition/ chemical speciation/ chromatography/ contamination/ fly ash/ litter/ mass spectrometry/ mineralization/ organic wastes/ oxidation/ poultry manure/ selenium/ semimetals/ sewage sludge/ soil amendments/ soil solution/ trace elements/ waste treatment/ analytical techniques/ metalloids/ microelements/ poultry litter

Abstract: Speciation of As and Se in soil solutions of fly ash-, poultry litter- and sewage sludge-amended soils was determined over a 10-day period by ion chromatography coupled to inductively coupled plasma mass spectrometry (IC-ICP-MS). Detection limits were 0.031, 0.028, 0.051, 0.161, 0.497, and 0.660 micro g/litre for dimethylarsinate (DMA), As-(III), monomethylarsonate (MMA), As(V), Se(IV),

and Se-(VI), respectively (100 micro litre injection). Arsenic was highly water-soluble from poultry litter and appeared to be predominantly As(V). Arsenic(V) was the predominant species in soil amended with two fly ashes. Application of fly ash/poultry litter mixtures increased As solubility and led to the prevalence of DMA as the major As species. DMA concentrations in these soil solutions decreased rapidly over the sampling period relative to As(V), which suggested that DMA readily underwent mineralization in the soil solution. Se(VI) was the predominant soluble Se species in all treatments indicating rapid oxidation of Se(IV) initially solubilized from the fly ashes.

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475. Solute leaching from fly ash amended soil under varying degrees of saturation.

Hutchison, J. M.; Seaman, J. C.; Jackson, B. P.; and Aburime, S. A.

In: *Coal Combustion Byproducts and Environmental Issues*. Uppsala, SWEDEN.)

New York, NY: Springer; pp. 134-141; 2006.

Notes: 7th International Conference on Biogeochemistry of Trace Elements.; ISBN: 0387258655

Descriptors: toxicology/ pollution assessment control and management/ soil science/ unsaturated flow apparatus: field equipment/ fly ash/ loamy sand soil/ equilibration time/ solute leaching/ settling pond

Abstract: Most of the fly ash produced in the US is stockpiled or disposed of in settling ponds where solute leaching can pose an environmental and health concern. Therefore, a series of saturated and unsaturated column experiments were conducted to evaluate the impact of saturation and pore solution residence time (i.e., equilibration time) on the leaching of solutes from fly ash when incorporated within surface horizon material from a loamy sand soil. Repacked soil columns were leached at various moisture contents using an Unsaturated Flow Apparatus (UFA), a modified centrifuge for conducting steady-state leaching experiments. Additional column experiments were conducted under saturated conditions to isolate the effects of residence time from that of water content. Addition of 10 percent fly ash (by weight) significantly increased water-holding capacity in the loamy sand. Leachate concentration of As and Se increased as residence time increased. Most Se leaching took place in the first few pore volumes, indicating that weathering the fly ash may help alleviate some of its phytotoxic effects. Since saturation was related to residence time in these experiments, the effect of water content could not be isolated, though there appeared to be a delay in the "leaching front" as the soil became desaturated. However, comparisons of unsaturated leaching studies to saturated leaching studies are difficult due to the variation in water content under unsaturated conditions.

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476. Some cytological observations of radish grown on fly-ash amended soil.

Mishra, P. K. and Mehta, U. C.

Cruciferae Newsletter 24: 15-16. (2002); ISSN: 0263-9459

Descriptors: chromosomes/ cultivars/ cytology/ DNA/ fly ash/ microscopy/ radishes/ root vegetables/ soil amendments/ soil pollution/ vegetables/ Capparales/ cultivated varieties/ deoxyribonucleic acid/ vegetable crops

Abstract: Three varieties of radish (*Raphanus sativus*), Japanese White, Pusa Himani, and Doppel Bock, were grown on 30% fly ash amended soil. DNA estimation, fixation and staining were carried out as described by McLeish and Sunderland [Experimental Cell Research (1961) 24, 527-540]. Measurement of nuclear dry mass was made by interference microscopy, and chromosome volume was estimated using length and width measurements of metaphase chromosomes. In all three varieties DNA content, chromosome volume and nuclear dry mass were increased over levels found in the controls. DNA content of Japanese White, Pusa Himani and Doppel Bock increased by 6.67, 12.16 and 6.28% respectively, while nuclear dry mass showed percentage increases of 5.9, 5.3 and 4.2%, respectively. All variations were significant ($p < 0.05$).

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477. **Stabilization of Pb and Cu contaminated soil using coal fly ash and peat.**

Kumpiene, J.; Lagerkvist, A.; and Maurice, C.
Environmental Pollution 145(1): 365-373. (2007)
NAL Call #: QH545.A1E52; ISSN: 0269-7491

Descriptors: bioavailability/ coal/ copper/ fly ash/ leaching/ lead/ peat/ phytotoxicity/ polluted soils/ seed germination/ shoots/ soil bacteria/ soil pollution/ soil stabilization/ soil toxicity/ soil types/ uptake/ bioaccumulation/ remediation/ toxic soils

Abstract: The stabilization of metal contaminated soil is being tested as an alternative remediation method to landfilling. An evaluation of the changes in Cu and Pb mobility and bioavailability in soil induced by the addition of coal fly ash and natural organic matter (peat) revealed that the amount of leached Cu decreased by 98.2% and Pb by 99.9%, as assessed by a batch test. Metal leaching from the treated soil was lower by two orders of magnitude compared to the untreated soil in the field lysimeters. A possible formation of mineral Cu- and Pb-bearing phases and active surface with oxides were identified by chemical equilibrium calculations. Low metal leaching during a two-year observation period, increased seed germination rate, reduced metal accumulation in plant shoots, and decreased toxicity to plants and bacteria, thereby demonstrating this stabilization method to be a promising technique for in situ remediation of Cu and Pb contaminated soil.

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478. **Stabilizing cattle feedlot soil with fluidized bed combustor ash.**

Greenlees, W. J.; Pitt, J. M.; Dawson, M. R.; Chriswell, C. D.; and Melvin, S. W. 41(1): 203-211. (1998); ISSN: 00012351 [TAAEA].

Notes: Chapter Number: St. Joseph, MI, United States.

Descriptors: cattle feedlots/ FBC ash/ fluidized bed combustor/ soil stabilization/ agricultural engineering/ engineering research/ fluidized bed combustors/ fly ash/ soil testing/ stabilization/ strength of materials/ soil stabilization/ soils/ animalia/ bos taurus

Abstract: Many cattle feedlots are operated on bare soil because it is expensive to cover the entire lot with concrete. During heavy rainfalls, feedlots built on clay-rich soils often

become muddy as their soils lose strength. These soils cannot support the weight of animals or equipment. As a result, the animals' rate of gain suffers, and feedlot management becomes difficult. Fluidized Bed Combustor (FBC) ash from the Iowa State University Physical Plant was used to produce a significant increase in soil strength on a cattle feedlot near Nevada, Iowa. FBC ash is the residue from burning high-sulfur coal in fluidized bed combustors. Limestone (calcium carbonate) enters the combustor with the coal as a sorbent to reduce sulfur dioxide emissions. FBC ash is considered a 'nuisance' waste, and the cost for disposal exceeds US\$20 per metric ton. Stabilizing cattle feedlot soil with FBC ash represents a recovery of resources because the ash, when combined with clay soil and water, has cementitious properties. Research was conducted with three objectives: (1) to determine whether FBC ash can be used to increase the strength of feedlot soil when applied at a level of quality control attainable by using ordinary agricultural tillage equipment; (2) to compare feedlot soil stabilized with FBC ash to non-stabilized feedlot soil in both laboratory and field tests; and (3) to develop a low-cost alternative to paving a feedlot with concrete. Field results from a feedlot treated with FBC ash show that soil strength was improved 200% to 300% when compared with an adjacent untreated feedlot.

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479. **Stressed out? Assessing trace metal uptake and stress in plants grown in coal fly ash-amended soils.**

Mattox, Joy M.; Brake, Sandra S.; Jensen, Ryan R.; and Short, Shaun E.

In: Abstracts with Programs: Geological Society of America. Lexington, KY, United States.; Vol. 34(2); pp. 87; 2002.

Notes: Geological Society of America, Southeastern Section, 51st annual meeting; Geological Society of America, North-Central Section, 36th annual meeting.

Descriptors: ash/ chemical composition/ coal/ ecology/ ecosystems/ Plantae/ sedimentary rocks/ soils/ trace metals/ environmental geology

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480. **Studies on hydraulic transportation of sewage sludge: Fly ash mixture slurry.**

Senapati, P. K.; Panda, D.; and Parida, A. 33(2): 67-74. (2007); ISSN: 10881697

Descriptors: fly ash/ head loss/ hydraulic transportation/ mineralogy/ rheology/ sewage sludge/ fly ash/ mineralogy/ plasticity/ rheology/ rheometers/ slurries/ soils/ transport properties/ head loss/ top soil/ torrance equation/ sewage sludge

Abstract: The present investigation highlights the transport characteristics of sewage sludge - fly ash mixture to be used as top soil in barren agricultural land for enhancing its fertility. Both mineralogical and rheological studies have been carried out. Mineralogical studies indicated the constituents imparting fertility to the soil. The rheological characteristics of the mixture slurry have been determined in a Haake RV100 rheometer at overall slurry concentration between 30-50% by weight. The slurry showed pseudo plastic behaviour within the range of study. The head loss of the mixture slurry has been determined by applying

Torrance equation. Based on the results, the basic design parameters for transporting 0.5-1 million tones of total dry solids (fly ash and sewage sludge) per annum have been worked out.

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481. Studies on the effect of stabilizing materials on the status of heavy metals (Cu, Zn, Mn) during composting of sewage sludge.

Li GuoXue; Meng FanQiao; Jiang Hua; and Shi YaJuan
Journal of China Agricultural University 5(1): 105-111. (2000)

Descriptors: coal/ composting/ fly ash/ heavy metals/ manganese/ peat/ phosphate/ sewage sludge/ soil amendments/ soil pollution/ stabilizing/ zeolites/ zinc/ Mn

Abstract: A series of composting tests were used to study the effect of stabilizing materials including fly ash, rock phosphate, zeolite and peat on the status of heavy metals (Cu, Zn, Mn) through composting. The results indicate that peat, coal fly ash and rock phosphate were effective in stabilization. The suitable amendment rate for coal fly ash and phosphate rock should be 25% and 20% respectively. Reproduced with permission from the CAB Abstracts database.

482. Studies on the effects of fly ash treated soil on the increased protein contents in the seeds of Glycine max (soya bean).

Goyal, V.; Augar, M. R.; and Shrivastava, D. K. 14(1): 328-332. (2002); ISSN: 09707077 [AJCHE]

Descriptors: effect/ fly ash/ glycine max/ protein/ soil/ acidity/ crop production/ fly ash/ parameter/ plant growth/ plant seed/ protein content/ soil chemistry/ soil property/ soybean

Abstract: The soil of Chhattisgarh State has been found to be of acidic nature, which is not conducive to plant growth and better crop yield. In the pot experiments, various proportions of fly ash and soil were used for soya bean plant growth observations. Soil and the fly ash were from Hasdeo-Bango Command Area and NTPC Korba, respectively. Various plant parameters, especially amino acid contents, showed improvement in the modified soil samples.

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483. Study on the effect of application of magnetized fly ash compound fertilizer on soyabeans.

Sun KeGang; Zhang ZhiWu; Song JiangChun; Guo JingShui; and Wang MingTang
Soybean Science 19(4): 381-385. (2000); ISSN: 1000-9841
Descriptors: application rates/ fertilizers/ fly ash/ nodulation / soyabeans/ Honan/ soybeans

Abstract: In a field trial on Shajiang black soils in Nanyang county, Henan, China, soyabeans given 49 kg magnetized fly ash compound fertilizer/667 m² had a yield of 114.9 kg/667 m², which was 23.7 kg or 25.9% higher than that of the control, 15.2 kg or 15.2% higher than with farmers' traditional fertilization practices, 4.9 kg or 4.5% higher than with the same amount of NPK fertilizer, and 2.8 kg or 2.5% higher than with non-magnetized fly ash compound fertilizer. Soyabean yield was highest (130.3 kg/667 m²) with application of 66.4 kg fly ash/667 m², while the optimum application was 49 kg/667 m², giving a yield of

127.18 kg/667 m². The magnetized fly-ash compound fertilizer improved soyabean root nodule formation. Reproduced with permission from the CAB Abstracts database.

484. Study on the fertilization technique of fly ash and nitrate phosphate fertilizer for improving wheat yield on clay soil in south Shanxi.

Li Lianqing
Journal of Shanxi Agricultural University (China) 18(3): 232-235. (Sept. 1998); ISSN: 1000-162X.

Notes: Original title: Nianzhiturang xiaomai gaochan de shiyong fenmeihui ji danlinfei jishu chutan. 5 tables; 1 ill., 3 ref. Summaries (En, Zh). Citation notes: CN (China).

Descriptors: fertilization/ fly ash/ nitrate-phosphate fertilizer/ wheat/ yield/ clay soil/ Shanxi/ China
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485. A study on the formula for polybasic compound fertilizer of powdered coal ash applied in peanut.

Zhao Qing; Shi LiYou; Li GuoZhen; Wang HaiHui; Yao YiYun; Gong QingHong; and Wan FangBao
Acta Agriculturae Universitatis Jiangxiensis 24(2): 200-203. (2002); ISSN: 1000-2286

Descriptors: application rates/ ash/ compound fertilizers/ crop yield/ groundnuts/ peanuts

Abstract: The result of the study indicates that a polybasic compound fertilizer of powder coal ash increases groundnut production. The yields from the treatments with different formulae were higher by 1%, on average, making remarkable difference. Based on economic performance, the formulae of 1:1.5:1 and 1:2:1 were optimum, which increased yield by 9.3 and 8.8%, respectively, compared with that of the control.

Reproduced with permission from the CAB Abstracts database.

486. A study on the formula for polybasic compound fertilizer of powdered coal ash applied in rice.

Wang HaiHui; Zhao Qing; Li GuoZhen; Shi LiYou; Yao YiYun; Gong QinHong; and Wan FangBao
Acta Agriculturae Universitatis Jiangxiensis 24(2): 196-199. (2002); ISSN: 1000-2286

Descriptors: coal/ crop yield/ fertilizers/ growth/ nutrient content/ plant development/ rice/ soil fertility/ paddy

Abstract: The results of this study showed that the application of a polybasic compound fertilizer of powdered coal ash increases the content of nutrients in the soil and enhances rice growth, development, production and economic performance. Formulae of 3:1:4 and 3:1:2 were considered optimum and increased the yield of early rice by 13.3 and 10.6% and of late rice by 10.4 and 9.8%, respectively, compared with that of the control.

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487. Summer cover crops and soil amendments to improve growth and nutrient uptake of okra.

Wang, Q. Li Y and Klassen, W.
HortTechnology 16(2): 328-338. (Apr. 2006-June 2006)
NAL Call #: SB317.5.H68; ISSN: 1063-0198

Descriptors: Abelmoschus esculentus/ okra/ cover crops/

nutrient uptake/ plant nutrition/ plant growth/ crop yield/ dry matter accumulation/ biosolids composts/ yard waste composts/ soil fertility/ heavy metals/ trace elements/ coal fly ash/ *Crotalaria juncea*/ *Vigna unguiculata*/ *Mucuna pruriens* var/ *utilis*/ *Sorghum drummondii*/ fallow

Abstract: A pot experiment with summer cover crops and soil amendments was conducted in two consecutive years to elucidate the effects of these cover crops and soil amendments on 'Clemson Spineless 80' okra (*Abelmoschus esculentus*) yields and biomass production, and the uptake and distribution of soil nutrients and trace elements. The cover crops were sunn hemp (*Crotalaria juncea*), cowpea (*Vigna unguiculata*), velvetbean (*Mucuna deeringiana*), and sorghum sudangrass (*Sorghum bicolor* x *S. bicolor* var. *sudanense*) with fallow as the control. The organic soil amendments were biosolids (sediment from wastewater plants), N-Viro Soil (a mixture of biosolids and coal ash, coal ash (a combustion by-product from power plants), co-compost (a mixture of 3 biosolids : 7 yard waste), and yard waste compost (mainly from leaves and branches of trees and shrubs, and grass clippings) with a soil-incorporated cover crop as the control. As a subsequent vegetable crop, okra was grown after the cover crops, alone or together with the organic soil amendments, had been incorporated. All of the cover crops, except sorghum sudangrass in 2002-03, significantly improved okra fruit yields and the total biomass production (i.e., fruit yields were enhanced by 53% to 62% in 2002-03 and by 28% to 70% in 2003-04). Soil amendments enhanced okra fruit yields from 38.3 to 81.0 g/pot vs. 27.4 g/pot in the control in 2002-03, and from 59.9 to 124.3 g/pot vs. 52.3 g/pot in the control in 2003-04. Both cover crops and soil amendments can substantially improve nutrient uptake and distribution. Among cover crop treatments, sunn hemp showed promising improvement in concentrations of calcium (Ca), zinc (Zn), copper (Cu), iron (Fe), boron (B), and molybdenum (Mo) in fruit; magnesium (Mg), Zn, Cu, and Mo in shoots; and Mo in roots of okra. Among soil amendments, biosolids had a significant influence on most nutrients by increasing the concentrations of Zn, Cu, Fe, and Mo in the fruit; Mg, Zn, Cu, and Mo in the shoot; and Mg, Zn, and Mo in the root. Concentrations of the trace metal cadmium (Cd) were not increased significantly in either okra fruit, shoot, or root by application of these cover crops or soil amendments, but the lead (Pb) concentration was increased in the fruit by application of a high rate (205 g/pot) of biosolids. These results suggest that cover crops and appropriate amounts of soil amendments can be used to improve soil fertility and okra yield without adverse environmental effects or risk of contamination of the fruit. Further field studies will be required to confirm these findings.

This citation is from AGRICOLA.

488. Swelling and consolidation behaviour of industrial waste stabilized expansive soil.

Srivastava, R. K.; Patil, P. G.; and Tiwari, R. P.
In: Soil Mechanics and Geotechnical Engineering. Proceedings of the Eleventh Asian Regional Conference. Seoul, Korea.; Vol. 1.; pp. 473-476; 1999.
Descriptors: disposal / evaluation/ fly ash/ interactions/ lime/ pollution/ sludges/ soil stabilization/ swelling/ Vertisols/ waste disposal/ wastes/ environmental pollution
Abstract: Expansive soils [black cotton soils, or Vertisols] cover an area of ~50 000 kmsuperscript 2 of the total Indian

sub-continent. This paper presents the results of experiments carried out to study the interaction of expansive soil with industrial wastes - lime sludge and fly ash. The experimental programme included chemical and geotechnical evaluation of fly ash and lime sludge and their interaction with expansive soil with special reference to swelling and consolidation behaviour. The study indicated that the best stabilizing effect was obtained when 16% of fly ash and 16% lime sludge were mixed with expansive soil. Reproduced with permission from the CAB Abstracts database.

489. Synthesis of artificial zeolite from fly ash for preparing nursery bed soils and the effects on the growth of Chinese cabbage.

Kim, Y. W.; Lee, H. H.; Kim, K. W.; Yoon, C. H.; and Shin, B. S.

Journal of Korean Society of Soil Science and Fertilizer 31(2): 95-106. (June 1998); ISSN: 0367-6315.

Notes: 12 illus.; 11 tables; 14 ref. Summaries (En, Ko).

Descriptors: artificial zeolite/ fly ash/ nursery beds/ soils/ growth/ Chinese cabbage

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490. Temporal and spatial development of soil solution chemistry and element budgets in different mine soils of the Lusatian lignite mining area.

Schaaf, W.; Gast, M.; Wilden, R.; Scherzer, J.; Blechschmidt, R.; and Huttel, R. F.

Plant and Soil 213(1/2): 169-179. (1999)

NAL Call #: 450 P696; ISSN: 0032-079X

Descriptors: acidification/ aluminium/ calcium/ chronosequences/ composition/ ecosystems/ fly ash/ formation/ gradients/ leaching/ lignite/ lime/ mining/ movement/ oxidation/ pines/ pyrites/ revegetation/ salinization/ silicates/ soil/ soil profiles/ soil solution/ substrates/ weathering/ aluminium silicates/ aluminum/ mine soils/ Scotch pine/ Scots pine

Abstract: Lignite and pyrite contents in the dump materials of the Lusatian opencast mining district in East Germany result in high acidification and salinization potentials. These extreme conditions require considerable amounts of alkaline materials like fly ash or lime to enable recultivation and revegetation. Investigations at chronosequence sites on different mining substrates show characteristic developments of the soil solution chemistry. Processes like weathering of primary and formation of secondary mineral phases, acid production and buffering, and their impacts on both the solid and the liquid soil phase result in high temporal and spatial dynamics especially in the initial phase of soil and ecosystem development. Soil solutions were continuously collected from different soil depths at seven sites with two representative soil substrates. All sites were afforested with pine (*Pinus*) and cover stand ages from 1 to 60 years. The results show that actual pyrite oxidation occurs at the youngest sites on lignite and pyrite containing substrates leading to extremely low pH values and high Fe^{3+} and SO_4^{2-} concentrations. The considerable acid production causes weathering of aluminium silicates resulting in high Al^{3+} concentrations. Ca^{2+} concentrations were unexpectedly high even at low pH showing no correlation to amelioration amounts or depths. Therefore it seems most probable that these mining substrates contain geogenic Ca sources. The transport of dissolved weathering products is limited due to low leaching rates

enabling formation of secondary phases which control the actual composition of the soil solution. Depth gradients of the soil solution composition at the chronosequence sites point to a gradual transport and leaching of these secondary phases from the soil profiles. Soil solution composition and dynamics at lignite and pyrite free sites show completely different patterns and have a higher potential for successful sustainable recultivation.

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491. Temporal variations in trace metal uptake measured in plants grown in coal fly ash amended soils.

Mattox, J. M.; Brake, S. S.; and Jensen, R. R.
In: Abstracts with Programs: Geological Society of America. Denver, CO, United States.; Vol. 34.; pp. 417; 2002.

Notes: Geological Society of America, 2002 annual meeting.

Descriptors: ash/ ICP mass spectra/ leaves/ mass spectra/ Plantae/ pollution/ soils/ spectra/ stems/ trace elements/ trace metals/ variations/ environmental geology
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492. Trace element mobility in coal fly ash and sewage sludge amended soils.

Yeledhalli, N. A.; Prakash, S. S.; and Ravi, M. V.
Environment and Ecology 25S(Special 4): 990-993. (2007)
NAL Call #: TD172.E5; ISSN: 0970-0420

Descriptors: black soils/ environmental impact/ fly ash/ groundwater/ groundwater pollution/ leachates/ leaching/ red soils/ salinity/ soil amendments/ soil pH/ soil toxicity/ soil types/ solid wastes/ toxic substances/ trace elements/ waste utilization/ environmental effects/ microelements/ poisons/ red earths/ toxic soils

Abstract: Red and black soil samples were collected from the same plot where field experiments on long term effect of co-application of fly ash and sewage sludge were laid. The lower level of quantitation for trace elements specified are more than adequate for determination of potential adverse environmental impact within the frame work of understanding toxicity of inorganic trace elements. The results of the column study indicated that the application of sewage decreased the pH of the leachate, while fly ash increased the pH. Whereas the solid wastes increased the leachate salinity in both in red and black soil. Application of solid wastes in soils did not results in appreciable concentration of potentially toxic heavy metals in the leachate. Alkaline coal fly ash groundwater reacts with water and forms hydration products that are considerably different from the original constituents of the ash when used for soil amendment and source of nutrient for crop production.

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493. Trace element solubility from land application of fly ash.

Jackson, B. P.; Miller, W. P.; Schumann, A. W.; and Sumner, M. E.
Journal of Environmental Quality 28(2): 639-647. (Mar. 1999-Apr. 1999)
NAL Call #: QH540.J6; ISSN: 0047-2425 [JEVQAA]

Descriptors: fly ash/ organic wastes/ mixtures/ solubility/ trace elements/ land application/ availability

Abstract: Use of fly ash (FA) as a soil amendment is hindered by a lack of macronutrients in the ash and concerns about trace element availability. Mixing FA with an organic waste can increase macronutrients while reducing odor and improving material handling, but the trace element solubility requires investigation. This study examined the trace element solubility and availability resulting from land application of such mixed wastes. Two FAs were applied as mixtures with either poultry litter (PL) or sewage sludge (SS) to field plots at rates 100 and 120 Mg ha⁻¹ for FA/PL and FA/SS, respectively. Suction cup lysimeters were used to collect soil solution, and trace element uptake was monitored in maize (*Zea mays* L.) leaf tissue and grain. Soluble B was initially >25 mg L⁻¹ for one high B FA/PL mixture and led to initial toxicity in seedlings. Soil solution concentrations of dissolved C, P, As, Se, Mo, Cu, and Cr were increased in FA/PL field plots. For P, C, As, and Cu, increased solubility was due to increased load in the FA/PL mixtures, while for Mo, Se, and Cr, mixing fly ash with poultry litter appeared to increase solubilization from the ash when compared with an equivalent mass of FA mixed with sewage. Leaf tissue data confirmed an increase in available As from the FA/PL mixtures, while leaf tissue Se was more dependent on the total Se concentrations of the ash.

This citation is from AGRICOLA.

494. Trace element solubility from land application of fly ash/organic waste mixtures with emphasis on arsenic and selenium speciation.

Jackson, Brian Philip
Athens, GA, United States: University of Georgia, 1998.
Descriptors: arsenic/ ash/ carbon/ chemical fractionation/ chromium/ copper/ detection/ experimental studies/ lysimeters/ mass spectra/ metals/ mixing/ organic carbon/ organic compounds/ pH/ pollutants/ pollution/ selenium/ sewage sludge/ soils/ solubility/ spectra/ trace elements/ environmental geology

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495. Trace element toxicity relationships to crop production and livestock and human health: Implications for management.

Gupta, U. C. and Gupta, S. C.
Communications in Soil Science and Plant Analysis 29(11/14): 1491-1522. (1998)
NAL Call #: S590.C63; ISSN: 0010-3624
Descriptors: acid soils/ animal nutrition/ applications/ arsenic/ boron/ cadmium/ chelating agents/ chlorosis/ cobalt/ consumption/ control/ copper/ crop production/ fertilizers/ fly ash/ grazing/ health/ iodine/ iron/ irrigation water/ legislation/ liming/ livestock/ management/ manganese/ mercury/ mineral deficiencies/ mineral nutrition/ minerals/ molybdenum/ nutrients/ pastures/ phytotoxicity/ plant nutrition/ reviews/ selenium/ sewage sludge/ sludges/ soil/ symptoms/ toxicity/ trace elements/ wastes/ zinc/ grazing lands/ microelements/ Mn/ Mo/ pasturing

Abstract: In nature, trace element toxicities occur in all living organisms. The consequences of these toxicities have been described in crops, livestock and humans. In some instances, the toxicities are a direct consequence of the organism's position in the food chain and their

environment, while in others, they are based upon genetic abnormalities resulting in physiological impairment. Nutrient toxicities in crops are more frequent for manganese (Mn) and boron (B) than for other nutrients. Manganese toxicity is found on acid soils in many parts of the world. Boron toxicities occur in irrigated regions where the well or irrigation waters are exceptionally high in B. Most other nutrient toxicities occur when large amounts of nutrients in question have been added in waste, e.g., sewage sludge. Crops grown near mines and smelters are prone to nutrient toxicities. Generally, the symptoms of toxicity in crops occur as burning, chlorosis and yellowing of leaves. Toxicities can result in decreased yield and/or impaired crop quality.

Toxicity levels of trace elements range from 20 to 50 micro g g⁻¹ for copper (Cu) and B to several hundred micro g g⁻¹ for Mn, molybdenum (Mo) and zinc (Zn). With the exception of Mo, toxicity of other nutrients can be reduced by liming. Following recommended rates of fertilizers and the safe and controlled use of waste materials, such as sewage sludge and coal fly ash, should reduce metal loading and nutrient toxicity in crops. Use of crop species and genotypes less susceptible to toxicity are recommended where toxicity is suspected. Toxicities of trace elements in animals are caused by the consumption of either feeds or grazing on pastures with high contents of the element in question. Accidental excess applications of minerals in grain mixes or oral ingestions of elements have been described as causing toxicity. Some toxicities, e.g., of Mo result in deficiency of other elements such as Cu. Some of the most toxic elements for livestock include Cu, lead (Pb), mercury (Hg), Mo, and selenium (Se). Under certain conditions, toxicities of arsenic (As), cobalt (Co), fluoride (F), iodine (I), iron (Fe), Mn, and Zn have also been reported. Symptoms of toxicity have been described in detail in the animal section. Trace elements, when in excess quantities, accumulate chiefly in the blood, liver, and kidneys. Measures of control for various trace element toxicities include removal of animals from affected areas or removal of the source of toxicity; gastric lavage and the specific use of oral doses of salts and chelates depending upon the element in question. Trace element/metal toxicities in humans are not common under normal conditions. Most toxicities are caused by environmental and/or genetic abnormalities, from excessive intake, by deliberate or accidental overdose, or from induced deficiencies (e.g. excess Zn causing Fe deficiency). Among the elements causing relatively frequent cases of toxicity are Pb, cadmium (Cd), Hg, Cu, Zn, and Fe. Selenium toxicity is generally limited to those areas/regions of the world, e.g. in certain parts of China, where soils with abnormally high Se content produce food crops containing highly toxic Se concentrations. Effective measures to control metal toxicities include gastric lavage, resuscitation, and the use of chelating agents in the acute phase. Protective legislation against the use of metal alloy utensils used for cooking is the long-term control strategy. Reproduced with permission from the CAB Abstracts database.

496. Trace element uptake in plants grown on fly ash amended soils.

Jensen, R. R.; Brake, S. S.; and Mattox, J. M. 86(1-4): 217-228. (2004); ISSN: 02772248 [TECSD].

Notes: doi: 10.1080/02772240400007070.

Descriptors: ANOVA/ fly ash/ plant uptake/ soil

amendment/ trace elements/ crops/ fly ash/ plants (botany)/ soil pollution/ soils/ tissue/ analysis of variance (ANOVA)/ trace element uptake/ trace elements/ bioaccumulation/ fly ash/ trace element/ farm crops/ fly ash/ plants/ soil/ tissue/ trace elements/ fraxinus

Abstract: Four crop plants were grown in a greenhouse in soils amended with 0, 5, 10, and 20% by weight of coal combustion fly ash to evaluate potential trace element uptake by the vegetation. The leaves and stems from each plant were harvested and analyzed for As, Cd, Co, Cu, Mn, Mo, Pb, Se, Tl, and Zn content during early, middle, and late growth. The trace element data were statistically analyzed using Analysis of Variance (ANOVA) to determine whether the trace element uptake in the four crop plants differed significantly between the soil treatments, and to identify significant differences in trace element uptake through time. The results show that the amount of amended fly ash does not significantly influence the concentration of most trace elements in plant tissue, and that some concentrations actually decrease with time. Although this study did not find a significant increase in trace element uptake, care must be taken in a natural environment where plants may behave differently.

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497. Trace elements in coal ash and sludge amended soils in India; comparison between baseline and monitored soils.

Datta, Saugata; Fyfe, W. S.; Powell, M. A.; Hart, B. R.; and Tripathy, S.

In: International Geological Congress, Abstracts. Rio de Janeiro, Brazil.; Vol. 31.

Brazil; 2000.

Notes: 31st International Geological Congress.

Descriptors: arsenic/ ash/ Asia/ chromium/ coal/ cobalt/ environmental effects/ erosion/ India/ Indian Peninsula/ lead/ metals/ mobilization/ monitoring/ nickel/ pH/ pollution/ red soils/ sedimentary rocks/ SEM data/ sludge/ soil erosion/ soils/ toxicity/ trace elements/ X-ray diffraction data/ environmental geology/ geochemistry of rocks, soils, and sediments

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498. Trace elements in turfgrass clippings collected from coal combustion product-amended putting greens.

Schlossberg, Maxim J

Applied Turfgrass Science(2007); ISSN: 1552-5821

Descriptors: golf courses/ coal fly ash/ soil amendments/ golf course soils/ nutrient uptake/ nutrient content/ *Agrostis stolonifera* var/ *palustris* / bioaccumulation/ arsenic/ cadmium/ copper/ nickel/ lead/ selenium/ zinc/ plant residues/ pollutants/ putting greens/ coal combustion products/ coal bottom ash/ grass clippings

Abstract: Golf course putting green construction methods rely on homogenous mixtures of coarse and medium-sized sands as root zone media, yet limited availability of mineral sands has increased interest in use of more ubiquitous medium- and coarse-textured components. Coal combustion products (CCP) are currently being used as substitutes and/or amendments of soil in golf course construction, including root zones of putting greens. However, the common practice of clipping disposal by surface land-application raises concern for potential trace

element contamination of soil and/or water resources. Three greenhouse studies evaluated the elemental composition of creeping bentgrass (*Agrostis palustris* Huds. cv. Crenshaw) leaf clippings collected over a 6-, 12-, or 18-month period following establishment of putting greens constructed using CCP, sand-sized bottom ash (BA) and/or fly ash (FA), as substitutes for mineral sand. Results showed levels of As, Cd, Cu, Ni, Pb, Se, and Zn in putting green clippings fell well below pollutant concentration regulatory limits, permitting such clippings to be safely land-applied without requiring maintenance of cumulative pollutant loading rate (CPLR) records onsite. This citation is from AGRICOLA.

499. Trace elements solubilization in waste-amended saline-sodic conditions.

Muhammad Irshad; Yamamoto, S.; and Honna, T.
Journal of Food, Agriculture and Environment 2(3/4): 255-259. (2004); ISSN: 1459-0255

Descriptors: animal manures/ application to land/ composts/ copper/ electrical conductivity/ fly ash/ iron/ manganese/ plant residues/ saline sodic soils/ sandy soils/ slags/ sodium/ soil pH/ soil types/ solubility/ trace elements/ waste management/ waste utilization/ water management/ zinc/ land application/ microelements/ Mn/ saline alkali soils/ water resource management

Abstract: The use of waste for soil amendment is receiving greater research attention but the extent to which saline-sodic waters affect the solubility of trace elements (TE) in waste amended soils is not well documented. In this laboratory study we determined the extent of TE [iron (Fe), manganese (Mn), copper (Cu) and zinc (Zn)] solubility in saline-sodic conditions after waste amendments. Wastes from the following four sources were used for the study: blast furnace slag (BFS), fly ash (FA), livestock manure compost (LC), plant residual compost (PC) and a control (no amendment). A sandy soil was saturated with either deionized water (S0) or 100 mmol cL⁻¹ CaCl₂, MgSO₄ and NaHCO₃ solution prepared at 15 and 45 SAR levels denoted as S1 and S2 respectively. The saturated soil was extracted after 1, 5 and 10 days and the extracts were analyzed for pH, ECe, SAR and water-soluble plus exchangeable Fe, Mn, Cu and Zn. The levels of TE were higher in LC and PC than BFS and FA amendments regardless of the salt ratios. The magnitude of SAR-induced solubility of TE decreased. Averaged exchangeable TE remained statistically similar in most of the amendments. Waste materials enhanced soil ECe and pH whereas the SAR was reduced in LC- and PC-treated soils. This is because of the higher amount of soluble Ca and Mg in LC and PC. The TE solubility was positively related to incubation period but the simple regression models showed that TE solubility was inversely related to the soil SAR. We suggest that the availability of TE could potentially be improved by waste amendments under saline-sodic or sodic conditions. Reproduced with permission from the CAB Abstracts database.

500. Traditional pest management practices in Kanyakumari district, southern peninsular India.

Kiruba, S.; Mishra, B. P.; Stalin, S. I.; Jeeva, S.; and Dhas, S. S. M.
Indian Journal of Traditional Knowledge 5(1): 71-74. (2006); ISSN: 0972-5938

Descriptors: coconuts / fertilizers/ fly ash/ indigenous knowledge/ insect control/ insect pests/ lime/ pest control/ pest management/ pesticidal plants/ pesticides/ plant pests/ repellents/ rice/ traditional technology/ trapping/ traps/ Aloaceae/ Madras/ neem/ paddy/ pesticide crops

Abstract: The paper deals with pests of paddy crop and coconut plantation, and their management through traditional methods by indigenous people of Kanyakumari district, Tamil Nadu, India. A total of 10 insect pests and 2 non-insect pests were identified in paddy fields. In coconut plantation, only 3 insect pests were recorded. The farmers use lime, fly ash and some plant species, namely *Azadirachta indica*, *Aloe barbadensis* [Aloe vera], *Coleus amboinicus* and *Pongamia pinnata* as pest deterrent materials as well as fertilizer. Different types of traps used against insect pests such as fire trap, meat trap, plant trap and pot trap are effective in controlling pests. Reproduced with permission from the CAB Abstracts database.

501. Transformation of nitrogen during vermicomposting of fly ash.

Bhattacharya, S. S. and Chattopadhyay, G. N.
Waste Management Resource 22(6): 488-91. (Dec. 2004); ISSN: 0734-242X

Descriptors: animals/ biodegradation, environmental/ carbon: metabolism/ cattle/ conservation of natural resources: methods/ manure/ nitrates: analysis: metabolism/ nitrogen: analysis: metabolism/ oligochaeta: metabolism: microbiology/ particulate matter/ quaternary ammonium compounds: analysis: metabolism/ soil

Abstract: In view of environmental problems generated by large-scale production of fly ash, increasing attention is now being paid to the recycling fly ash as a source of plant nutrients in agriculture. However, the low amount of nitrogen in such materials forms a major constraint for such application. In the present study, the possibility of improving the N status in mixtures of fly ash and organic matter was investigated by adopting vermicomposting technology. Different combinations of fly ash and cow (*Bos taurus*) dung; namely fly ash alone, cow dung alone and fly ash + cow dung at 1:1, 1:3 and 3:1 ratios were incubated with and without epigeic earthworms (*Eisenia fetida*) for 50 days. The occurrence of N in different bio-available forms; namely easily mineralizable, NH₄⁺ and NO₃⁻ tended to increase considerably in the series treated with earthworms. This behaviour was attributed primarily to increased microbiological activity in the vermicomposted samples and also to a considerable rise in the concentration of nitrogen-fixing bacteria in this series. Among the three combinations of vermicomposted fly ash and cow dung, the 1:1 mixture appeared to exhibit the highest availability of nitrogen. This citation is from PubMed.

502. Translocation of metals from fly ash amended soil in the plant of *Sesbania cannabina* L. Ritz: Effect on antioxidants.

Sarita Sinha and Gupta, A. K.
Chemosphere 61(8): 1204-1214. (2005)
NAL Call #: TD172 .C54; ISSN: 0045-6535

Descriptors: antioxidants/ ascorbic acid/ copper/ cysteine/ fly ash/ iron/ lead/ leaves/ manganese/ metals/ nickel/ phytoremediation/ proline/ roots/ soil amendments/ soil pollution/ translocation/ zinc/ malondialdehyde/ Mn/ vitamin C

Abstract: The plants of *Sesbania cannabina* Ritz grown on different amendments of fly ash (FA), have shown a high accumulation of metals (Fe, Mn, Zn, Cu, Pb and Ni). The highest accumulation of Fe and the lowest level of Ni were recorded in these plants. The different amendments of fly ash with garden soil (GS) were extracted with DTPA and the levels of metals were found to be decreased with an increase in fly ash application ratio from 10% to 50% FA. The analysis of the results showed an increase in the level of malondialdehyde (MDA) content of the roots for all the exposure periods. The maximum increases of 136% (roots) and 120% (leaves) were observed in MDA content at 100% FA after 30 d of growth of the plant, compared to GS. The level of antioxidants was found to increase for all the exposure periods in the roots of the plants to combat metal stress. At 30 d, the maximum increase of 57% (ascorbic acid) and 78% (free proline) was observed in the roots of the plants grown on 100% and 10% FA, respectively, as compared to their respective GS. At 90 d, a maximum increase of 42% (cysteine) and 117% (NPSH) was recorded in the roots of the plants grown on 25% and 100% FA, respectively, as compared to their respective GS. In leaves, a significant increase in antioxidants i.e. cysteine, NPSH and free proline content was recorded after 30 d, whereas no such trend was observed for the rest of the exposure periods. The chlorophyll and carotenoid contents increased with an increase in the FA amendment ratio from 10% to 50% FA for all the exposure periods as compared to GS. In both roots and leaves, the level of protein content increased in all the amendments and 100% FA at 30 d as compared to GS. Thus, there is a balance in the level of MDA content and level of antioxidants in the plants at 90 d. In view of its tolerance, the plants may be used for phytoremediation of metals from fly ash contaminated sites and suitable species for plantation on fly ash land fills. Reproduced with permission from the CAB Abstracts database.

503. Transport and plant uptake of zn in an oxyaquic haplustalf amended with coal ash and sewage sludge: A field study.

Khodke, U M; Tripathy, S; Panda, R K; Veeresh, H; and Sajwan, K S.

In: Coal Combustion Byproducts and Environmental Issues. Uppsala, Sweden.: Springer; pp. 159-170; 2006. Notes: Meeting Information: 7th International Conference on Biogeochemistry of Trace Elements.; ISBN: 0387258655

Descriptors: biochemistry and molecular biophysics/ agronomy: agriculture/ soil science/ Leguminosae: angiosperms, dicots, plants, spermatophytes, vascular plants/ irrigation: applied and field techniques/ field experiment: applied and field techniques/ leaching/ sewage sludge/ coal ash/ loading rate/ root zone/ available soil water/ Oxyaquic Haplustalf/ maximum allowable depletion

Abstract: Field experiments were conducted to study the movement and uptake of Zn in an Oxyaquic Haplustalf (pH = 5.2) amended with coal ash (pH = 7.5) and sewage sludge (pH = 4.3) at low application rates. The plots received cumulative loadings of sludge (39.5 Mg ha⁻¹), ash (78 Mg ha⁻¹) and mixture of ash and sludge (1:2 i.e. 19.5:39 Mg ha⁻¹) over two years. Irrigated peanut (*Arachis hypogaea* L.) was the test crop. Irrigations were scheduled at two levels viz. 15% (I-1) and 50% (I-2) maximum allowable depletion (MAD) of available soil water (ASW) in the root zone. Soil samples were collected from 0-

15, 15-30, 30-45 and 45-60 cm depths during the experiment and analyzed for pH and water extractable concentration (WEC) of Zn. Pre and post experiment profile soil samples were also analyzed for total Zn concentration. The water extractable concentrations (WEC) of Zn were generally higher in sludge treated plots than the ones receiving mixture and ash. This is in accordance to the order of Zn loading by the amendments. Cyclic variation in WEC of Zn was perceptible within the top 15 cm layer of the soil compared to that at higher depths in all sampling periods across the treatments; but was more distinct in the case of plots treated with only sludge. The increase in WEC of Zn below 15 cm layer in sludge treated plots indicated the possibility of leaching. Noticeable increases in total Zn concentrations in the surface layers of sludge and mixture treated plots were observed. The total Zn concentration in the profile soil from sludge applied plots indicated significant movement of Zn within 15-30 cm and thereafter a marginal increase up to 45cm signifying the possibility of Zn movement at lower depths. Plant accumulation of Zn was the highest in sludge treated plots (150 mg kg⁻¹) followed by the ones treated with mixture (99 mg kg⁻¹) and coal ash (56 mg kg⁻¹) as compared to the control (25 mg kg⁻¹). On the other hand, the ratio of concentrations of Zn in the plant to its total in surface soil followed the order -: control < ash < mixture < sludge indicating that the plant accumulation is governed by its loading rates.

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504. Turf culture under declining volume and frequency of irrigation on a sandy soil amended with fly ash.

Pathan, S. M.; Aylmore, L. A. G.; and Colmer, T. D.

Plant and Soil 266(1/2): 355-369. (2004)

NAL Call #: 450 P696; ISSN: 0032-079X

Descriptors: application rates/ evaporation/ fly ash/ growth/ irrigation/ lawns and turf/ leaf water potential / plant water relations/ resistance to penetration/ sandy soils/ soil types/ soil water content/ water stress/ Bermuda grass/ lawns and sports turf/ watering

Abstract: The effects of four rates (0, 5, 10 and 20%, wt/wt) of fly ash amendment in a sandy soil (top 100-120 mm) on soil properties, turf (*Cynodon dactylon* (L.) Pers., cv. Wintergreen) water relations, growth and colour, were assessed during 84 days of irrigation treatments (irrigated daily, every 3rd day, or every 4th day) imposed during summer in a Mediterranean-type climate. In plots irrigated at 40% of net evaporation summed and applied every 3rd day: (i) soil water contents were 14-33% higher in the fly ash amended soil zone when compared to values in plots with non-amended soil; (ii) soil water content below the root zone (i.e., 1500 mm) during that period remained low (being only 1-2% above the permanent wilting point), indicating minimal, if any, deep drainage. Extractable soil P was 2.0- to 3.8-fold higher in the fly ash amended soil compared to non-amended soil. By contrast extractable P was 1.7- to 2.1-fold higher in the soil 100-500 mm below the surface in non-amended plots, compared with fly ash amended plots. Irrigation at 40% replacement of net evaporation summed and applied every 3rd day did not adversely impact on turf growth or colour, when compared to plots irrigated daily, irrespective of fly ash treatments. However, extending irrigations (at 40% of net evaporation) to every 4th day reduced turf growth and colour, but the turf recovered fully from the mild water stress within 21 days of being irrigated daily at 100% replacement of net

evaporation. Therefore, 40% replacement of net evaporation summed and applied every 3rd day was a suitable watering schedule for maintenance of turf, with minimal risks of deep drainage.
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505. Upper profile changes over time in an Appalachian hayfield soil amended with coal combustion by-products.

Zhou, X.; Ritchey, K. D.; Clark, R. B.; Persaud, N.; and Belesky, D. P.

Communications in Soil Science and Plant Analysis 37(9-10): 1247-1267. (2006)

NAL Call #: S590.C63; ISSN: 0010-3624

Descriptors: agricultural soils/ soil amendments/ coal fly ash/ industrial byproducts/ gypsum/ soil chemical properties/ soil physical properties/ soil depth/ calcium/ magnesium/ land application/ dolomitic limestone/ exchangeable aluminum/ soil hydraulic properties/ soil density/ bulk density/ West Virginia/ hayfield soils/ flue gas desulfurization sludge/ fluidized bed combustion byproducts / calcitic dolomitic limestone

Abstract: Large amounts of flue gas desulfurization (FGD) and fluidized bed combustion (FBC) by-products from burning coal, consisting primarily of gypsum, are available for potential use as a soil amendment. However, information is limited on longer-term changes in chemical and physical properties induced over time and over small depth increments of the upper soil profile after applying these amendments. This study examined longer-term effects in an abandoned Appalachian pasture soil amended with various liming materials and coal combustion by-products (CCBPs). Soil chemical and physical properties were investigated over time and depths. The results indicated limited dissolution and movement of the calcium (Ca) and magnesium (Mg) applied with the chemical amendments, except for Ca and Mg associated with sulfate. However, sufficient dissolution occurred to cause significant increases in exchangeable Ca and Mg and decreases in exchangeable Al that were reflected in corresponding increases in soil pH. These beneficial effects persisted over time and were confined to the upper 0- to 15-cm depth of the profile. The greatest benefits appeared to be in the upper 0- to 5-cm surface layer. Both Ca and Mg applied as calcitic dolomitic limestone tended to be immobilized in the upper 0- to 5-cm layer of the soil profile; Ca more so than Mg. The presence of S applied in the FGD and FBC amendments appeared to enhance the mobility of Ca and Mg. The ratio of Ca/Mg in HCl extracts from the calcitic dolomitic treatment was close to that of applied calcitic dolomite, implying that the inactive component in soil might be the original calcitic dolomite particles. Soil physical properties measured over small depth increments showed that application of the amendments improved the saturated hydraulic conductivity only in the upper 0- to 5-cm depth and had little or no significant effect on the dry bulk density and plant-available water.

This citation is from AGRICOLA.

506. Use coal ash slags with fertilizers.

Pykhteeva, M. A. and Rafal'skiy, S. V.

Kartofel' i Ovoshchi 8: 9-10. (2006); ISSN: 0022-9148

Descriptors: ash/ crop quality/ crop yield/ fertilizers/ mineral nutrition/ plant development/ plant disease control/ plant

diseases/ plant nutrition/ plant pathogenic fungi/ plant pathogens/ potatoes/ slags/ starch/ trace element fertilizers/ tubers/ micronutrient fertilizers/ Peronosporomycetes/ phytopathogens/ Pythiaceae

Abstract: Investigations were conducted in Russia during 2001-05 to study the effect of various doses of coal ash slags obtained from a brown coal-fired power station used as a chemical soil improver, as well as a combined effect of mineral fertilizers and ash slags on growth, development, yield and quality of potato cv. Nevskii. Ash slags were used at 40, 60 and 80 t/ha, and mineral fertilizers were used at N₄P₄₅K₄₅, N₆₀P₆₀K₆₀ and N₉₀P₉₀K₉₀. Effects of different doses of fertilizers and improvers on disease control, particularly *Phytophthora infestans*, yield and starch content are considered.

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507. Use of alkaline flyash-based products to amend acid soils: Extractability of selected elements and their uptake by plants.

Spark, K. M Swift R. S.

Australian Journal of Soil Research 46(7): 585-599. (2008)

NAL Call #: 56.8 Au7; ISSN: 0004-9573

Descriptors: fly ash/ soil pH/ soil amendments/ acetic acid extract / plant uptake/ contaminants/ Internet resource

Abstract: In addition to promoting plant growth, the incorporation of flyash material into soil also has the potential to affect the solubility and plant availability of some elements. This paper reports on the effect of 2 flyash products (FAP) on the extractability and plant uptake as a function of pH of selected elements of concern in the environment: As, B, Cd, Co, Cu, Cr, Mn, Pb, Ni, and Zn. The results for the growth response of maize plants (*Zea mays* L.) in the FAP-amended soils have been reported in a companion paper. The addition of the FAP to the soils used in this study at rates up to 5% w/w resulted in increased levels of Cu, Mn, Ni, As, and Co in an acetic acid extract. The levels of Cr, Mn, Ni, Pb, Zn, As, and Co in these extracts all showed a dependency on pH for some soils. Maize plants grown in the amended soils exhibited an increase in the plant uptake of Cu, Mn, and Ni in some soils. However, none of the elements studied increased the plant uptake to levels which would generally be considered toxic to plants or cause problems in the food chain. The presence of the FAP decreased the plant availability of Ni at low pH and levels of Mn and Cd in the acetic acid extract were decreased, most likely due to sorption of these elements by the FAP. There is no evidence that either the flyash alone, or the 2 FAP used in this study would pose a threat to plants or the environment when used at levels of up to 5% w/w. Possible beneficial effects for the environment were observed as the incorporation of FAP into soils has the capacity to reduce the uptake and potential toxicity of Cd, Ni, or Mn in some soils.

This citation is from AGRICOLA.

508. Use of coal ash generated at Minn-Dak for soil stabilization at a sugarbeet piling site.

Carlson, J. L.; Jensen, P. W.; Groneman, J.; Thilmony, P. J.; Niday, M. G.; and Scharf, J.

In: Proceedings from the 31st Biennial Meeting Operations of the American Society of Sugar Beet Technologists. Vancouver, BC, Canada.; pp. 211-218; 2001.

Descriptors: clay soils/ construction/ environmental impact/ fly ash/ processing/ sampling/ soil amendments/ soil analysis/ soil compaction/ soil stabilization/ soil strength/ sugarbeet/ test procedure/ environmental effects/ sampling techniques/ smectite/ United States of America

Abstract: Results of a study on the use of different tests (ash leach testing, beneficial use testing and finished piling site leachate testing) to assess the potential application of fly ash or a mixture of fly and bottom ash for soil stabilization at a sugarbeet piling site for the Minn-Dak Farmer's Cooperative near Galchutt in the Red River Valley of North Dakota, USA during March 2000 are discussed. The addition of ash from the low sodium-high calcium coals used in the Minn-Dak facility to the smectite clay soils of the Red River Valley stabilized the soil by reducing the shrink-swell potential and reacting with water and soil to produce cementitious properties which provided additional strength to a weak subgrade during construction of the pad and aided soil compaction. Sampling of the amended soils and subsequent chemical analysis suggested that potential environmental impacts that might result from the soil amendment were minimal.

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509. Use of coal combustion products (fly ash) for reducing mud problems in heavy use areas for dairy cattle.

Pennington, J. A.; VanDevender, K. W.; Andrews, M. C.; and Griffin, D. J.

In: Annual Meeting of the American Dairy Science Association/American Society of Animal Science/Canadian Society of Animal Science. Cincinnati, OH, USA.; Vol. 88(Suppl. 1); pp. 21; 2005.

NAL Call #: 44.8 J822

Descriptors: Biochemistry and Molecular Biophysics/ Animal Husbandry: Agriculture/ Bovidae: Animals, Artiodactyls, Chordates, Mammals, Nonhuman Vertebrates, Nonhuman Mammals, Vertebrates/ Rainfall/ Mud/ Feeding Area/ Talcum Powder/ Soil Ash Mixture/ Heavy Use Area
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510. The use of coal fly ash in sodic soil reclamation.

Kumar, D. and Singh, B.

Land Degradation and Development 14(3): 285-299. (2003)
NAL Call #: S622.L26; ISSN: 1085-3278

Descriptors: adsorption/ aluminium/ boron/ bulk density/ calcium/ cobalt/ electrical conductivity/ fly ash/ gypsum/ iron/ lead/ magnesium/ manganese/ molybdenum/ nickel/ nitrogen/ phosphorus/ potassium/ reclamation/ saturated hydraulic conductivity/ sodic soils/ sodium/ soil chemical properties/ soil pH/ soil physical properties/ soil types/ soil water/ sulfur/ wheat/ zinc/ aluminum/ chemical properties of soil/ elemental sulphur/ Indian Punjab/ Mn/ Mo/ physical properties of soil/ soil moisture / sulphur

Abstract: An experiment was conducted for two years in northwest India to explore the feasibility of using coal fly ash for reclamation of waterlogged sodic soils and its resultant effects on plant growth in padi-wheat rotation. The initial pH, electrical conductivity, exchangeable sodium percentage and sodium adsorption ratio of the experimental soil were 9.07, 3.87 dS m⁻¹, 26.0 and 4.77 (me l)⁻¹/2, respectively. The fly ash obtained from electrostatic

precipitators of thermal power plant had a pH of 5.89 and electrical conductivity of 0.88 dS m⁻¹. The treatments comprised of fly ash levels of 0.0, 1.5, 3.0, 4.5, 6.0 and 7.5 per cent, used alone as well as in combination with 100, 80, 60, 40, 20 and 10 per cent gypsum requirement of the soil, respectively. There was a slight reduction in soil pH while electrical conductivity of the soil decreased significantly with fly ash as measured after padi and wheat crops. The sodium adsorption ratio of the soil decreased with increasing fly ash levels, while gypsum treatments considerably added to its favourable effects. Fly ash application increased the available elemental status of N, K, Ca, Mg, S, Fe, Mn, B, Mo, Al, Pb, Ni, Co, but decreased Na, P and Zn in the soil. An application of fly ash to the soil also increased the concentrations of above elements except Na, P and Zn in the seeds and straw of padi and wheat crops. The available as well as elemental concentrations in the plants was maximum in the 0 per cent fly ash+100 per cent gypsum requirement treatment except Na and heavy elements like Ni, Co, Cr. The treatment effects were greater in the fly ash+gypsum requirement combinations as compared to fly ash alone. Saturated hydraulic conductivity and soil water retention generally improved with the addition of fly ash while bulk density decreased. Application of fly ash up to 4.5 per cent level increased the straw and grain yield of padi and wheat crops significantly in both years. The results indicated that for reclaiming sodic soils of the southwest Punjab, gypsum could possibly be substituted up to 40 per cent of the gypsum requirement with 3.0 per cent acidic fly ash. Reproduced with permission from the CAB Abstracts database.

511. Use of fly ash in increasing the efficiency of gypsum and fertilizer treatments for revegetation of sodic soil.

Jha, M. N.; Sharma, S. D.; and Gupta, M. K.

Annals of Forestry 13(1): 9-16. (2005); ISSN: 0971-4022

Descriptors: afforestation/ fly ash/ growth/ gypsum/ multipurpose trees/ plant height/ potassium fertilizers/ reclamation/ revegetation/ sodic soils/ soil types/ superphosphates/ survival/ trees/ urea/ use efficiency/ waste utilization/ water management/ woody plants/ potash fertilizers/ reafforestation/ reforestation/ water resource management

Abstract: An experiment was conducted near Phulpur NTP plant in Allahabad District, Uttar Pradesh, India to explore the possibilities of using fly ash as an ameliorant in sodic soil for improving its bioproductive potential. Eight treatments consisting of fly ash, fertilizer (urea, single superphosphate and muriate of potash) and gypsum were applied to *Albizia procera* in four replications. Results showed that the survival of *A. procera* was higher and it attained greater height when planted in pits containing 1:1 mixture of fly ash and soil. Maximum survival and height were achieved by planting *A. procera* in pits treated with fly ash, fertilizer and gypsum. The efficiency of gypsum and fertilizer, in promoting the growth performance of *A. procera*, increased by adding fly ash. The experiment therefore, confirmed that fly ash, a byproduct of coal combustion process, could be a potential soil amendment for increasing tree cover in sodic areas.

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512. Use of flyash and biogas slurry for improving wheat yield and physical properties of soil.

Garg, R. N.; Pathak, H.; Das, D. K.; and Tomar, R. K. *Environmental Monitoring and Assessment* 107(1/3): 1-9. (2005)

NAL Call #: TD194.E5; ISSN: 0167-6369

Descriptors: biogas slurry/ bulk density/ crop yield/ fly ash/ leaf area/ leaf area index/ roots/ saturated hydraulic conductivity/ soil amendments/ soil density/ soil physical properties/ soil water content/ soil water retention/ wheat/ LAI/ New Delhi/ physical properties of soil

Abstract: This study explores the potential use of byproducts of energy production, i.e., fly ash from coal-powered electricity generation, and biogas slurry from agricultural waste treatment, as nutrient sources in agriculture. These residues are available in large amounts and their disposal is a major concern for the environment. As both residues contain considerable amounts of plant nutrients, their use as soil amendment may offer a promising win-win opportunity to improve crop production and, at the same time, preventing adverse environmental impacts of waste disposal. The effect of fly ash and biogas slurry on soil physical properties and growth and yield of wheat (*Triticum aestivum*) was studied in a field experiment in New Delhi, India. Leaf area index, root length density and grain yield of wheat were higher in plots amended with fly ash or biogas slurry compared to unamended plots. Both types of amendments reduced bulk density, and increased saturated hydraulic conductivity and moisture retention capacity of soil. The study showed that fly ash and biogas slurry should be used as soil amendments for obtaining short-term and long-term benefits in terms of production increments and soil amelioration.

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513. Use of flyash as environmental and agronomic amendments.

Zhang, G. Y.; Dou, Z.; Toth, J. D.; and Ferguson, J. *Environmental Geochemistry and Health* 26(2): 129-134. (2004)

NAL Call #: TD195.M5 M54; ISSN: 0269-4042

Descriptors: animal manures/ dairy wastes/ desulfurization/ fluidized bed wastes/ fly ash/ pig manure/ poultry manure/ soil amendments/ soil management/ water quality/ desulphurization/ poultry litter/ water composition and quality

Abstract: Coal combustion power plant flyash materials have been reported as useful soil amendments with agronomic and environmental benefits. This paper reports the efficacy of fluidized bed combustion (FBC) and flue gas desulfurization (FGD) byproducts, when amended with dairy, swine, and broiler litter manures, in reducing phosphorus (P) solubility and potential impact on water quality. At a rate of 400 g/kg, FBC reduced water soluble P by 60% for dairy and swine and 50% for broiler litter, as compared to un-treated control samples. Byproduct FGD had little effect when amended into dairy manure, but reduced water soluble P by nearly 80% when amended into swine and broiler manure at a rate of 250 g/kg. The amount of Ca added in the amendments together with pH of the mixture is the major contributing factor in soluble P reduction. Sequential extraction results showed that the flyash treatments shifted water soluble P into mainly bicarbonate extractable P. The latter is still considered

available for crop uptake but less vulnerable for environmental losses. Coal combustion byproducts, when amended into manure and used properly, can provide a useful and viable option for improving nutrient management on animal farms.

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514. The use of polymers and coal combustion by-products for amelioration of crusting in disturbed soils.

Stoddard, Albert Augustus III

Athens, GA, United States : University of Georgia, 1998.

Descriptors: ash/ biodiversity/ coal/ combustion/ erosion/ fertilizers/ gypsum/ infiltration/ polyacrylamide/ polymers/ rainfall/ runoff/

sedimentary rocks/ sedimentation/ simulation/ soils/ stabilization/ sulfates/ surface water/ testing

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515. Use of resistant varieties and organic nutrients to manage yellow stem borer in rice.

Rani, B. U.; Rajendran, R.; and Suresh, K.

International Rice Research Notes 31(2): 39-41. (2006)

NAL Call #: SB191.R5I6; ISSN: 0117-4185

Descriptors: botanical insecticides/ cultivars/ cultural control/ farmyard manure/ fly ash/ insect control/ insect pests/ neem seed cake/ non wood forest products/ organic amendments/ pest control/ pest resistance/ phosphate solubilizing bacteria/ plant pests/ rice/ silica/ biofertilizers/ cultivated varieties/ FYM/ Madras / minor forest products/ neem seed oilmeal/ non timber forest products/ paddy

Abstract: An experiment was conducted from October 2004 to January 2005 at Agricultural College and Research Institute in Tamil Nadu, India to determine the impact of using resistant cultivars (TKM6, IR36 and a control MDU5) and organic nutrients (farmyard manure (FYM), biofertilizers (Azospirillum+phosphobacterium+silica solubilizing bacteria (SSB)), lignite fly ash, neem seed cake) to manage yellow stem borer [*Scirpophaga incertulas*] in rice. The percent deadhearts recorded at 30 and 45 days after transplanting (DAT) and the percent whiteheads at 70 DAT were significantly different. Deadhearts ranged from 0.51% to 12.04% at 30 DAT. TKM6 treated with FYM, Azospirillum, phosphobacterium, SSB, lignite fly ash and neem seed cake recorded significantly less deadheart incidence (0.51%) with a corresponding reduction of 95.8% and 83.8% over MDU5+NPK (inorganic) and TKM6+NPK (inorganic), respectively. The same trend was observed at 45 DAT. TKM6 given organic nutrients recorded the lowest whitehead incidence (0.97%) against that of MDU5+NPK (inorganic) (6.9%).

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516. Using low calcium ash of brown coal from the azeiskoe deposit as a combined amendment for gray forest soil.

Kulikova, N. N.; Sutin, A. N.; Tanicheva, I. V.; Antonenko, A. M.; Paradina, A. F.; Boiko, S. M.; and Kochnev, N. K.

Agrokhimiya 0(6): 21-27. (1999); ISSN: 0002-1881

Descriptors: soil science/ Gramineae: angiosperms, monocots, plants, spermatophytes, vascular plants/ Leguminosae: angiosperms, dicots, plants, spermatophytes, vascular plants/ gray forest soil

Abstract: The positive effect of brown coal low-calcium ash on the complex of the physicochemical properties was studied in gray forest gleyey medium loamy soil. The biological activity of the soil was investigated as was the productivity of potatoes, pea-oat mixture, and maize. The effect of the ash on the trace element composition of the soil and plants was considered. The ash was produced by coal from Azeiskoe deposits in Russia.

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517. Utilisation of lignite flyash as source of plant nutrient for rice.

Jeyabal, A.; Arivazhagan, K.; and Thanunathan, K. *Fertiliser News* 45(7): 55-58. (2000)

NAL Call #: 57.8 F4123; ISSN: 0015-0266

Descriptors: alkaline soils/ application rates/ dry matter accumulation/ field experimentation/ filter cake/ fly ash/ plant nutrition/ pollution/ rice/ soil amendments/ sugarcane byproducts/ yield components/ yields/ clarification mud/ environmental pollution/ Madras/ paddy

Abstract: In field studies on alkaline soils at the Annamalai University Experimental Farm, Tamil Nadu, India, 10 or 20 t sugarcane pressmud [filter cake]/ha and/or 1 or 2 t lignite fly ash (LFA)/ha were incorporated into the soil before transplanting rice cv. ADT 37. Combined application of pressmud and LFA increased tiller numbers, dry matter production, panicle numbers and grain and straw yields. Grain yields with combined application were 6.33 t/ha compared with 5 t/ha in the control. Addition of LFA at 2 t/ha to 10 t pressmud/ha gave yields 9.2% higher than with pressmud alone. The combined application of both LFA and pressmud was recommended for increased rice yields. Also, utilization of sugar industry waste (pressmud) in agriculture reduces pollution risks.

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518. Utility of flyash in agriculture: A review.

Suwalka, R. L.

Agricultural Reviews 24(3): 197-203. (2003); ISSN: 0253-1496

Descriptors: acid soils/ alkaline soils/ fly ash/ growth/ nutrient content/ nutrient uptake/ reviews/ seed germination/ soil amendments/ soil chemical properties/ soil physical properties/ soil types/ sustainability/ chemical properties of soil/ physical properties of soil

Abstract: Characterization of fly ash has widely shown about its usefulness in improving soil physico-chemical properties and crop growth, as its disposal needs large area of land. The research conducted on the use of fly ash in agriculture indicates that main constituents of flyash are silicates of iron and aluminium. It contains fairly high available major nutrients like P, K and S and micronutrients such as Zn, Cu, Fe, Mn and B with high bioavailable heavy metals. Depending upon its source of availability it may be acidic or alkaline in reaction and therefore, it can be used as ameliorant to reclaim acidic and alkali soils. Fly ash also acts as a soil modifier to upgrade the physical properties of clay as well as sandy soil. Fly ash not only enhance germination of seed but also helps in development of plant due to increased nutrient content and uptake by plants in terms of sustainable economic production. Further, the work done in India is very scanty on the use fullness of fly ash in agriculture like as build up of heavy metals as well as

toxic levels of nutrients, its use in combination with fertilizer and compost and its effect on the soil microbes responsible for nitrification. Hence an attempt has been made to summarize the work done in recent past on the use of fly ash in crop production in this review article. Reproduced with permission from the CAB Abstracts database.

519. Utilization of coal fly ash; a solid waste from thermal power stations; in agriculture and its effect on soil properties and crop yields.

Srivastava, P. C.; Prashant Srivastava; Singh, S. K.; and Gangwar, M. S.

Reutilization of Industrial Effluents and Waste: 123-131. (2001)

Descriptors: agricultural soils/ agriculture/ biochemistry/ chemical composition/ coal/ crop yield/ fly ash / microbiology/ nutrient content/ organic wastes/ plant nutrition/ power stations/ soil chemical properties/ soil conditioners/ soil fertility/ soil physical properties/ soil types/ solid wastes/ thermal energy/ trace element fertilizers/ chemical properties of soil/ micronutrient fertilizers/ physical properties of soil

Abstract: Coal fly ash, a solid waste from thermal power stations, can be used in agriculture as a soil conditioner and micronutrient source. Some physical and chemical properties of coal fly ashes, including those derived from Indian coals, are reviewed. Indian coal fly ashes are deficient in N, medium to high in P, high in K, Ca, Mg, S, B and micronutrient cations. The effects of coal fly ash application on soil physical, chemical, microbiological and biochemical properties of soil are discussed. Application of coal fly ash to soil affects both macro- and micronutrient content as well as yields of growing plants depending upon application rate, stage of weathering, composition of fly ash and the nature of crop. The combined use of coal fly ash at tolerable levels of toxic elements and organic manure is beneficial for obtaining higher yields.

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520. Utilization of coal fly ash as a slow-release granular medium for soil improvement.

Yoo JeongGun and Jo YoungMin

Journal of the Air and Waste Management Association 53(1): 77-83. (2003); ISSN: 1047-3289

Descriptors: coal/ fly ash/ granules/ leaching/ potassium/ potassium fertilizers/ potassium hydroxide/ slow release fertilizers/ soil amendments/ waste management/ waste utilization/ potash fertilizers

Abstract: This work proposes a new potential application of waste coal fly ash as a K fertilizer support. Fly ash was reacted with KOH to facilitate the impregnation of K as well as to enhance the bonding force. In particular, the applied process resulted in a significant slow-releasing characteristic of fertilizer elements. To examine the effect of K impregnation, a few detailed leaching tests were carried out in terms of process variables such as reaction time and temperature, sintering time and temperature, and KOH concentration. The current experiment presented an optimum preparation condition that is competitive with conventional commercial fertilizers. The manufactured ash fertilizers inhibited release of the K elements. It was also

found through the continuous leaching test with pure water that the ash fertilizer had excellent moisture absorbability. Reproduced with permission from the CAB Abstracts database.

521. Utilization of coal fly ash for the production of artificial aggregates as a crop growth medium with acidic "Kunigami Mahji" soils in Okinawa, Japan.

Jayasinghe, G. Y. and Tokashiki, Y. 32(1): 1-9. (2006); ISSN: 10881697

Descriptors: 'Kunigami Mahji' soils/ Aggregate stability/ Aggregate strength/ Coal fly ash/ Synthetic light weight aggregates (SLWA)/ Agriculture/ Coal ash/ Industrial waste disposal/ Land fill/ Soil conditioners/ Coal fly ash/ Crop production/ Synthetic light weight aggregates (SLWA)/ Industrial wastes/ Brassica/ Brassica rapa/ Brassica rapa subsp rapa/ Spinacia oleracea

Abstract: The escalating world wide production of coal fly ash and its respective costs of disposing create an urgent need to find potential utilization methods in order to avoid disposal as land fillings. Development of synthetic light weight aggregates (SLWA) with coal fly ash and used paper can be regarded as an unconventional method for ash utilization which is being not much addressed. This study examined the properties of SLWA developed by coal fly ash, used paper and starch as a binder and their utilization as a soil amendment to improve the crop production in acidic, low productive 'Kunigami Mahji' soils in sub tropical Okinawa, Japan. Produced aggregates showed high levels of stability, strength and water holding capacities. Moreover heavy metal contents in aggregates were analyzed and found to remain well below the permissible level. SLWA, which had the highest aggregate stability and strength (i.e. produced at 20% level of starch application) were used as an amendment to improve the crop production in 'Kunigami Mahji' soils. Aggregates were mixed in 6 proportions with 'Kunigami Mahji' soils at the percentages of 0 % (100 % soil), 10%, 25%, 50%, 75% and 100% (100% SLWA) in a pot experiment. Komatsuna, which is called Japanese mustard spinach (*Brassica rapa* Var. *Pervidis*), was used in the experiment. It is evident that aggregate mixing percentage up to 25% with 'Kunigami Mahji' soils, was the best mixing percentage which gave the maximum yield. Moreover SLWA addition as a soil amendment significantly enhanced physical and chemical properties of 'Kunigami Mahji' soils. Therefore, this study demonstrates that coal fly ash together with used paper can be used to produce synthetic light weight aggregates, which can be utilized to improve the crop production in low productive 'Kunigami Mahji' soil as a soil amendment. Moreover this SLWA production can be recommended as an effective alternative method for fly ash disposal.

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522. Utilization of ingredients from fuel ashes for fertilization of triticale plants: Wykorzystanie skadnikow popiou weglowego do nawozenia roslin pszenzyta.

Murkowski, A. and Stankowski, S.

Folia Universitatis Agriculturae Stetinensis, Agricultura 91: 87-91. (2002); ISSN: 1506-1973.

Notes: Language: Polish.

Descriptors: fertilizers/ fly ash/ photosynthesis/ seedlings/

triticale/ vigour/ carbon assimilation/ carbon dioxide fixation/ vigor

Abstract: The effects of solutions from stone ash produced by a "Dolan Odra" power plant (Poland) on two-week-old seedlings of triticale cv. Bogo were studied under laboratory conditions. The results showed that the water fraction from the ashes was not phytotoxic. The water fraction from ashes supplemented with fertilizers had a positive effect on the light phase of photosynthesis and on the vitality index of plants.

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523. Utilization of the gypsum from a wet limestone flue gas desulfurization process.

Chou, M.-I. M.; Patel, V.; Lytle, J. M.; Chou, S. J.; and Carty, R. H.

In: Proceedings of the International Conference on Solid Waste Technology and Management.

Philadelphia, PA, USA: Widener University School of Engineering; pp. 754-760; 1999.

Notes: Chapter Number: Chester, PA, United States.; ISBN: 10918043

Descriptors: calcium compounds/ cost benefit analysis/ desulfurization/ fertilizers/ flue gases/ gypsum/ limestone/ soil mechanics/ wet limestone flue gas desulfurization process/ effluent treatment

Abstract: The authors have been developing a process which converts FGD-gypsum to ammonium sulfate fertilizer with precipitated calcium carbonate as a by-product during the conversion. Preliminary cost estimates suggest that the process is economically feasible when ammonium sulfate crystals are produced in a granular size (1.2 to 3.3 mm), instead of a powder form. However, if additional revenue from the sale of the PCC for higher-value commercial application is applicable, this could further improve the economics of the process. Ammonium sulfate is known to be an excellent source of nitrogen and sulfur in fertilizer for corn and wheat production. It was not known what impurities might co-exist in ammonium sulfate derived from scrubber gypsum. Before the product could be recommended for use on farm land, the impurities and their impact on soil productivity had to be assessed. The objectives of this phase of the study were to evaluate the chemical properties of ammonium sulfate made from the FGD-gypsum, to estimate its effects on soil productivity, and to survey the marketability of the two products. The results of this phase of the study indicated that the impurities in the ammonium sulfate produced would not impose any practical limitations on its use at application levels used by farmers. The market survey showed that the sale price of solid ammonium sulfate fertilizer increased significantly from 1974 at \$110/ton to 1998 at \$187/ton. Utilities currently pay \$16 to \$20/ton for the calcium carbonate they use in their flue gas scrubber system. The industries making animal-feed grade calcium supplement pay \$30/ton to \$67/m-ton for their source of calcium carbonate. Paper, paint, and plastic industries pay as much as \$200 to \$300/ton for their calcium carbonate fillers. The increased sale price of solid ammonium sulfate fertilizer and the possible additional revenue from the sale of the PCC by-product could further improve the economics of producing ammonium sulfate from FGD-gypsum.

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524. Variability of inorganic and organic constituents in lime spray dryer ash.

Taerakul, P.; Sun, P.; Walker, H.; Weavers, L.; Golightly, D.; and Butalia, T. 84(14-15): 1820-1829. (2005); ISSN: 00162361 [FUELA].

Notes: doi: 10.1016/j.fuel.2005.03.015.

Descriptors: Lime spray dryer ash/ Re-use/ Variability/ Byproducts/ Coal combustion/ Desulfurization/ Electrostatic separators/ Flue gases/ Hazardous materials/ Leachate treatment/ Leaching / Molecular weight/ Polycyclic aromatic hydrocarbons/ Power plants/ Pyrolysis/ Available lime index (ALI)/ Lime spray dryer (LSD) ash/ Re-use/ Variability/ Coal ash

Abstract: Flue gas desulfurization (FGD) by-products, including lime spray dryer (LSD) ash, have many demonstrated uses. However, concern about the temporal variability in the chemical properties of this material has limited widespread utilization. To determine the variability in inorganic and representative model organic constituents, this study measured elemental composition, leaching properties, polycyclic aromatic hydrocarbon (PAH) concentrations, available lime index (ALI), calcium carbonate equivalent (CCE), and total neutralization potential (TNP) for a representative LSD ash. All parameters investigated showed little variability over different time periods (e.g., daily to yearly) and little variability between samples collected from different particle collection hoppers. Metal concentrations including As, Se, and Hg in LSD ash and in the leachate did not surpass limits for land application (EPA 503 Rule) or limits for the determination of hazardous waste as specified in the Resource Conservative and Recovery Act (RCRA). While a number of PAHs were detected, including naphthalene and phenanthrene, the levels were low and in the range of natural soils. The low variability in ALI, CCE, TNP, and inorganic and organic composition suggests that LSD ash is a consistent and environmentally benign material for agricultural and other engineering applications. _ 2005 Elsevier Ltd. All rights reserved.

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525. Vase life of cut roses grown in coal bottom ash-amended media: A correlation with tissue calcium.

Cross, Marlene; Bearce, Bradford; and Arora, Rajeev. In: 97th Annual International Conference of the American Society for Horticultural Science. Lake Buena Vista, Florida, USA.; Vol. 35(3); pp. 405; 2000.

NAL Call #: SB1.H6

Descriptors: Horticulture: Agriculture/ Rosaceae: Angiosperms, Dicots, Plants, Spermatophytes, Vascular Plants/ Coal Bottom Ash Amended Media/ Vase Life/ Meeting Abstract/ Meeting Poster

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526. Weed flora mediated mycorrhizal infective potential preservation benefit for succeeding crops in fly ash.

Goswami, A.; Panja, B. N.; and Chaudhuri, S.

Journal of Interacademia 11(2): 244-246. (2007); ISSN: 0971-9016

Descriptors: cowpeas/ dry matter accumulation/ farmyard manure/ fly ash/ growth/ inoculum/ maize/ mycorrhizas/ plant colonization/ plant height/ rhizosphere/ roots/ weeds/

Bermuda grass/ black eyed peas/ corn/ FYM/ southern peas

Abstract: This study was conducted to investigate whether the roots of five mycorrhizal weeds (viz., *Cynodon dactylon*, *Urochloa mutica*, *Eleusine indica*, *Colocasia esculenta* and *Borreria hispida*) grown on fly ash could be used as inoculum source, and to determine whether mycorrhizal potential preserved by them would be helpful for the growth and nutritional improvement of the succeeding crops grown on fly ash. The roots and rhizosphere ash sample of five weed species with intensity of 59.3-77.6% mycorrhizal colonization were collected in bulk from 0-2 m zone from the borderline of the fly ash pond of Bandel Thermal Power Station in West Bengal, India. Fly ash was amended with sterilized farmyard manure. The growth responses of cowpea, maize and jowar (sorghum) grown in fly ash under inoculated and non-inoculated mycorrhizal conditions revealed that mycorrhizal plants exhibited higher growth response in terms of plant height, dry matter accumulation in root and shoot than non-mycorrhizal control plants. Percent increment of plant height and total dry matter accumulation over non-mycorrhizal one was higher in maize and jowar respectively, followed by other crops. Total dry matter gained by the crops due to mycorrhization ranged from 40.2-73.3%. Based on these results, the inoculum prepared by mixing the roots of mycorrhizal weed species could be used as source for inoculating mycorrhiza-susceptible crops.

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527. Western Australian fly ash on sandy soils for clover production.

Summers, R.; Clarke, M.; Pope, T.; and O'Dea, T. *Communications in Soil Science and Plant Analysis* 29(17/18): 2757-2767. (1998)

NAL Call #: S590.C63; ISSN: 0010-3624

Descriptors: analysis / cadmium/ dry matter/ fertilizers/ fly ash/ foliar diagnosis/ growth/ mercury/ pastures/ phosphorus/ phosphorus fertilizers/ potassium/ potassium fertilizers/ retention/ sandy soils/ soil/ variation/ foliage diagnosis/ grazing lands/ phosphate fertilizers/ potash fertilizers/ tissue analysis

Abstract: An experiment was conducted to determine the value of fly ash in Western Australia as an amendment for sandy soils and as a replacement for phosphorus or potassium fertilizers. The results showed large increases in clover (*Trifolium subterraneum*) dry matter production (49% to 278%), attributed to improvements in nutrient and water retention from the fly ash. The fly ash provided a substantial amount of the phosphorus needed by the clover, although application of phosphorus fertilizer further increased dry matter production in the presence of fly ash. No evidence was obtained from plant growth or tissue analysis that the fly ash provided potassium to the pasture. The maximum yield was achieved when 50 t fly ash/ha was applied to the soil. However, only 10 to 40 t/ha was required to achieve 75 to 90% of the maximum production. Although a statistically significant increase in cadmium and mercury concentration could be attributed to fly ash, the increase was small and within the range of natural variation of levels found at the sites.

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528. Yield and nutrition of rice and wheat in a fly ash-amended soil.

Benipal, D. S.; Manchanda, J. S.; Kansal, B. D.; Arora, C. L.; and Thind, H. S.

Environment and Ecology 24S(Special 4): 1145-1149. (2006)

NAL Call #: TD172.E5; ISSN: 0970-0420

Descriptors: aluminium/ application rates/ bulk density/ cadmium/ calcium/ chemical composition/ copper/ crop yield/ fly ash/ iron/ lead/ magnesium/ manganese/ nickel/ nutrient availability/ nutrient content/ phosphorus/ plant composition/ potassium/ radionuclides/ rice/ seeds/ sequential cropping/ soil density/ soil organic matter/ soil pH/ sulfur/ waste utilization/ wheat/ zinc/ aluminum/ chemical constituents of plants/ elemental sulphur/ Mn/ organic matter in soil/ paddy/ radioactive isotopes/ radioactive nuclides/ radioisotopes/ sulphur

Abstract: A field experiment was conducted in Ropar, Punjab, India, during 1999-2000 to study the effects of fly ash (0, 10, 20 and 40 t/ha) on soil properties, yield, and nutrition of crops in a rice-wheat system. Soil pH and bulk density decreased, while organic matter increased with the application of 40 t fly ash/ha. The availability of P, S and Cu in soil decreased, while that of K, Ca, Mg, Zn, Fe and Mn increased with graded levels of applied fly ash. The grain yield of rice increased by 4.5 and 2.3 quintal/ha over the control with the application of 10 and 20 t fly ash/ha, respectively. The levels of Al, Cd, Ni and Pb in soil and grains of wheat and rice, and the concentration of radionuclides (40K, 226Ra and 228Ac) in wheat grain was within the permissible limits. [1.0 quintal=100.0 kg]. Reproduced with permission from the CAB Abstracts database.

529. Yield and trace metal levels in rice (*Oryza sativa*) as influenced by flyash, fertilizer and farmyard manure application.

Arvind Kumar; Sarkar, A K; Singh, R P; and Sharma, V N
Indian Journal of Agricultural Sciences 68(9): 590-592. (1998)

NAL Call #: 22 AG83I; ISSN: 0019-5022

Descriptors: cereal grains/ cobalt/ contamination/ copper/ crop yield/ farmyard manure/ fly ash/ grain/ heavy metals / iron/ lead/ manganese/ manures/ mineral nutrition/ mineral uptake/ nickel/ NPK fertilizers/ plant nutrition/ rice/ soil amendments/ trace elements/ yields/ zinc/ FYM/ microelements/ Mn/ paddy

Abstract: In a field experiment in 1994 in Bihar, rice (*Oryza sativa*) was amended with 4 or 8% fly ash with NPK fertilizer and/or farmyard manure (FYM). The application of 8% fly ash + the recommended NPK rate produced the highest grain yield of 4.85 t/ha which was not significantly different from 4.63 t obtained with 4% fly ash + 10 t FYM + 50% of the recommended NPK rate. Nickel content of rice grain was higher with 8 than 4% fly ash alone (7.6 vs. 4.4 mg/kg), but the uptake of other trace elements (Fe, Mn, Cu, Co, Pb and Zn) were not significantly different. Fly ash did not significantly influence the availability of trace metals in soil.

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530. Yield and trace metals of vegetable crops as influenced by fly ash.

Arvind Kumar; Rajesh Kumar; Singh, R. P.; and Sarkar, A. K.

Journal of Research, Birsa Agricultural University 17(2): 155-160. (2005); ISSN: 0971-1724

Descriptors: cobalt/ copper/ crop yield/ fly ash/ iron/ lead/ manganese/ nickel/ nutritive value/ okras/ potatoes/ tomatoes/ zinc/ Mn/ nutritional value/ quality for nutrition

Abstract: Field experiments conducted during 1997/98 and 1998/99, in Ranchi, Bihar, India, revealed that the yield of okra, tomato, colocasia and potato increased significantly due to the incorporation of fly ash (0, 4, 8 and 16%) in soil. Per cent increase in yield of all crops was maximum under the treatment with 16% fly ash. Content of trace metals (Zn, Cu, Fe, Mn, Pb, Ni and Co) in edible parts increased when the crops were grown in fly ash-treated soil. The study highlighted the need to monitor the trace metal levels, especially heavy metals (Pb, Ni and Co) which increased from 4.15 to 31.40, 5.33 to 26.67 and 4.39 to 43.30 mg kg⁻¹, respectively, when plants were grown in and around fly ash dumps. Higher content of heavy metals in short duration crops is a potential health hazard which prohibits its application in soil as a plant nutrient source or as a soil conditioner.

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531. Yield, NPK concentration and their uptake by sunflower and cotton as influenced by fly ash with and without FYM and fertilizers.

Malewar, G. U.; Badole, S. B.; Mali, C. V.; and Siddiqui, M. B.

Journal of Soils and Crops 9(1): 18-22. (1999); ISSN: 0971-2836

Descriptors: cotton/ crop yield/ farmyard manure/ fertilizers/ fly ash/ mineral uptake/ NPK fertilizers/ nutrient uptake/ sunflowers/ uptake/ vertisols/ FYM

Abstract: In field experiments on Vertisols at Parbhani, Maharashtra, India, sunflowers cv. MFSH-8 and cotton cv. NHH-44 were given different combinations of NPK fertilizers, FYM and 0-20 t fly ash/ha. Sunflower seed and seed cotton yields were significantly increased due to combined application of FYM (10 t/ha) + full recommended doses of 60:30:30 and 80:40:40 kg NPK/ha, respectively. The optimum rate of fly ash was 10 t/ha for both crops. Data on NPK concentrations and uptake are tabulated, and follow a similar pattern to crop yields.

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532. Zeolite synthesis from pre-treated coal fly ash in presence of soil as a tool for soil remediation.

Terzano, R.; Spagnuolo, M.; Medici, L.; Tateo, F.; and Ruggiero, P.

Applied Clay Science 29(2): 99-110. (Apr. 2005)

NAL Call #: TA455.C55; ISSN: 0169-1317.

Notes: References: 50; illus. incl. 2 tables. DOI: 10.1016/j.clay.2004.12.006.

Coal Combustion Byproducts

Descriptors: ash/ chemical properties/ chemical ratios/ clay mineralogy/ degradation/ faujasite/ framework silicates/ geochemistry/ heavy metals/ pollution/ remediation/ silicates/ soil pollution/ soil treatment/ soils/ synthesis/ zeolite group/ Environmental geology/ Geochemistry of rocks, soils, and sediments/ Sedimentary petrology
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Construction and Demolition Byproducts

533. Agricultural disposal method of construction site gypsum wallboard waste.

Carr, J. and Munn, D. A.

Journal of Construction Education 6(1): 28-32. (2001);
ISSN: 15228150

Descriptors: agricultural uses/ disposal/ drywall/ gypsum wallboard/ recycling/ tipping fees

Abstract: Over two million tons of gypsum wallboard waste is created each year. Traditionally this material ends up in landfills. The wallboard waste takes up considerable amounts of space since it is difficult to compact. Also the potentials exist for elements in the wallboard to be acted upon by bacteria in municipal solid waste and create harmful concentrations of hydrogen sulfide that can escape from the landfill. Additionally, disposal costs at both municipal sanitary landfills and construction and demolition landfills are very high exceeding \$300.00 per ton in some areas. This paper explores an alternative to landfill disposal. The reuse of the gypsum wallboard scrap in agricultural uses may be a suitable best method to be used for the disposal of these materials. The paper presents the results of an experiment that investigates the agricultural use of scrap gypsum and its effect on soybeans.

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534. Beneficial reuse of aggregate mineral fines and scrap new construction wallboard.

Korcak, R. F.; Meininger, R.; and Yost, P. A./ Power, J. F.; Dick, W. A.; Kashmanian, R. M.; Sims, J. T.; Wright, R. J.; Dawson, M. D.; and Bezdicek, D.; Series: Soil Science Society of America Book Series 6.
Madison, USA: Soil Science Society of America Inc. 2000; pp. 583-603.

Descriptors: application to land/ gypsum/ industrial wastes/ soil amendments/ waste disposal/ waste utilization/ land application/ mineral fines

Abstract: The types and amounts of aggregate mineral fines and scrap gypsum wallboard are examined. Agricultural utilization studies including the benefits derived from mineral fines and scrap gypsum wallboard are reviewed.
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535. Characterization of dairy cattle manure/wallboard paper compost mixture.

Saludes, Ronaldo B.; Iwabuchi, Kazunori; Miyatake, Fumihito; Abe, Yoshiyuki; and Honda, Yoshifumi
Bioresource Technology 99(15): 7285-7290. (2008)
NAL Call #: TD930.A32 ; ISSN: 0960-8524

Descriptors: dairy cattle/ cattle manure/ compost/ bulking agents/ composting/ physicochemical properties/ hydrogen sulfide/ ammonia

Abstract: The aim of this research was to evaluate the use of manufacturing wallboard paper scraps as an alternative bulking agent for dairy cattle manure composting. The characteristics of the composting process were studied based on the changes in physico-chemical parameters and final compost quality. Composting of dairy cattle manure with wallboard paper was performed in a 481-L cylindrical reactor with vacuum-type aeration. Rapid degradation of

organic matter was observed during the thermophilic stage of composting due to high microbial activity. High temperature and alkaline pH conditions promoted intense ammonia emission during the early stage of composting. The number of mesophilic and thermophilic microorganisms were found to be affected by changes in temperature at different composting stages. The total nitrogen (N), phosphorus (P), potassium (K), and sodium (Na) concentrations of the mixture did not change significantly after 28 days of composting. However, the presence of gypsum in the paper scraps increased the calcium content of the final compost. The wallboard paper had no phyto-inhibitory effects as shown by high germination index of final compost (GI=99%).

This citation is from AGRICOLA.

536. Composter expands with additional feedstocks.

Block, D

Biocycle 40(3): 30-32. (1999)

NAL Call #: 57.8 C734 ; ISSN: 0276-5055

Descriptors: composting/ food wastes/ litter/ manures/ organic wastes/ recycling/ waste wood/ United States of America

Abstract: Recent expansion of the Wood Recycle and Composting Centre in Wichita, Kansas, USA, is described. The expansion was implemented to take advantage of opportunities for organics and drywall recycling. Composting trials are being carried out with a wide mix of residuals including grain, food, wood, low-grade fibre and animal bedding and manure. Organic materials are also enabling the company to gain more value from low-end woody materials by using them in composting rather than in mulch production. The site has received a modified site permit to allow 1,000 tons each of new materials to be composted in separate windrows.
Reproduced with permission from the CAB Abstracts database.

537. Composting and bioremediation process evaluation of wood waste materials generated from the construction and demolition industry.

McMahon, V.; Garg, A.; Aldred, D.; Hobbs, G.; Smith, R.; and Tothill, I. E.

Chemosphere 71(9): 1617-1628. (2008)

NAL Call #: TD172 .C54; ISSN: 0045-6535

Descriptors: bioremediation/ composting/ composts/ green manures/ hardboard/ industrial wastes/ medium density fibreboards/ melamine/ particleboards/ phytotoxicity/ poultry manure/ waste management/ waste utilization/ waste wood/ chipboards/ medium density fiberboards/ poultry litter

Abstract: The suitability of using bioremediation and composting techniques for diverting construction and demolition (C&D) waste from landfill has been validated in this study. Different timber products from C&D waste have been composted using various composting approaches. The present work demonstrates the quality of compost produced as a result of composting of mixed board product wood waste, which is frequently obtained from the construction and demolition industry. Three compost mixes were prepared by mixing shredded chip board, medium density fibre, hardboard and melamine. Poultry manure,

Eco-Bio mixture and green waste were used as nutrient supplements. The results revealed that compost produced from mixtures of poultry manure and green waste used as nutrient supplements improved the performance in plant growth trials (phytotoxicity tests). Results obtained from the experimental study clearly indicate that the composts produced comply with the criterion suggested in BSI PAS 100 (A specification for compost materials) for use in different applications. Composting can also be demonstrated to be a very practical approach to material management including transport reduction to and from the site. The economic suitability of the process will be improved with the increase in landfill tax. In the current regulatory scenario, it is recommended that these materials should be composted at a centralised facility. This citation is from AGRICOLA.

538. Construction drywall as a soil amendment.

White, EH and Burger, ME

BioCycle . July 1993; 34(7): 70-71.(1993)

NAL Call #: 57.8 C734 ; ISSN: 0276-5055

Descriptors: soil amendments/ construction materials/ Zea mays/ nutritional status/ soil fertility/ gypsum
This citation is from AGRICOLA.

539. Evaluating onsite beneficial reuse of ground engineered wood wastes from residential construction.

Gaskin, J. W.; Risse, L. M.; Kastner, J. R.; and McLaurin, W. J.

Transactions of the ASAE 48(5): 1731-1738. (Sept. 2005-Oct. 2005)

NAL Call #: 290.9 AM32T; ISSN: 0001-2351

Descriptors: waste wood/ engineered wood products/ construction materials/ adhesives/ mulches/ mulching/ soil pollution/ water pollution/ pollutants/ leaching/ soil chemistry/ phytotoxicity/ ornamental plants/ risk assessment

Abstract: Wood wastes from residential construction can be potentially reused onsite as mulches. Engineered wood products (EWP) are estimated to comprise about 30% of residential construction wood waste. Due to the presence of various adhesives, there is concern about the beneficial reuse of these materials. We evaluated potential environmental impacts of mulches with a ground EWP component. No hazardous levels of constituents were found using a toxicity characteristic leaching procedure (TCLP). Changes in runoff water quality and soil chemistry below the mulch were evaluated through rainfall simulation on 0.9 x 4.6 m test plots using four treatments: bare soil control, 100% dimension lumber, typical residential mix of wood wastes, and 100% structural EWPs. A companion study evaluated the effect of the 100% EWP and the typical residential mix mulches on the growth of common landscaping plants. No purgeable halocarbons, benzene, toluene, ethyl benzene, xylene, or phenols were detected in runoff. Nutrient concentrations in runoff from the freshly ground wood treatments ranged from 0.5 to 8.19 mg L⁻¹ for total nitrogen and 0.13 to 0.21 mg L⁻¹ for total phosphorus. The freshly ground 100% EWP treatment had the highest total nitrogen concentrations in runoff (8.19 mg L⁻¹). Biochemical oxygen demand was similar for all freshly ground wood treatments, ranging from 155 to 273 mg L⁻¹. These concentrations decreased by an order of magnitude after one year. There were no significant

impacts on the growth of three common landscaping plants. Results indicate that these wood wastes can be beneficially reused rather than landfilled.

This citation is from AGRICOLA.

540. Land application of crushed gypsum wallboard waste for alfalfa.

Wolkowski, R. P.

Communications in Soil Science and Plant Analysis 31(1-2): 187-199. (2000)

NAL Call #: S590.C63; ISSN: 0010-3624 [CSOSA2]

Descriptors: Medicago sativa/ gypsum/ solid wastes/ land application/ preplanting treatment/ top dressings/ crop yield/ plant density/ soil/ nutrient content/ soil fertility/ application rate/ chemical constituents of plants/ Wisconsin/ site factors/ wallboard

Abstract: Three seasons of research that evaluated the effect of the land application of crushed gypsum wallboard waste (CW) for alfalfa were conducted at four Wisconsin locations having differing soil types and climatic conditions. Material was applied at rates up to 36.0 Mg ha⁻¹ preplant and 2.2 Mg ha⁻¹ topdress. The highest application of CW pre-plant showed a positive trend for increased yield of alfalfa at three of the four locations, although this response was not statistically significant. Stand density was not affected with the exception of one year at one location for which the stand was lower where the highest rate of CW was applied. The soil pH decreased slightly where high rates of CW were applied, presumably caused by an increase in soil solution hydrogen ions which were displaced from exchange sites. Soil calcium (Ca) and sulfur (S) usually increased, and soil test magnesium (Mg) usually decreased where the highest rate of CW was applied. There was no consistent effect of CW application on the soil test levels of other nutrients. Application of CW generally increased the Ca and S, and reduced the Mg concentrations in the harvested forage. Crushed wallboard appears to be as effective as commercial gypsum fertilizer, although this study did not compare equivalent rates of the two materials. No phytotoxic effects from the direct application of CW were noted. The land application of wallboard was found to have no substantial positive or negative agronomic effect on alfalfa production. This practice provides a reasonable alternative to land filling. This citation is from AGRICOLA.

541. Mulch and topsoil fit the bill in Florida.

Block, D.

Biocycle 41(2): 71-72. (2000)

NAL Call #: 57.8 C734 ; ISSN: 0276-5055

Descriptors: composting/ mulches/ organic wastes/ recycling/ topsoil/ mulching materials/ United States of America

Abstract: Recycling of land clearing material, construction and demolition debris and yard trimmings by Florida Recyclers (USA) is described. The recycled product was used as an alternative to cypress mulch while the fines were used in soil blends. Following separation of metals, cardboard and contaminants, the wood waste and trimmings were ground, screened and processed before colouring for use as mulch. The topsoil materials are placed in static piles with occasional watering over the three-month period.

This citation is from AGRICOLA.

542. Reclaiming acid mine soil with drywall and manure.

Munn, D. and Murray, F.

Biocycle 40(10): 59-60. (1999)

NAL Call #: 57.8 C734 ; ISSN: 0276-5055

Descriptors: building materials/ cattle manure/ coal mined land/ manures/ reclaimed soils/ soil types/ United States of America

Abstract: The suitability of ground drywall, obtained from construction wastes, as an amendment to revegetate an Ohio acid mine soil was investigated. Germination rates and growth of maize and rye were measured for the amended soil plots with different levels of ground drywall amended with cow manure. The germination, appearance and yield of rye were all enhanced significantly by the addition of ground drywall to the acid mine soil. Although maize yields increased with increasing application rates of drywall, the variation in growth within treatments was smaller at the higher rates of drywall application. Ground drywall at the rates of 10, 20 and 30 g/kg made this acid mine soil, amended with cow manure, better suited for the germination and early growth of rye and maize. Reproduced with permission from the CAB Abstracts database.

543. Sulfate leaching from recovered construction and demolition debris fines.

Jang, Y. C. and Townsend, T.

Advances in Environmental Research 5(3): 203-217.

(2001); ISSN: 10930191 .

Notes: doi: 10.1016/S1093-0191(00)00056-3

Descriptors: batch leaching test/ column leaching test/ construction and demolition waste/ drywall/ gypsum/ recovered fines/ recycling/ sulfate

Abstract: Recovered soil fines are a product of the mechanical processing of construction and demolition (C&D) debris for recycling. C&D debris fines have been proposed as a substitute for soil in a number of applications. Questions have been raised regarding the potential environmental impact of sulfate leaching from particles of gypsum drywall in the soil fines. Sulfate has a secondary drinking water standard of 250 mg/l and may convert to hydrogen sulfide during some reuse scenarios. Soil fines were collected from 13 C&D debris recycling facilities in south Florida. A leaching study on the C&D debris fines was performed to examine sulfate leachate concentrations resulting from both batch and column leaching experiments. The sulfate concentrations resulting from the batch leaching tests ranged from 890 to 1600 mg/l. The results of the column leaching tests also resulted in high sulfate concentrations. The source of sulfate in the debris fines was the dissolution of gypsum wallboard. The results from a multiple batch test indicated that the mass of the gypsum content in C&D debris fines ranged from 1.5% to 9.1%. The amount of gypsum that would be applied via soil fines during a typical reuse scenario is greater than normal agricultural operations where gypsum is applied. When considering the beneficial reuse of C&D debris fines, site-specific hydrogeology and appropriate state and local regulations for allowable sulfate concentrations in groundwater should be considered. .
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Foundry Industry Byproducts

544. Amelioration of physical strength in waste foundry green sands for reuse as a soil amendment.

de Koff, J. P.; Lee, B. D.; and Dungan, R. S.

Journal of Environmental Quality 37(6): 2332-2338. (Nov. 2008-Dec. 2008)

NAL Call #: QH540.J6; ISSN: 0047-2425 .
18948487

Descriptors: green sands/ foundry waste/ soil amendment

Abstract: To avoid increasing costs of landfill disposal, it has become increasingly important for U.S. foundries to identify beneficial reuses for the 8 to 12 million tons of waste foundry sand (WFS) generated annually. A major drawback to the reuse of some WFSs as a soil amendment is their high soil strength, under dry conditions, where root growth may be limited. Fifteen WFSs were analyzed for strength to rupture using lab-formed clods, exchangeable cations (Na, Mg, Ca), metal oxide concentration (Fe, Mn, Al, Si), cation exchange capacity (CEC), and % clay. Several WFS samples from gray iron foundries demonstrated high strength to rupture values (> 1.5 MPa), and could potentially restrict root growth in amended soils. The percentage of Na-bentonite exhibited a positive correlation ($R(2) = 0.84$) with strength to rupture values. When WFSs containing more Na-bentonite were saturated with 1 mol L⁻¹ Ca ions, strength values decreased by approximately 70%. Waste foundry sands containing less Na-bentonite were saturated with 1 mol L⁻¹ Na ions and exhibited a threefold increase in strength. Additions of gypsum (up to 9.6 g kg⁻¹ sand) to high strength waste foundry sands also caused decreases in strength. These results indicate that high strength WFSs have properties similar to hardsetting soils which are caused by high Na(+) clay content and can be ameliorated by the addition of Ca(2+).

This citation is from PubMed.

545. Blending foundry sands with soil: Effect on dehydrogenase activity.

Dungan, R. S.; Kukier, U.; and Lee, B.

Science of the Total Environment 357(1/3): 221-230. (2006)

NAL Call #: RA565.S365; ISSN: 0048-9697

Descriptors: binding agents/ biological activity in soil/ copper/ enzyme activity/ landfills/ lead/ microbial activities/ oxidoreductases/ sand/ soil amendments/ zinc/ redox enzymes

Abstract: Each year U.S. foundries landfill several million tons of sand that can no longer be used to make metalcasting molds and cores. A possible use for these materials is as an ingredient in manufactured soils; however, potentially harmful metals and resin binders (used to make cores) may adversely impact the soil microbial community. In this study, the dehydrogenase activity (DHA) of soil amended with molding sand (clay-coated sand known as "green sand") or core sands at 10%, 30%, and 50% (dry wt.) was determined. The green sands were obtained from iron, aluminum, and brass foundries; the core sands were made with phenol-formaldehyde or furfuryl alcohol based resins. Overall, incremental additions of these sands resulted in a decrease in the DHA which lasted throughout the 12-week experimental period. A brass green sand, which contained high concentrations of Cu, Pb, and Zn, severely impacted the DHA. By week 12 no DHA was detected in the 30% and 50% treatments. In contrast,

the DHA in soil amended with an aluminum green sand was 2.1 times higher (all blending ratios), on average, at week 4 and 1.4 times greater (30% and 50% treatments only) than the controls by week 12. In core sand-amended soil, the DHA results were similar to soils amended with aluminum and iron green sands. Increased activity in some treatments may be a result of the soil microorganisms utilizing the core resins as a carbon source. The DHA assay is a sensitive indicator of environmental stress caused by foundry sand constituents and may be useful to assess which foundry sands are suitable for beneficial use in the environment. Reproduced with permission from the CAB Abstracts database.

546. The characterization of total and leachable metals in foundry molding sands.

Dungan, R. S. and Dees, N. H.

Journal of environmental management 90(1): 539-548. (2009)

NAL Call #: HC75.E5J6; ISSN: 03014797 [JEVMA].

Notes: doi: 10.1016/j.jenvman.2007.12.004.

Descriptors: beneficial use/ foundry/ leaching/ metals/ molding sand/ SPLP/ TCLP/ aluminum/ antimony/ arsenic/ barium/ beryllium/ boron/ cadmium/ chromium/ cobalt/ copper/ iron/ lead/ magnesium/ manganese/ metal/ molybdenum/ nickel/ silver/ vanadium/ zinc/ chemical analysis/ concentration (composition)/ leaching/ toxicity/ trace metal/ agricultural land/ chemical analysis/ chemical binding/ foundry/ leaching/ precipitation/ sand/ soil pollution/ solid waste/ toxicity testing/ water contamination

Abstract: Waste molding sands from the foundry industry have been successfully used as a component in manufactured soils, but concern over metal contamination must be addressed before many states will consider this beneficial use. Since there is little data available on this topic, the purpose of this study was to characterize total and leachable metals from waste molding sands. A total elemental analysis for Ag, Al, As, B, Ba, Be, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, V, and Zn was conducted on 36 clay-bonded and seven chemically bonded molding sands. Total metal concentrations in the molding sands were similar to those found in agricultural soils. The leaching of metals (i.e. Ag, As, Ba, Be, Cd, Cr, Cu, Ni, Pb, Sb, and Zn) was assessed via the toxicity characteristic leaching procedure (TCLP), synthetic precipitation leaching procedure (SPLP), and ASTM water leach test. Based on the TCLP data, none of the 43 molding sands would meet the Resource Conservation and Recovery Act (RCRA) characteristic for toxicity due to high Ag, As, Ba, Cd, Cr, and Pb. Compared to the TCLP results, the metal concentrations were generally lower in the SPLP and ASTM extracts, which is likely related to the buffering capacity of the extraction fluids.

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547. The characterization of trace metals and organics in spent foundry sands over a one-year period.

Dungan, R. S.

Journal of Residuals Science and Technology 5(3): 111-125. (2008); ISSN: 15448053

Descriptors: trace metals/ organic materials/ spent foundry sands/ beneficial use

Abstract: Millions of tons of spent sand, used to create metalcasting molds, are generated by the foundry industry each year in the United States. Not surprisingly, spent foundry sands (SFSs) are an excellent substitute for virgin sands that are currently used in manufactured soils and geotechnical applications. The purpose of this study was to characterize trace metals and EPA-priority polycyclic aromatic hydrocarbons (PAHs) and phenolics in ferrous and non-ferrous SFSs over a one-year period. Overall, the total metal concentrations in the SFSs were similar to those found in native soils, while the PAHs and phenolic concentrations were relatively low. Metal leaching tests were also performed, which revealed that the SFSs have a low metal leaching potential under the specific test conditions. The data from this study suggests that the majority of SFSs are not hazardous in nature, except those that use olivine sands or are from brass foundries, due to the presence of elevated concentrations of Ni or Cu, Pb, and Zn, respectively. This information will be useful to environmental regulators who are considering including SFSs in their beneficial use regulations. © 2008 DEStech Publications, Inc.

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548. Sand and organic amendment influences on soil physical properties related to turf establishment.

McCoy, E. L.

Agronomy Journal 90(3): 411-419. (May 1998-June 1998)

NAL Call #: 4 AM34P; ISSN: 0002-1962 [AGJOAT]

Descriptors: *Lolium perenne*/ soil amendments/ peat/ sand/ soil physical properties/ topsoil/ guidelines / cation exchange capacity/ bulk density/ hydraulic conductivity/ soil organic matter/ porosity/ biomass production/ compression/ water availability/ humus/ cation exchange/ establishment/ bubbling pressure/ soil compression index

Abstract: Topsoil blending is a common practice in many metropolitan areas, yet few scientific guidelines are available for design of general-use, lawn-area soils. The objective of this study was to provide blending guidelines with focus on establishing a vigorous turfgrass ground cover. A Mahoning silt loam (fine, illitic, mesic Aerie Epiaqualf) and a Tioga loam (coarse-loamy, mixed, mesic Dystric Fluventic Eutrochrept) were each blended with a spent foundry sand and a peat humus to form 28 individual soil mixes for each native soil. Soil properties and perennial ryegrass (*Lolium perenne* L.) growth were measured for each soil mix. Cation exchange capacity (CEC), bulk density, and plant available water exhibited changes due to soil mix that largely resulted from differences in mix organic matter (OM) content. Compression index, bubbling pressure (Hb), air-filled porosity, and saturated hydraulic conductivity (Ksat) responded to both sand and OM contents of the soil mixes. The pore distribution parameter, gamma, exhibited a response to sand and OM contents, but only at high levels of either component. Principal component analysis (PCA) of soil properties revealed that the first two principal components contained 85 to 88% of the total data variation with correlations between compression index, Hb, air-filled porosity, Ksat, and gamma contained in the first component and correlation between CEC, bulk density, and available water contained in the second component. Regression of turf clipping yield vs. PCA factor scores and regression of factor scores vs. total sand and OM contents suggested that a high-quality, general-use soil for lawn establishment would contain about

65% sand and have an OM content of 8% by weight. The multivariate process of relating turf yield to soil physical properties, as applied in this study, should provide more generalized mix formulation guidelines than do recommendations based on relating turf yield to mix composition.

This citation is from AGRICOLA.

549. Saturated hydraulic conductivity of soils blended with waste foundry sands.

Dungan, R. S.; Lee, B. D.; Shouse, P.; and Koff, J. P. de *Soil Science* 172(10): 751-758. (2007)

NAL Call #: 56.8 So3; ISSN: 0038-075X

Descriptors: bentonite/ clay soils/ Inceptisols/ industrial wastes/ loam soils/ Mollisols/ sand/ sandy loam soils/ saturated hydraulic conductivity/ soil amendments/ waste utilization/ pedotransfer function

Abstract: Beneficial uses are being sought after for the large quantities of waste foundry sand (WFS) that are landfilled. Potential applications include their use in synthetic soils and incorporation into agricultural soils. In this laboratory study, we investigated the saturated hydraulic conductivity (K_s) of sandy loam, loam, silty clay, and clay soils that were blended with WFS. Each soil was blended with 0% to 50% green sand (bentonite-coated sand) from an iron and aluminium foundry and a phenolic urethane no-bake sand from a steel foundry. The soils and foundry blends were packed into fixed-wall columns, and K_s was assessed using the constant and falling head methods. The results showed that K_s generally increased in a linear manner as the WFS blending ratio was increased in the soils. Compared with soil only, K_s increases were the greatest in the loam and silty clay soils; at 50% WFS, K_s was as much as 235- and 600-fold higher, respectively. However, K_s was lower over the blending range in soils containing green sands that were predominantly coated with sodium bentonite as compared with calcium bentonite. We attribute this to the high swelling properties of sodium bentonite.

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550. Use of spinach, radish, and perennial ryegrass to assess the availability of metals in waste foundry sands.

Dungan, Robert S. and Dees, Nikki H.

Water, Air and Soil Pollution 183(1-4): 213-223. (July 2007)

NAL Call #: TD172 .W36; ISSN: 0049-6979

Descriptors: soil pollution/ polluted soils/ heavy metals/ waste disposal/ sand/ soil amendments/ *Spinacia oleracea*/ spinach/ *Raphanus sativus*/ radishes/ *Lolium perenne*/ grasses/ bioavailability/ uptake mechanisms/ bioaccumulation/ chemical constituents of plants

Abstract: Plant uptake is a major pathway by which toxic metals can enter the food chain. In this laboratory study we grew spinach, radish, and perennial ryegrass on sand blends containing 50% waste foundry sand (WFS) to assess the availability of Al, B, Ba, Be, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, V, and Zn. The WFSs utilized in this study were from aluminum, iron, and steel foundries. Although there were differences in the amounts of metals accumulated by the various plant species, excessive amounts of heavy metals were not taken up, regardless of WFS treatment. In spinach and radish, B, Cu, Fe, Mn and

Zn were found to be within or close to the sufficiency range for agronomic crops. In ryegrass cuttings at 27, 57, and 87 days, Cu and Zn were within sufficiency ranges, but plants were Fe deficient and contained elevated concentrations of B, Mn, and Mo. Data from this study will be useful for state regulatory agencies interested in developing beneficial use regulations for WFSSs.
This citation is from AGRICOLA.

Pulp and Paper Industry Byproducts

551. **13C/12C composition, a novel parameter to study the downward migration of paper sludge in soils.**

Lichtfouse, Eric; Rogers, Karyne; Payet, Cecile; and Renat, Jean-Christophe

Geochemical Transactions 3(6): 2002. (2002); ISSN: 1467-4866.

Notes: References: 15; illus. DOI: 10.1039/b205560k.

Descriptors: C-13/ C-12/ carbon/ environmental effects/ industrial waste/ isotope ratios/ isotopes/ pollution/ sewage sludge/ sludge/ soils/ stable isotopes/ Environmental geology/ Geochemistry of rocks, soils, and sediments

© American Geological Institute

552. **13c study of soils 8 years after paper sludge disposal.**

Lichtfouse, Eric; Rogers, Karyne; Payet, Cecile; and Renat, Christophe.

In: 223rd National Meeting of the American Chemical Society, Orlando, FL, USA.; Vol. 223(1-2): GEOC 8.; 2002.

Notes: ISSN: 0065-7727.

Descriptors: biochemistry and molecular biophysics/ soil science/ terrestrial ecology: ecology, environmental sciences/ waste management: sanitation/ paper sludge disposal: agricultural lands, forestry lands, waste disposal method/ soil properties/ meeting abstract

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553. **Accumulation and availability of Zn, Cu, Mn and Fe in soils polluted with paper mill waste water.**

Matli Srinivaschari; Dhakshinamoorthy, M.; and Arunachalam, G.

Madras Agricultural Journal 87(4/6): 237-240. (2000)

NAL Call #: 22 M262; ISSN: 0024-9602

Descriptors: application date/ copper/ electrical conductivity/ gypsum/ iron/ irrigation/ irrigation water/ manganese/ NPK fertilizers/ nutrient availability/ paper mill sludge/ polluted soils/ rice/ rice husks/ soil amendments/ soil fertility/ soil ph/ soil pollution/ soil toxicity/ trace elements/ waste water/ zinc/ Madras/ microelements/ Mn/ paddy/ rice hulls/ toxic soils/ watering

Abstract: Field experiments were conducted at M/s Sun Paper Mill Farms, Cheranmahadevi, Tamil Nadu, India, during Kar (June-August) and Pishanam (November-February) seasons, 1995-96, to determine the effect of continuous use of paper mill waste water on the accumulation of Zn, Cu, Fe and Mn in soil. The treatments included three different irrigation sources and three soil amendments (NPK at 120:60:60 kg ha⁻¹, rice husk ash and gypsum) with rice cv. ASD36 as test crop. Soils irrigated with paper mill waste water increased soil pH and electrical conductivity (EC) in both seasons. Gypsum was better in lowering pH than rice husk ash; whereas for EC, rice husk ash proved better. DTPA extractable Zn, Cu, Fe and Mn largely accumulated in the upper 15 cm soil depth and the extent of their accumulation was increased with increased time of application. Application of rice husk ash proved significant in preventing micronutrients from reaching toxic levels in soil.

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554. **Active carbon pools and enzyme activities in soils amended with de-inking paper sludge.**

Chantigny, M. H.; Angers, D. A.; and Beauchamp, C. J.

Canadian Journal of Soil Science 80(1): 99-105. (2000)

NAL Call #: 56.8 C162; ISSN: 0008-4271

Descriptors: alkaline phosphatase/ application rates/ available water/ biomass/ carbendazim/ carbon/ deficiency/ enzyme activity/ hydrolysis/ incorporation/ interference/ levelling/ microbial flora/ microorganisms/ organic matter/ paper mill sludge/ phosphoric monoester hydrolases/ physical properties/ properties/ sludges/ soil/ soil amendments/ soil organic matter/ soil water/ soil water content/ wastes/ water availability/ water content/ alkaline phosphomonoesterase/ carbendazol/ MBC/ medamine/ micro organisms/ microbial biomass/ microflora/ organic matter in soil/ phosphatases/ soil moisture

Abstract: A field study was undertaken in Quebec province, Canada, on a well-drained clay loam and a poorly drained silty clay loam amended with de-inking paper sludge (DPS) at rates of 0 (control), 50 or 100 t ha⁻¹. K₂SO₄-extractable C (C_{ext}), soil water content (SWC), microbial biomass C (MBC) and different enzyme activity rates were periodically measured in soil during 1075 d following DPS incorporation. Compared with control soils, C_{ext} content increased by 100 to 200%, and soil water content increased by 35% following incorporation of DPS at 100 t ha⁻¹. Those differences decreased in time as DPS decomposed. Soil MBC increased proportionally with the rate of DPS amendment and was approx. twice the amount in soils amended with 100 t ha⁻¹ compared with the control. Microbial quotient (ratio of MBC to total soil organic C) was greater in DPS-amended than in control soils until day 370, reflecting the input of labile C from DPS. Compared with the control, fluorescein diacetate hydrolysis and alkaline phosphatase activity rates increased by 40 to 100% when adding 50 t DPS ha⁻¹. However, the rates were similar for 50 and 100 t DPS ha⁻¹. It is concluded that DPS promoted microbial growth and activity in the soil by improving C and water availability. However, levelling off of enzyme activity at a DPS application >50 t ha⁻¹ could reflect changes in soil microbial community, or some kinetic interference or nutrient deficiency induced by excessive C input. Reproduced with permission from the CAB Abstracts database.

555. **Aggregation and organic matter decomposition in soils amended with de-inking paper sludge.**

Chantigny, M. H.; Angers, D. A.; and Beauchamp, C. J.

Soil Science Society of America Journal 63(5): 1214-1221. (Sept. 1999-Oct. 1999)

NAL Call #: 56.9 So3; ISSN: 0361-5995 [SSSJD4]

Descriptors: clay loam soils/ agricultural soils/ land application/ soil organic matter/ degradation/ application rate/ soil aggregates/ soil aggregation/ Quebec/ stability/ paper mill sludge/ silty clay loam soils

Abstract: De-inking paper sludge (DPS) has been traditionally disposed of by burning or landfilling, but could be used as an organic amendment in agricultural soils. Our objective was to assess the impact of DPS incorporation on organic matter and aggregation of a clay loam (Typic Dystrochrept) and a silty clay loam (Typic Humaquept). Whole soil C, particulate (> 53 micrometers) and light

fraction (density < 1.8 Mg m⁻³) C, and water-stable aggregation were measured periodically during a 3-yr period after a single application of DPS at rates of 0 (control), 50, and 100 Mg ha⁻¹). Microscopic observations of water-stable aggregates were also performed. Adding DPS increased whole soil C content, which remained greater than in the control for the duration of the study. After 2 yr, about 40% of the initial material remained in the soil. The proportion of residual C attributed to DPS and present in the particulate fraction remained constant at 70 to 90% during the first 2 yr of the study, whereas the proportion of residual C present in the light fraction decreased from > 95% for fresh DPS to < 50% after 2 yr. One year after incorporation of DPS, the proportion of water-stable aggregates > 1 mm was 2 to 6 times larger in amended soils than in the control. This effect was still statistically significant after 3 yr. Microscopic observations revealed that DPS formed into clusters of wood fibers which became encrusted with mineral particles. We hypothesized that this encrustation provided physical protection to the decaying DPS which remained particulate (> 53 micrometers) in size and progressively densified to > 1.8 Mg m⁻³). As a result, water-stable macroaggregates were formed with DPS as a central core. This citation is from AGRICOLA.

556. Aggregation and organic matter decomposition in soils amended with de-inking paper sludge; Comments on.

Beyer, L. and Mueller, K.
Soil Science Society of America Journal 64(4): 1544-1545. (July 2000-Aug. 2000)
 NAL Call #: 56.9 So3; ISSN: 0361-5995 [SSSJD4].
 Notes: Comment on original article published in *Soil Science Society of America Journal*, 63(5), Sept/Oct, 1999, p 1214-1221 Reply by M Chantigny and D Angers, p 1544-1545.
 Descriptors: clay loam soils/ agricultural soils/ land application/ soil organic matter/ degradation/ application rate/ soil aggregates/ soil aggregation/ stability/ paper mill sludge/ silty clay loam soils
 This citation is from AGRICOLA.

557. Aggregation and organic matter decomposition in soils amended with de-inking paper sludge; Discussion and reply.

Beyer, Lothar; Mueller, Klaus; Chantigny, Martin ; Angers, Denis A.; and Beauchamp, Chantal
Soil Science Society of America Journal 64(4): 1544-1545. (Aug. 2000)
 NAL Call #: 56.9 So3; ISSN: 0361-5995.
 Notes: For reference to original see Chantigny et al., *Soil Sci. Soc. Am. J.*, Vol. 63, p. 1214-1221, 1999.
 Descriptors: aggregate/ carbon/ critical review/ fertilization/ nitrogen/ organic compounds/ sludge/ soil management/ soil treatment/ soils/ soils
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558. Aggregation and organic matter decomposition in soils amended with de-inking sludge; Response to comments on.

Chantigny, Martin; Angers, Denis; and Beauchamp, Chantal
Soil Science Society of America Journal 64(4): 1544-1545. (2000)
 NAL Call #: 56.9 So3; ISSN: 0361-5995

Descriptors: pollution assessment control and management/ soil science/ aggregation/ decomposition/ soil organic matter
 © Thomson Reuters

559. Agricultural use of three organic residues: Effect on orange production and on properties of a soil of the 'comarca costa de huelva' (sw spain).

Madejon, Engracia; Burgos, Pilar; Lopez, Rafael; and Cabrera, Francisco
Nutrient Cycling in Agroecosystems 65(3): 281-288. (2003)
 NAL Call #: S631 .F422; ISSN: 1385-1314
 Descriptors: enzymology: biochemistry and molecular biophysics/ horticulture: agriculture/ soil science/ waste management: sanitation/ rutaceae: angiosperms, dicots, plants, spermatophytes, vascular plants/ field experiment: applied and field techniques/ organic fertilization: applied and field techniques/ soil sampling: applied and field techniques/ Ec [Electrical Conductivity]/ humic substances/ municipal solid waste compost/ olive mill waste water sludge compost/ organic residues: agricultural use/ pH/ paper mill sludge/ soil chemical properties/ soil enzymatic activity/ soil properties/ soil quality/ total organic carbon
 Abstract: Disposal of urban, agricultural and industrial organic residues implies an increasing problem because of all the economic and environmental repercussions involved. One of the most adequate ways of managing this problem is the agricultural use of these wastes as organic amendments. Three organic residues (AC, olive mill waste water sludge compost; MWC, municipal solid waste compost; and PS, paper mill sludge) were used in a 3-year field experiment involving orange production. The effect of their application on crop production and on soil quality was investigated. Soil samples (0-20 cm depth) collected 11 months after the last soil amendment were analysed for: pH and EC, Kjeldahl-N, available-P, available-K, total organic carbon, humic substances, dehydrogenase, phosphatase, beta-glucosidase, urease and benzoyl-argininamide hydrolysing protease (BAA-protease) activities. Generally, the application of the MWC and PS increased orange yield when compared to control. Moreover, total organic carbon and humic substances significantly increased in soils treated with all the organic amendments. Organic fertilisation increased the Kjeldahl-N and available-P contents of the soil. The application of the organic residues also caused significant increases in dehydrogenase, beta-glucosidase, urease and BAA-protease activities of the soil. Significant positive correlations (p < 0.01) between these enzymatic activities and total organic carbon were found for all treatments. Significant positive correlation between dehydrogenase, urease, beta-glucosidase, and BAA-protease and orange yield was also found. However, a clear inhibition of phosphatase activity was observed in soils treated with PS. The results indicate that the repeated application to the soil of moderate amounts of organic amendments has positive effects on the chemical and biochemical properties of the soil, as well as on the orange yield.
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560. Agronomic utilization of biosolids from pulp and paper mills and other residuals in Quebec: Risk management.

Hébert, M. and Beaulieu, R. Montreal, QC.; pp. 637-649; 2002.

Notes: Sponsors: TAPPI; NCASI; PAPTAC; FSDA.

Descriptors: agronomy / effluents/ odor control/ risk management/ septic tanks/ soil pollution/ soils/ trace elements/ biosolids/ paper and pulp mills/ agronomy/ effluents/ paper mills/ pathogens/ pulp mills/ risk management/ soil/ trace elements

Abstract: The agronomic utilization of residuals is increasing in the province of Quebec (Canada). Indeed, about 2% of farmland is receiving residuals. Biosolids from pulp and paper mills contribute about 65% of the quantities applied on agricultural soils. Fortunately, these biosolids contain few contaminants and are therefore generally classified excellent quality. Research also demonstrated that short-term accumulation of trace elements in soils is nonexistent or negligible. In the long term, loading estimates for metals in soils show values significantly lower than those accepted by the USEPA for municipal biosolids. New risk based analysis done in Quebec suggests also that the risk is very low for highly exposed individuals with contaminants such as cadmium and dioxins and furans. Moreover, the hypothesis of an "unknown contaminant" that could cause irreparable damage, despite the theoretical possibility, is considered to be unlikely according to the international experience with biosolids, and specific utilization criteria used in Quebec. However, although no instance of damage is known, risks reside in illegal spreading of residuals containing pathogens, especially with untreated residuals from septic tanks. Some malodorous biosolids may also pose concerns. The Quebec Ministry of the Environment is developing a new approach to prevent these odor problems.

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561. Altering soil carbon and nitrogen stocks in intensively tilled two-year rotations.

Griffin, T. S. and Porter, G. A.

Biology and Fertility of Soils 39(5): 366-374. (2004)

NAL Call #: QH84.8.B46; ISSN: 0178-2762

Descriptors: soil science/ Gramineae: angiosperms, monocots, plants, spermatophytes, vascular plants/ Solanaceae: angiosperms, dicots, plants, spermatophytes, vascular plants/ intensive tilling/ soil microbial biomass/ two year rotations: intensive tilling

Abstract: Information is needed on the ability of different crop management factors to maintain or increase soil C and N pools, especially in intensively tilled short crop rotations. Soil samples from field experiments in Maine were used to assess the effect of cover crop, green manure (GM) crop, and intermittent or annual amendment on soil C and N pools. These field experiments, of 6-13 years' duration, were all characterized by a 2-year rotation with either sweet corn (*Zea mays* L.) or potato (*Solanum tuberosum* L.), and primary tillage each year. Total, particulate organic matter (POM), and soil microbial biomass (SMB)-C and -N pools were assessed for each experiment. Total C and N stocks were not affected by red clover (*Trifolium pratense* L.) cover crop or legume GM, but were increased by 25-53% via a single application of papermill sludge or an annual manure and/or compost amendment. With the exception of continuous potato production which dramatically reduced the SMB-C and SMB-N concentration, SMB-C and -N were minimally affected by changes in cropping sequence, but were quite sensitive to amendments, even those that were primarily C. POM-C and -N, associated with the coarse mineral fraction (53-2,000 μm), were more responsive to

management factors compared to total C and N in soil. The change in soil C fractions was a linear function of increasing C supply, across all experiments and treatments. Within these intensively tilled, 2-year crop rotations, substantial C and N inputs from amendments are needed to significantly alter soil C and N pools, although cropping sequence changes can influence more labile pools responsible for nutrient cycling.

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562. Ammonia volatilization from liquid hog manure amended with paper products in the laboratory.

Subair, S.; Fyles, J. W.; and O'Halloran, I. P.

Journal of Environmental Quality 28(1): 202-207. (1999)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: amendments/ ammonia/ carbon/ liquid manures/ losses/ newspapers/ nitrogen/ paper/ paper bags/ paper mill sludge/ pH/ pig manure/ piggery effluent/ pulps/ volatilization/ filter paper/ hydrogen ion concentration/ potential of hydrogen

Abstract: Reduction in NH_3 volatilization from liquid pig manure (LHM) by paper bag (PB), filter paper (FP), newsprint (NP), and pulp sludge (PS) added at 2.5 and 5% (fresh LHM weight) was evaluated in a 56 d incubation study. Cumulative NH_3 volatilization ranged between 28 and 53% of initial manure N. When the rate increased from 2.5 to 5%, NH_3 volatilization was reduced by 47, 40, 37, and 29%, respectively, compared to the control. Increasing the rate increased the amount of C lost from the LHM and reduced the net mineralization of organic N. Hence, the addition of organic amendments appeared to have decreased NH_3 volatilization by increasing microbial activity and N immobilization. Liquid pig manure pH was negatively correlated with C loss, indicating that microbial decomposition of paper amendments lowered manure pH but this effect did not appear to be important in controlling NH_3 volatilization. Paper lignin content was not correlated with the loss of C, manure pH, or NH_3 volatilization, suggesting that the effectiveness of paper products in reducing NH_3 volatilization is not controlled by lignin content but rather by other more labile components. Reproduced with permission from the CAB Abstracts database.

563. Analysis and effect of paper mill effluent on germination and seedling growth of some pulses: *Vigna radiata*, *glycine max* and *cicer arietinum*.

Joshi, P. K. and Tandon, S.

Journal of Industrial Pollution Control 19(1): 9-13. (2003);

ISSN: 09702083 [JIPCE]

Descriptors: *Cicer arietinum* l-(gram)/ *Glycine max* l-merr (soyabean)/ paper mill effluent/ seed germination/ seedling growth/ *Vigna radiata* l-wilezek (moong)/ effluent/ germination/ growth response/ pulp and paper industry/ seedling/ toxicity/ water pollution/ *Cicer arietinum*/ *Glycine max*/ *Vigna radiata*

Abstract: Paper mills are one of the major sources of water pollution. The industries release colouring materials such as organic dyes/metallic dyes. In this study, the authors have attempted to find the effect of paper mill effluent on germination and seedling growth of three selected crops *Vigna radiata* L. Wilczek (Moong), *Glycine max* L. Merr (Soyabean), and *Cicer arietinum* L. (Gram). For this, the different concentrations of the effluent were made as 0% (control), 25%, 50%, 75% and 100% (pure effluent) in

distilled water. The concentration 25% of the effluent is found good for seedling growth of *Vigna radiata* and *Glycine max* while 50% concentration of effluent is found good for seedling growth *Cicer arietinum*. The present data showed that the concentrations below 50% gave the stimulatory effect on seedling growth of the crops of these pulses while concentrations above 50% is found to be toxic and may cause inhibition in the growth. The germination of these seeds is found in decreasing order as increase in the concentration of the effluent for all these crops.

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564. Application of paper de-inking sludge on soils; Comments on the paper of Fierro, Angers and Beauchamp.

Beyer, L. and Mueller, K.

Soil Biology and Biochemistry 33(3): 413-416. (Mar. 2001)

NAL Call #: S592.7.A1S6; ISSN: 0038-0717 [SBIOAH].

Notes: Discussion of the article "Decomposition of paper de-inking sludge in a sandpit minesoil during its revegetation" by A Fierro, DA Angers, and CJ Beauchamp, this journal, v 32 p 143-150, 2000 Reply by A Fierro, DA Angers, and CJ Beauchamp, p 415-416.

Descriptors: land application/ degradation/ sand/ mined soils/ land restoration/ letters (correspondence)

This citation is from AGRICOLA.

565. Application of paper mill sludge on blueberry: Effects on soil chemical properties and yield.

Lafond, J.; Simard, R. R.; and Roy, M.

In: 1999 Annual Meeting of the Canadian Society of Soil Science..Charlottetown, Prince Edward Island, Canada.); Vol. 79(4).; pp. 644; 1999.

NAL Call #: 56.8 C162

Descriptors: Horticulture: Agriculture/ Nutrition/ Waste Management: Sanitation/ Soil Science/ Ericaceae: Angiosperms, Dicots, Plants, Spermatophytes, Vascular Plants/ Crop Yield/ Paper Mill Sludge: Soil Amendment/ Soil Chemistry/ Abstracts

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566. Application of wastewater from paper and food seasoning industries with green manure to increase soil organic carbon: A laboratory study.

Lin, Chin-Ching; Arun, A. B.; Rekha, P. D.; and Young, Chiu-Chung

Bioresource Technology 99(14): 6190-6197. (2008)

NAL Call #: TD930.A32; ISSN: 0960-8524.

Notes: Publisher: Elsevier Science, The Boulevard Langford Lane Kidlington Oxford OX5 1GB UK, [mailto:nlinfo-f@elsevier.nl], [URL:http://www.elsevier.nl] DOI: 10.1016/j.biortech.2007.12.025

Language: English.

Descriptors: carbon/ combined treatment/ effluents/ food industry/ foods/ industrial wastewater/ laboratories/ manure/ organic carbon/ paper mills/ pulp and paper industry/ soil/ soils (organic)/ waste water/ wastewater/ total organic carbon/ *Oryza sativa*/ *sesbania*

Abstract: This laboratory scale experiment was designed to study the suitability of organic wastes from paper and food seasoning industries to improve the soil organic carbon for rice cultivation. Lignin-rich wastewater from paper industry

and nitrogen-rich effluent from a food industry at suitably lower concentrations were used at two levels of green manure to enhance the soil organic carbon fraction over time. Both the groups of soils with or without *Sesbania* were incubated under submerged condition at 25 degree C for 15 days. Wastewaters from paper industry (WP), food industry (WS), and a combination of WP + WS were added separately to both the treatment groups in flasks. After 103 days of incubation, from all the three treatments and control, total organic carbon and alkali-soluble organic carbon fractions were analyzed. Results indicated that in all the three treatments containing green manure amended with industrial wastewaters, the organic carbon content increased significantly. The alkali-soluble organic carbon fraction was increased by 59% in the soil amended with green manure containing WS and by 31% in the treatment without green manure compared to control. The paper mill waste water namely, WP, increased the organic carbon only in the soil containing green manure by 63%. The combined treatment of WP + WS with green manure increased alkali-soluble organic carbon fraction by 90% compared to control, while in the treatment without green manure, the organic carbon increase was 71%. Overall, the combined treatment WP + WS with green manure could increase the alkali-soluble organic carbon fraction more than all other treatments. Hence, wastewater rich in organics from paper and food industries can be efficiently used to temporarily increase the soil organic carbon content.

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567. Ash fertilization in a clearcut and in a Scots pine stand in central Sweden: Effects on soil water and soil chemistry coupled to laboratory leachings of six ash products.

Ring, E.; Lovgren, L.; Nohrstedt, H. O.; and Jansson, G. *Report SkogForsk* 2: 51. (1999); ISSN: 1103-6648

Descriptors: ash/ bark/ clear felling/ fertilizers/ fly ash/ mineral oils/ paper mill sludge/ residues/ soil amendments/ soil chemical properties/ soil chemistry/ soil properties/ soil water/ wood chips/ chemical properties of soil/ clearcutting/ Scotch pine/ Scots pine/ soil moisture

Abstract: The effects of various fly ash products from a Swedish paper mill (PBF) and a pulp mill (CNO) on soil water and chemical properties were investigated in a 2 year scots pine (*Pinus Sylvestris*) stand in Central Sweden. PBF ash was produced by the combustion of bark, wood chips, logging residues and biochemical sludge. CNO originated from the combustion of bark and petrochemical oil. The PBF products were PBF loose, PBF self (self hardened and crushed) , PBF drum (granulated) , PBF disc (granulated) and PBF pellets. The CNO product was pelleted. Data on chemical characteristics, particle size distribution, leaching characteristics off all ash products are tabulated and discussed. The effects of various treatments on soil chemical variables showed only a few significant ($P < 0.05$) effects in clear felled area, and none of the products affected water pH. Nitrate content increased in treatments with PBF self, drum, disc, pelleted and CNO pelleted. Three years after application increased amounts of P were

observed following the application of PBF lose and self, and CNO. PBF drum increased increased Al content in the humus layer and CNO increased pH (in H₂O) from 4.0 to 4.8, and immobilized ammonium.
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568. Assessment of the pulp and paper mill effluent on growth, yield and nutrient quality of wheat (*triticum aestivum* L.).

Singh, A.; Agrawal, S. B.; Rai, J. P. N.; and Singh, P. *Journal of Environmental Biology* 23(3): 283-288. (2002)
NAL Call #: QH540.J65 ; ISSN: 02548704 [JEBID]
Descriptors: effluent / plant growth/ pulp and paper mill/ soil texture/ triticum/ carbohydrate/ chlorophyll/ lipid/ protein/ effluent/ growth/ nutritive value/ pulp and paper industry/ soil amendment/ wheat/ yield response/ biomass/ effluent/ grain yield/ paper/ plant growth / plant height/ sand/ soil quality/ wheat/ growth, development and aging/ industrial waste/ physiology/ plant root/ sewage/ water pollutant/ India/ triticum aestivum/ biomass/ carbohydrates/ chlorophyll/ industrial waste/ lipids/ paper/ plant roots/ triticum/ waste disposal, fluid/ water pollutants
Abstract: Assessment of agropotentiality of the effluent coming out from century pulp and paper mill, Ghanshyamdham, Lalkua (Uttaranchal) has been made on wheat (*Triticum aestivum* var. UP-2329) crop grown in two soils differing in texture with different effluent concentrations. Diluted effluent increased the chlorophyll content, plant height, shoot and root biomass, grain yield, protein, carbohydrate and lipid contents in wheat grains, while undiluted effluent caused inhibition in plant growth resulting in a sharp decline of yield. Pure soil provided better growth and yield results than those soil mixed with sand.

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569. Beneficial use of by-product solids from the kraft recovery cycle.

Thacker, W. E.

Ncasi Technical Bulletin(931): 1-36. (2007); ISSN: 08860882 .

Notes: Language of Original Document: French; English.
Descriptors: agricultural limestone/ aox removal/ asphalt/ calcium carbonate/ causticizing/ cement/ ceramic/ concrete/ earthen construction/ green liquor dregs/ green liquor sludge/ land application/ lime grit/ lime mud/ lime sludge/ liming agent/ mine reclamation/ recausticizing/ asphalt/ cements/ concretes/ kraft pulp/ limestone/ paper and pulp industry/ sewage sludge/ lime grit/ liming agents/ mine reclamation/ solid wastes/ asphalt/ calcium carbonate/ causticizing/ concrete/ kraft pulps/ lime stone/ pulp mills/ solid wastes/ white liquor mud
Abstract: Causticizing residues - slaker grits, green liquor dregs, and excess lime mud - are among the significant by-product solids from kraft pulp mills. These materials have chemical and physical properties that can make them suitable for a number of beneficial uses. The predominant use, especially for lime mud, is as a liming agent on agricultural land. Another important use is as a feedstock for cement kilns. Additional uses that have been the subject of research or of limited application for at least one of the causticizing by-products include forest land application, acid mine reclamation, soil stabilization/earthen construction, brick additive, gaseous sulfur-compound

treatment, wastewater neutralization, wastewater AOX removal, sludge bulking control, and asphalt additive. Based on a literature review and contact with kraft mills, this report describes characteristics of causticizing by-products and their possible beneficial uses.
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570. Beneficial use of municipal and industrial wastes in cotton production.

Boquet, D. J.; Breitenbeck, G. A.; and Coreil, C. B. Jr. *Louisiana Agriculture* 42(2): 10-11. (1999); ISSN: 0024-6735

Descriptors: application methods/ ash/ band placement/ composts/ cotton/ crop yield/ fertilizers/ incorporation/ industrial wastes/ loess soils/ nitrogen fertilizers/ paper mill sludge/ refuse/ residual effects/ sewage sludge/ silt loam soils/ soil amendments/ soil properties/ waste utilization/ municipal wastes/ trash/ United States of America
Abstract: In field trials in 1996 on loess silt loam soils at Macon Ridge, near Winnsboro, Louisiana, USA, cotton was given municipal biosolids with or without boiler ash, composted sewage sludge, paper mill sludge or paper mill boiler ash broadcast on the soil surface and incorporated or buried under the crop rows in a 6-inch-wide and 24-inch-deep trench. Control plots were given 80 lb N fertilizer/acre. Residual effects of the treatments were assessed in 1997 and 1998. Cotton fibre yields were increased by all treatments except paper mill sludge. The highest increases were with municipal biosolids, with or without boiler ash, with both application methods. Paper mill sludge gave some yield increases as a residual effect in 1997. Boiler ash was beneficial as a liming material. Application of the waste materials improved soil properties for 3 years.
Reproduced with permission from the CAB Abstracts database.

571. Beneficial use of pulp and paper residues for soil amendment in the province of Quebec.

Leclerc, Jacques; Liard, Alain; Villeneuve, Florent; and Desilets, Louis. Vol. 3.

Vancouver, Can: TAPPI Press; pp. 1171-1178; 1998.

Notes: Chapter Number: Norcross, GA, United States.

Descriptors: agriculture/ environmental protection/ forestry/ industrial waste disposal/ land reclamation / laws and legislation/ paper and pulp mills/ sludge disposal/ soil conditioners/ soil amendments/ waste utilization
Abstract: Over the last 3 years, the beneficial use of pulp and paper sludges increased from 3.9% of the total amount generated in the province of Quebec to more than 20%. In early 1994, the Quebec Forest Industries Association (QFIA) formed a sub-committee dedicated to the promotion of the use of pulp and paper residues in agriculture, sylviculture, horticulture and reclamation of degraded sites, where landfilling (41.1%) and burning (56.2%) were the most common manners to dispose of all types of residues at that time. Facing a lack of guidelines and standards in that field, the QFIA joined the Quebec Ministry of Environment and Wildlife (MEF) in a government/industry working group with the objective to set a series of criteria and good management practices to facilitate the beneficial use of pulp and paper residues as soil amendments. In 1997, after 3 years, the work in partnership with all interested parties resulted in the characterization of sludges from 45 mills, modeling and monitoring, and pilot and full scale trials. After only one season of experimentation with

the provisional criteria and good management practices, more than 575,000 wet metric tons of residues were beneficially used. This is just a beginning of the total potential use of residues for soil amendments. Some issues are still under discussion with the environmental authorities concerning temporary winter storage in the field and the classification of the sludges according to their potential pathogenic content.

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572. Beneficial use of solid wastes at P. H. Glatfelter company's glatfelter division.

Gingerich Jr., J. C. Denver, CO.); Vol. 1.; pp. 55-60; 2000.

Notes: Conference code: 61635

Sponsors: TAPPI; NCASI; PAPTAC; FSDA.

Descriptors: dewatering/ land fill/ paper and pulp mills/ recycling/ wastewater sludge production/ solid wastes/ drainage/ land fill/ paper mills/ pulp mills/ recycling/ solid wastes

Abstract: The Glatfelter Division of the P. H. Glatfelter Company consists of two millsites; a fully integrated kraft pulp and paper mill in Spring Grove, Pennsylvania and a recycled paper mill in Neenah, Wisconsin. Both facilities produce fine, white papers. Solid waste disposal has been a primary environmental concern for these mills. This has led over the years to varied solutions for minimizing the volume of solid wastes sent to landfills. The most recent concern for Spring Grove has been high calcium waste solids generation: ash from the circulating fluid bed (CFB) power boiler, and excess lime mud from pulp mill lime kiln outages and system purges. For Neenah it has been primary and-secondary wastewater sludge production. The lime content and cementitious properties of dry CFB ash have allowed its development as a soils amendment and conditioning additive, and lime substitute. The moist lime mud has been developed as an agricultural soil conditioner. The dewatered, mixed wastewater sludge is processed into glass aggregate in a thermal plant adjacent to the Neenah mill. This facility was developed and is owned by Minergy Corporation. Ten other area paper mills also have their waste sludges processed through this facility.

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573. Beneficial uses of pulp and paper power boiler ash residues.

Elliott, A. and Mahmood, T.

Tappi Journal 5(10): 9-16. (2006) [TAJOD]

Descriptors: coal ash / fly ash/ paper/ paper and pulp industry/ solid wastes/ wastewater treatment/ chlorinated organics/ wastewater treatment systems/ wood residues/ pulp/ ash/ boilers/ effluent treatment/ electric generators/ land fill/ paper/ paper mills/ pulps

Abstract: Ash residuals generated from recovery and power boilers combusting wood residues, sludges, or auxiliary fuels constitute a major fraction of the solid residues produced by pulp and paper mills. Generation rates in Canada, and likely elsewhere, for ashes of different types have increased substantially since the mid-1990s. Landfilling is the primary disposal method, but there are many potential beneficial applications for these ashes. Large-scale opportunities include land application and construction. Smaller-scale applications exist within both wastewater treatment systems and the papermaking process. Ashes from wood-fired power boilers are generally more suitable for land application than those from coal

combustion, as they contain fewer metals at lower concentrations (except for cadmium). The major benefit of land application arises from the neutralizing properties of ashes, as they provide alkalinity to the soil. Compared to fly ashes, bottom ashes have higher bulk density, lower carbon content and few, if any, dioxins and furans. Land application of ashes produced from salt-laden hog fuels at coastal pulp and paper mills is regulated for dioxins and furans. However, steps can be taken to minimize the generation of such chlorinated organics, making these ashes suitable for land application.

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574. Bioconversion of paper and pulp mill solid wastes.

Mini, K.; Udayasoorian, C.; and Ramaswami, P. P.

Madras Agricultural Journal 86(4/6): 195-198. (1999)

NAL Call #: 22 M262; ISSN: 0024-9602

Descriptors: composts / conversion/ effluents/ fertilizers/ industrial wastes/ manufacture/ paper mill sludge/ sugar factory waste/ Hyphomycetes/ Lentinaceae/ Poriales/ sugar factory effluent

Abstract: Begasse pith (BP) is solid waste discharged from sugarcane bagasse-based paper and pulp industry. It contains high quality of cellulose and lignin. An attempt has been made to convert the bagasse pith into biomanure for land application using activated sludge (AS) and ETP (effluent treatment plant) sludge (ETPS) which are solid wastes obtained from the same factory rich in essential plant nutrients. The AS and ETPS were mixed with BP in different properties to maintain the optimum C:N ratio and nutritional requirement of microorganisms during composting. In order to enhance the composing process, an external source of inocula viz., *Pleurotus sajor-caju* (250 kg), *Trichoderma viride* (0.4%) and a new bacterial culture, EM 4 (500 ml) were added per 100 kg of substrate. NPK content was increased in all treatments and the C:N ratio was reduced to a level suitable for land application within a period of 10 weeks. Mixing BP with AS and ETPS in 2:1:1 ratio produced a better quality compost than mixing BP with AS at 1:1 ratio.

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575. Biological parameters for compost stability assessment and process evaluation.

Lasaridi, K. E. and Stentiford, E. I.

Acta Horticulturae 469: 119-128. (1998)

NAL Call #: 80 Ac82; ISSN: 0567-7572

Descriptors: assays/ assessment/ composting/ composts/ consumption/ evaluation/ germination/ inhibition/ oxygen/ paper mill sludge/ phytotoxicity/ refuse/ regulations/ respirometry/ seed germination/ sludges/ stability/ substrates/ variation/ municipal wastes/ rules/ trash

Abstract: The stability of three composts, representing a variety of substrates (biosolids, refuse, and paper pulp sludge) and composting processes, was assessed through biological and chemical assays. Biological parameters, especially respirometry and germination tests, are more suitable for the evaluation of compost stability, although some chemical parameters (e.g. C:N ratio) are still widely used and even appear in regulations. Three different respirometric parameters were used for the assessment of stability; their common factor is that they all take advantage of the improved technology of the Clark-type polarographic dissolved oxygen probe. The SOUR (specific oxygen

uptake rate) measures the rate of O₂ consumption in an aqueous compost suspension; the TOD₂₀ is the total O₂ consumed by the same suspension in 20 hours; and the DSO_{UR} is the rate of O₂ consumption by a solid compost matrix. The range of values obtained differed for each of three parameter, but they all showed similar variations with composting time, and had highly significant correlations with each other. Cress (*Lepidium sativum*) seed germination, used to evaluate compost stability in terms of phytotoxicity, showed strong inhibition during the thermophilic phase, which subsided later. Of the chemical parameters, the reduction of volatile solids was the most useful, having a highly significant correlation with compost age and the respirometric parameters. The C:N ratio and its variation during composting depended on the type of compost, and was thus of limited usefulness.

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576. A case study of waste management at the northern Finnish pulp and paper mill complex of stora enso veitsiluoto mills.

Nurmesniemi, H.; Pöykiö, R.; and Keiski, R. L. *Waste Management* 27(12): 1939-1948. (2007); ISSN: 0956053X [WAMAE].

Notes: doi: 10.1016/j.wasman.2006.07.017.

Descriptors: acidity/ byproducts/ fluidized beds/ land fill/ paper and pulp industry/ waste management/ green liquor dregs/ hydraulic barrier/ landscaping agent/ wastewater treatment/ acidity/ byproducts/ fluidized beds/ land fill/ paper and pulp industry/ waste management/ wastewater treatment/ landfill/ mill/ pulp and paper industry/ solid waste/ waste management/ wastewater/ water treatment/ chemical waste/ clay/ energy yield/ finland/ forest management/ hydraulic permeability/ landfill/ landscaping/ liquid/ mining/ nonhuman/ paper industry/ priority journal/ pulp mill/ sludge/ soil fertilization/ solid waste management/ waste water treatment plant/ wood debris/ finland/ forestry/ industrial waste/ paper/ refuse disposal/ waste management/ wood/ acidity/ byproducts/ effluent treatment / fluidized beds/ land fill/ pulps/ Eurasia/ Europe/ Finland/ Kemi/ Lappi [Finland]/ Northern Europe/ Scandinavia

Abstract: This work presents the current waste management system at the pulp and paper mill complex of Stora Enso Oyj Veitsiluoto Mills at Kemi, Northern Finland. This paper covers examples of case studies carried out at the mill and describes how the wastes and by-products are utilized as a neutralizing agent for acidic wastewaters (i.e., green liquor dregs from the causticizing process), as a hardener in filling mine cavities (i.e., ash from the fluidized bed boiler), as a landscaping agent (i.e., ash as well as the fibre clay from chemical wastewater treatment plant), as a hydraulic barrier material for landfills (i.e., fibre clay), and as a soil enrichment agent (i.e., calcium carbonate from the precipitated calcium carbonate plant). In addition, the wood waste from the wood-handling plant, sawmill, packaging pallet plant and from the groundwood mill, as well as the biosludge from the biological wastewater treatment plant, are all incinerated in the fluidized bed boiler for energy production. Due to effective utilization of the solid wastes generated at the mills, the annual amount of waste to be disposed of in the landfill has decreased between 1994 and 2004 from 42,990 to 6083 tonn (expressed as wet weight). The paper also gives an overview of the relevant European

Union legislation on the forest industry and on waste management, as well as of the pulping process and of the generation of major solid wastes in the pulp and paper mills. © 2006 Elsevier Ltd. All rights reserved.

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577. Changes in cadmium and zinc phytoavailability in agricultural soil after amendment with papermill sludge and biosolids.

Merrington, G. and Madden, C.

Communications in Soil Science and Plant Analysis 31(5-6): 759-776. (2000)

NAL Call #: S590.C63; ISSN: 0010-3624 [CSOSA2]

Descriptors: agricultural soils/ cadmium/ zinc/ heavy metals/ bioavailability/ soil properties/ physicochemical properties/ sewage sludge/ land application/ Lolium perenne/ dry matter accumulation/ paper mill sludge

Abstract: The co-disposal of papermill sludge with biosolids is seen as an alternative soil amendment to papermill sludge and inorganic fertilizer. The objectives of this study were to assess the suitability of co-disposal of papermill sludge and biosolids by measuring changes in the soil physicochemical properties and the phytoavailability of cadmium (Cd) and zinc (Zn). Biosolids were applied with papermill sludge as an alternative source of N to inorganic fertilizers at rates calculated on the basis of C:N ratios of the amendments and common papermill sludge disposal practices. Perennial ryegrass (*Lolium perenne* L.) was grown on amended soils for 6 months under glasshouse conditions. The papermill sludge amendment alone increased soil pH and the rate of carbon degradation compared to the control (no amendment) and biosolid co-disposal amendment. There was no difference in dry matter yield per pot of ryegrass between the treatments. Cadmium concentrations in plant tissue increased through the trial with the application of biosolids and papermill sludge. These findings were correlated well with the sorption properties of the soils for Cd as derived from isotherms. However, Zn uptake was unaffected by the application of the papermill sludge and biosolids.

This citation is from AGRICOLA.

578. Changes in copper, lead and zinc concentrations in plants from paper mill sludge-treated soils.

Calace, N.; Petronio, B. M.; Picciolo, M.; Pietrantonio, M.; and Pietroletti, M.

Annali Di Chimica 90(11-12): 655-663. (2000)

NAL Call #: 385 AN7 ; ISSN: 00034592 [ANCRA]

Descriptors: copper/ lead/ metal/ zinc/ barley/ chemistry/ industrial waste/ metabolism/ paper/ pH/ soil/ copper/ hordeum/ hydrogen-ion concentration/ industrial waste/ lead/ metals/ paper/ soil/ zinc

Abstract: Effects of paper mill sludge addition on the availability of metals were studied on different soils both laboratory and naturally polluted; copper, lead and zinc concentrations were determined in *Hordeum Distichum* plants grown on the untreated and on sludge-treated soils. In some case a decrease of metal concentration is observed on sludge-treated soils; these results are consistent with the reduction of metal mobile forms in the soil, before plant growth. The decrease of metal availability in sludge-treated soils may be related with the pH value of the soil after sludge addition.

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579. Changes in soil organic matter, enzymatic activities and heavy metal availability induced by application of organic residues.

Burgos, P.; Madejon, E.; and Cabrera, F. Naples Capri, Italy.; pp. 353-362; 2002.

Descriptors: application rates/ beta glucosidase/ bioavailability/ biological activity in soil/ composting/ composts/ Entisols/ enzyme activity/ heavy metals/ humic acids/ milling byproducts/ organic amendments/ organic carbon/ oxidoreductases/ paper mill sludge/ phosphoric monoester hydrolases/ polluted soils/ proteinases/ refuse/ sandy soils/ sludges/ soil enzymes/ soil fertility/ soil organic matter/ soil pollution/ soil types/ solid wastes/ strawberries/ urease/ humic substances/ municipal wastes/ organic matter in soil/ phosphatases/ proteases/ redox enzymes/ soil quality/ trash

Abstract: A 3-year field experiment on a sandy soil (Typic Endoaquent) in Spain supporting a strawberry (cv, Camarosa) crop was carried out to study the effects of the application of three organic residues (olive mill waste water sludge compost at 10 000 kg/ha, AC; municipal solid waste compost at 48 000 kg/ha, MWC; and paper mill waste at 48 000 kg/ha, PW) on organic matter content, enzymatic activities, and available heavy metals (Fe, Mn, Cu, Zn, Cd, Co, Ni and Pb). Significant increases in organic carbon content (total organic carbon (TOC), total extractable carbon (TEC) and humic acid carbon (HAC)) were observed in soils, depending on the nature of organic amendments. The application of the organic residues also caused significant increases in dehydrogenase [oxidoreductase], phosphatase [phosphoric monoester hydrolases], beta -glucosidase, urease and BAA-protease [proteinase] activities. This favourable effect on soil biological activity was more noticeable in MWC and PW treatments. Significant positive correlation ($P < 0.01$) between enzymatic activities and TOC was found for all treatments. Available heavy metal contents increased slightly in the soils treated with MWC and PW but did not affect negatively soil enzymatic activities. A discriminant analysis generated two functions (F1 and F2) based on linear contributions of the variables (TOC, TEC, HAC, dehydrogenase, phosphatase, beta -glucosidase, urease, and BAA-protease). F1 was correlated with dehydrogenase, TOC and BAA-protease and separated the treatments control (without organic amendments) and AC from PW and MWC. F1 underlined the effect of the higher doses of organic matter applied with MWC and PW. F2 was correlated with humic substances (TEC and HAC), and beta -glucosidase separated treatments C and PW from AC and MWC. This function shows the difference of the effect of composted (AC and MWC) and fresh residues (PW) on soil properties. Results showed that the application of organic residues to a sandy soil improves its agronomic quality by increasing soil organic matter and enhancing soil enzyme activities.

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580. Chemical sequential extraction of heavy metals and sulphur in bottom ash and in fly ash from a pulp and paper mill complex.

Nurmesniemi, H.; Poykio, R.; Kuokkanen, T.; and Ramo, J. *Waste Management Resources* 26(4): 389-99. (Aug. 2008); ISSN: 0734-242X . 18727331

Descriptors: chemical sequential extraction/ heavy metals/ sulphur/ bottom ash/ fly ash/ pulp and paper mills

Abstract: A five-stage sequential extraction procedure was used to determine the distribution of 11 metals (Cd, Cr, Cu, Mo, Pb, Zn, As, Co, V, Ni, Ba), and sulphur (S) in bottom ash and in fly ash from a fluidized bed co-combustion (i.e. wood and peat) boiler of Stora Enso Oyj Oulu Mill at Oulu, Northern Finland, into the following fractions: (1) water-soluble fraction (H_2O); (2) exchangeable fraction (CH_3COOH); (3) easily reduced fraction ($NH_2OH-HCl$); (4) oxidizable fraction ($H_2O_2 + CH_3COONH_4$); and (5) residual fraction ($HF + HNO_3 + HCl$). Although metals were extractable in all fractions, the highest concentrations of most of the metals occurred in the residual fraction. From the environmental point of view, this fraction is the non-mobile fraction and is potentially the least harmful. The Ca concentrations of 29.3 g kg^{-1} (dry weight) in bottom ash and of 68.5 g kg^{-1} (dry weight) in fly ash were correspondingly approximately 18 and 43 times higher than the average value of 1.6 g kg^{-1} (dry weight) in arable land in Central Finland. The ashes were strongly alkaline pH (approximately 12) and had a liming effects of 9.3% (bottom ash) and 13% (fly ash) expressed as Ca equivalents (dry weight). The elevated Ca concentrations indicate that the ashes are potential agents for soil remediation and for improving soil fertility. The pH and liming effect values indicate that the ashes also have a pH buffering capacity. From the environmental point of view, it is notable that the heavy metal concentrations in both types of ash were lower than the Finnish criteria for ash utilization.

This citation is from PubMed.

581. Chemical traits alteration of an acid soil by lime and recycling paper residue application.

Balbinot Junior, A. A.; Torres, A. N. L.; Fonseca, J. A. da; Teixeira, J. R.; and Nesi, C. N.

Revista de Ciencias Agroveterinarias 5(1): 16-25. (2006); ISSN: 1676-9732.

Notes: Original title: Alteracao em caracteristicas quimicas de um solo acido pela aplicacao de calcario e residuos de reciclagem de papel.

Descriptors: acid soils/ aluminium/ base saturation/ boron/ cadmium/ calcium/ cation exchange capacity/ chromium/ copper/ environmental impact/ industrial wastes/ iron/ lead/ lime/ magnesium/ manganese/ mercury/ nickel/ organic amendments/ paper mill sludge/ phosphorus/ potassium/ recycling/ soil acidity/ soil amendments/ soil chemical properties/ soil pH/ soil types/ sulfur/ zinc/ aluminum/ chemical properties of soil/ elemental sulphur/ environmental effects/ Mn/ sulphur

Abstract: The recycling paper process generates residues that are usually placed in embankments. However, these residues present some constituents that can correct soil acidity and act as a source of nutrients, such as calcium. On the other hand, these residues also have heavy metals, which can cause negative environmental impacts. This work aimed to evaluate the effects of doses of lime and two kinds of recycling paper industry residues on the pH_{water} ; pH_{SMP} ; levels of P, K, M.O., Al, Ca, Mg, Al+H; CTC; saturation by bases and by Al; Ca:Mg ratio; and levels of S, Zn, Cu, B, Mn, Fe, Hg, Pb, Ni, Cd and Cr. The lime and recycling paper residues corrected soil acidity, as well as modified significantly other soil chemical characteristics. The soil K levels were reduced by recycling paper residue

application. Conversely, the application of recycling paper industry residues did not increase the levels of soil heavy metals.

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582. Combined de-inking paper sludge and poultry manure application on corn yield and soil nutrients.

Gagnon, B.; Nolin, M. C.; and Cambouris, A. N. *Canadian Journal of Soil Science* 84(4): 503-512. (2004)
NAL Call #: 56.8 C162 ; ISSN: 0008-4271

Descriptors: application methods/ application rates/ crop quality/ crop yield/ Humic Gleysols/ immobilization/ maize/ nitrogen/ nutrient availability/

nutrient uptake/ nutrients/ organic amendments/ organic carbon/ phosphorus/ Podzols/ poultry manure/ precision agriculture/ sandy loam soils/ saturation/ sludges/ soil fertility/ soil organic matter/ soil pH/ soil types/ waste treatment/ watersheds/ catchment areas/ corn/ deinking/ organic matter in soil/ poultry litter/ precision farming/ site specific crop management

Abstract: Application of combined de-inking paper sludge and poultry manure may be an appropriate way to dispose of these residues and restore fertility of highly degraded soils. An experiment was initiated to determine the effects of a single application of this material, using two different application techniques, on corn yield and soil properties of two 12-ha fields of contrasting textures located in the Nicolet watershed in the province of Quebec, Canada. De-inking paper sludge was mixed with poultry manure (PP) at a ratio of 25:1 and strip-applied before corn seeding. The study included three treatments: untreated control, a constant application rate, and variable application rates according to initial soil organic C content. The variable application rates were 10, 20 and 30 Mg dry weight ha⁻¹. The strips were randomized within blocks, and the strips ran lengthwise in the blocks. Soil N immobilization and P release occurred on both sites at least 2 mo after PP incorporation, as measured at the corn eight-leaf and silk apparition stages by the anion-exchange membranes. Despite early N immobilization, grain yield was not affected whereas plant P uptake was increased by PP. At both sites, a single application of PP increased soil pH and major nutrient levels at harvest but had no significant effect on soil organic C. The application of PP also increased P saturation indices but the measured values were well below critical thresholds above which environmental risks would be high. The variable application rate treatment did not differ from the equivalent constant rate treatment for improving soil status and crop growth. This study indicates that mixing de-inking paper sludge and poultry manure may provide a cost-effective and environmentally friendly approach to land disposal of these wastes.
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583. Combined primary/secondary papermill sludge as a nitrogen source in a cabbage-sweet corn cropping sequence.

Simard, R. R. *Canadian Journal of Soil Science* 81(1): 1-10. (2001)
NAL Call #: 56.8 C162; ISSN: 0008-4271

Descriptors: ammonium nitrate/ application rates/ cabbages/ crop yield/ Gleysols/ maize/ nitrogen fertilizers/ nutrient uptake/ organic nitrogen/ paper mill sludge/

recovery/ residual effects/ sequential cropping/ soil types / sweetcorn/ Capparales/ corn

Abstract: Combined primary/secondary paper mill sludge (PS) is rich in N and may potentially be used as N source for horticultural crops. A 3-year experiment was conducted at the Joseph-Rheaume research farm of Laval University, located in Ste-Croix de Lotbiniere, Quebec, Canada during 1996-98 to determine the effects of PS application on crop yields, N uptake and N recovery. The PS was applied in 1996 on a Bedford silty clay (Humic Gleysol) cropped to winter cabbage (*Brassica oleracea* var *capitata* cv. Bartolo) at 0, 8, 16, 32, and 64 t ha⁻¹ (dry basis). In 1997, PS was applied at 44% of the 1996 rates to the same plots and cropped to sweetcorn (*Zea mays* cv. Delectable). No PS was applied in 1998 to evaluate residual effects on sweetcorn. Treatments with ammonium nitrate (AN) at 50, 100 and 200% of N fertilizer recommendations were included each year as a reference for crop response. The PS had a C:N ratio of 42:1 in 1996 and of 28:1 in 1997. About 29% of the total N in PS was inorganic. Cabbage and sweetcorn marketable yields and N uptake increased with increasing amounts of PS applied. AN supplemented with PS further increased cabbage yields. Based on the N fertilizer replacement value, the N efficiency coefficient of PS was 44% in the first year. N residual effect of the PS applied in 1996 was observed on the sweetcorn yield in 1997. The two PS applications also had a very significant residual effect on sweetcorn yield in the third year, although supplemental AN at 150 kg N ha⁻¹ tended to further increase yields. The apparent total N recovery by the two crops was similar for PS and AN (i.e., 34 vs. 38%). The apparent recovery of organic N from PS decreased with increasing rates of application from 46 to 25%. These results suggest that PS is an effective source of N for crops and that significant residual N effects should be considered when estimating the N needs of subsequent crops.
Reproduced with permission from the CAB Abstracts database.

584. Comparative effectiveness of different organic and industrial wastes on peanut: Plant growth, yield, oil content, protein content, mineral composition and hydration coefficient of kernels.

Basu, M.; Bhadoria, P. B. S.; and Mahapatra, S. C. *Archives of Agronomy and Soil Science* 53(6): 645-658. (2007); ISSN: 03650340

Notes: doi: 10.1080/03650340701591569.

Descriptors: arachis hypogaea/ farmyard manure/ hydration coefficient/ paper factory sludge/ rice husk ash/ water hyacinth/ arachis hypogaea/ eichhornia crassipes
Abstract: The present study aimed to evaluate the relative efficacy of different organic and industrial wastes, namely, farmyard manure (FYM), water hyacinth (WH) and paper factory sludge (PFS) in combination with chemical fertilizer (CF) along with or without soil amendments like lime or rice husk ash (RHA) on plant growth, yield, mineral composition, oil content, protein content and hydration coefficient of peanut kernels. Results revealed that the integrated application of organic or industrial wastes and CF in conjunction with soil amendments significantly ($p \leq 0.05$) improved the yield and quality of peanut kernels over sole CF. Application of RHA improved the content of P, K, Ca, Mg, Fe, Mn, Zn and Cu. Application of lime under similar combinations decreased the content of Fe, Mn, Zn and Cu, however, improved the content the other nutrients

in kernels. Among three organic sources, PFS was superior against FYM and WH. RHA along with organic wastes and CF improved the yield and quality of peanut kernels in a better and comparable way than lime. Hence, these two industrial wastes (PFS and RHA) could be used as a substitute for FYM and lime, respectively, for improving yield and quality of peanut kernels under acid lateritic soils. Â© 2007 Taylor & Francis.

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585. Comparative rooting of deciduous landscape shrub cuttings in media amended with paper mill biosolids from four different sources.

Chong, C.; Hamersma, B.; and Bellamy, K. L.

Canadian Journal of Plant Science 78(4): 519-526. (1998)

NAL Call #: 450 C16; ISSN: 0008-4220

Descriptors: growing media/ ornamental plants/ ornamental woody plants/ paper mill sludge/ perlite/ rooting/ shading/ shoot cuttings/ woody plants/ *Lonicera xylosteoides*/ ornamentals/ potting composts/ *Prunus cistena*/ rooting media/ *Symphoricarpos chenaultii*/ *Viburnum dentatum*

Abstract: The rooting response of stem cuttings from 6 species of deciduous landscape shrub (*Symphoricarpos x chenaultii* cv. Hancock, *Prunus triloba* cv. Multiplex, *Lonicera x xylosteoides* cv. Clavey's Dwarf, *Philadelphus x virginialis* cv. Minnesota Snowflake, *Prunus x cistena* and *Viburnum dentatum*) under mist and 50% shade (outdoor lath) in flats filled with 100% perlite medium, or perlite mixed with 15, 30, 45 or 60% of fresh paper mill biosolids, by volume, from 1 of 4 sources (Atlantic, Domtar, Thorold, and QUNO). The biosolids had little or no adverse effect, despite wide variability in rooting response due to species, source and/or level of biosolids. Regression analyses indicated that, with few exceptions, the percentage rooting, mean root number per rooted cutting, and length of the longest root per cutting increased linearly or curvilinearly, or was unaffected, when regressed over level of biosolids. Optimum amounts of biosolids in the rooting medium ranged from 30 to 60% by volume. The electrical conductivities of the biosolids-amended media were acceptable (0.1-0.3 dS m⁻¹) for rooting of woody cuttings and pore space characteristics were comparable to or better than those of perlite. Reproduced with permission from the CAB Abstracts database.

586. Comparison of chemical methods of assessing potentially available organic nitrogen from organic residues applied to a sandy soil.

Cordovil, C. M. D. S.; Coutinho, J.; Goss, M. J. ; and Cabral, F.

Communications in Soil Science and Plant Analysis 38(7-8): 989-1006. (2007)

NAL Call #: S590.C63; ISSN: 0010-3624

Descriptors: soil science/ suidae: animals, artiodactyls, chordates, mammals, nonhuman vertebrates, nonhuman mammals, vertebrates/ sandy soil/ soil organic matter/ poultry manure/ cambic arenosol/ waste production

Abstract: More than 90% of the nitrogen (N) in soils is bound as organic N compounds. The available N can be estimated on the mineral N released during time-consuming incubations of soil. Several chemical methods have been developed as substitutes for incubations. On the other

hand, there has been an increase in waste production. Residues could potentially offset the need for mineral fertilizers, being both an economic and environmental benefit. Thus, the development of a routine method for prediction of N supply both from soil organic matter (SOM) and the application of organic residues is of great interest. An incubation experiment was performed in a Cambic Arenosol to evaluate different chemical methods. Air-dried soil was mixed with increasing amounts of composted solid municipal waste, secondary pulp-mill sludge, hornmeal, poultry manure, the solid phase from pig slurry, and composted pig manure. Samples were incubated for 244 days under a controlled environment. Among the chemical extractants studied, hot 2 M potassium chloride (KCl) and hot 0.01 M calcium chloride (CaCl₂) showed promise in indicating values of N-0 (potentially available nitrogen), and these simple methods are suitable for use in routine laboratory conditions.

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587. Comparison of microbial indicators under two water regimes in a soil amended with combined paper mill sludge and decomposed cow manure.

Subhashis Tripathy; Pradip Bhattacharyya; Equeenuddin, S. M.; Kim KangJoo; and Kulkarni, H. D.

Chemosphere 71(1): 168-175. (2008)

NAL Call #: TD172 .C54; ISSN: 0045-6535

Descriptors: acid phosphatase/ Alfisols/ application rates/ application to land/ beta glucosidase/ biological activity in soil/ biological indicators/ cattle manure/ enzyme activity/ lateritic soils/ microbial activities/ organic amendments/ paper mill sludge/ soil amendments/ soil enzymes/ soil flora/ soil types/ sulfuric ester hydrolases/ waste disposal / waste management/ waste utilization/ water holding capacity/ acid phosphomonoesterase/ land application/ microbial biomass/ microbial communities/ soil respiration/ sulfatases/ sulphatases

Abstract: An incubation study was conducted under laboratory conditions to compare the effects of soil amendment of combined paper mill sludge (PS) and decomposed cow manure (DCM) on selected microbial indicators. A lateritic soil (Typic Haplustalf) was amended with 0 (control), 20 or 80 t ha⁻¹ (wet weight) of PS or DCM. The amended soils were then adjusted to 60% water holding capacity (WHC) or submerged conditions, and incubated at 27 degrees C in dark for up to 120 days (d). The microbial biomass C (MBC), the basal soil respiration and the enzyme activities of the beta -glucosidase, acid phosphatase and sulphatase were analyzed at day 15, 30, 45, 60 and 120. Compared to the unamended soil (control), the MBC, the basal soil respiration and the enzyme activities increased with the rate of PS and DCM. At similar rate, the DCM treatment increased significantly the MBC, the soil respiration and the enzyme activities compared to the PS treatment. Also, the water regimes affected the microbial activities. At 60% WHC, the MBC and soil respiration increased during the first 30 d and decreased thereafter. The enzyme activities showed similar trends, where they increased for the first 60 d, and decreased thereafter. In contrast, under submerged condition, the MBC and enzymes activities declined during 120 d, whereas the soil respiration increased. Compared to the control, the used of PS and DCM had no negative impact of

the soil microbial parameters, even at the highest application rate. Long-term field experiments are required to confirm these laboratory results.
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588. Compost effects on soil chemical properties and field nursery production.

Gonzalez, R. F. and Cooperband, L. R.

Journal of Environmental Horticulture 21(1): 38-44. (2003)
NAL Call #: SB1.J66; ISSN: 0738-2898

Descriptors: application to land/ biomass production/ cattle manure/ composts/ crop production/ dry matter/ dry matter accumulation/ electrical conductivity/ growth/ Mollisols/ mulches/ nitrogen/ nutrient availability/ nutrient content / nutrient uptake/ organic amendments/ ornamental plants/ paper mill sludge/ phosphorus/ poultry manure/ sawdust/ shrubs/ silt loam soils/ soil chemical properties/ soil degradation/ soil fertility/ soil organic matter / soil pH/ soil types/ woody plants/ zinc/ chemical properties of soil/ land application/ mulching materials/ organic matter in soil/ ornamentals/ poultry litter/ United States of America

Abstract: Field production of ornamental shrubs results in significant topsoil removal and degradation of soil chemical properties. We amended field soils with compost to evaluate effects on soil chemical properties and shrub biomass production. We applied either duck manure-sawdust (DM), potato cull-sawdust-dairy manure (PC) or paper mill sludge-bark (PMB) composts to a silt loam soil of Madison, Wisconsin, USA, as: (i) incorporated 2.5 cm of compost tilled into the top 15 cm of soil; or (ii) incorporated+mulched 2.5 cm tilled into soil+2.5 cm applied over the soil surface. We grew *Spirea japonicum* [*Spiraea japonica*] 'Gumball', *Juniper chinensis* [*Juniperus chinensis*] 'Pfitzeriana' and *Berberis thunbergia* [*B. thunbergii*] 'Atropurpurea' seedlings and measured total and plant available nutrients and shrub biomass production and nutrient contents over two growing seasons. Total soil C was 15-21% higher in all mulched treatments compared to incorporated-only and no-amendment control treatments. Total soil N, P and Cu, available P, S, Ca, Mg, K, pH and electrical conductivity increased with increasing TC. Mulched DM compost produced significantly higher DTPA-extractable Zn relative to other treatments. In the second growing season, mulched dry matter (DM) compost produced 39-42% greater total barberry biomass than all other treatments. Among all shrub species, the best soil chemical predictors of plant growth were TC, TS, soluble P, exchangeable Ca and K and DTPA-Zn. The best tissue nutrient-content predictors of plant growth were total shoot N, P and Zn and root Zn. The unique growth response of barberry to mulched DM compost suggests that all shrubs may not respond to compost amendments, particularly over the short term.

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589. Composting by-products from a bleached kraft pulping process: Effect of type and amount of nitrogen amendments.

Das, K. C.; Tollner, E. W.; and Tornabene, T. G.

Compost Science and Utilization 9(3): 256-265. (2001)
NAL Call #: TD796.5.C58 ; ISSN: 1065-657X

Descriptors: amendments/ ammonium nitrate/ bark/ byproducts/ carbon nitrogen ratio/ composting/ paper mill sludge/ poultry manure/ pulp and paper industry/ solid wastes/ sulfate pulping/ kraft process/ kraft pulping/ paper industry/ poultry litter/ sulphate pulping

Abstract: Over 70% of solid wastes (byproducts) generated in the manufacture of paper pulp are presently disposed of in landfills. Most of these byproducts are compostable and reusable in horticulture, landscaping and agriculture. This work addresses the questions of nitrogen amendments required for composting a mix of four bleached kraft pulp mill byproducts - namely, primary sludge, bark, grit and ash. Two nitrogen amendments, ammonium nitrate and chicken litter were compared to determine which provided a more rapid mass reduction and stabilization. Different amounts of ammonium nitrate addition were evaluated to determine if decreasing the C:N ratio of the initial mix (from 130.9 to 28.3) resulted in more rapid composting. A blend of sludge, grit, bark and ash in dry weight percentages of 56, 25, 6 and 13% respectively, stabilized (measured using oxygen respirometry) in a period of 28 days. Although in the initial stages of composting there were differences resulting from the effect of the two types of nitrogen amendments, at the 28th day no significant difference was observed. It was also found that decreasing the C:N ratio did not accelerate the composting process. A composting mix with a C:N ratio of 130.9 had similar mass reduction compared to others with C:N of 95.3, 79.5 and 28.3. Lower C:N ratios were in fact less preferable because of high soluble salt content and greater amendment requirements.

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590. Composting of de-inking paper sludge with poultry manure at three nitrogen levels using mechanical turning: Behavior of physico-chemical parameters.

Charest, M. H. and Beauchamp, C. J.

Bioresource Technology 81(1): 7-17. (Jan. 2002)

NAL Call #: TD930.A32 ; ISSN: 0960-8524 [BIRTEB]

Descriptors: composts / carbon nitrogen ratio/ physicochemical properties/ waste utilization

Abstract: De-inking paper sludge (DPS) is rich in carbon (C) but poor in nitrogen (N). Thus, it has a high C:N ratio which limits the composting process. Accordingly, the goal of this study was to investigate the effect of three N treatments on DPS composting. Compost piles of 100 m³ were formed by mixing raw DPS with poultry manure and chicken broiler floor litter, giving on average 0.6%, 0.7% and 0.9% total N. The changes in physico-chemical parameters, total weight and fiber losses, and maturity of composting piles of DPS were monitored during 24 weeks. The compost piles had a neutral to alkaline pH throughout the study. Inorganic N decreased whereas organic N increased over time for all treatments. These changes in magnitude were different among N treatments resulting in a final total N content of 0.9% for the 0.6% N treatment whereas final total N contents of 0.7% and 0.9% N were measured for the 0.7% and 0.9% N treatments. The total weight, cellulose and hemicellulose losses were higher in 0.6% N treatment giving the lowest C:N ratio after 24 weeks of composting. However, none of the 24 week-old composts of DPS were mature based on their final C:N ratio and colorimetric test of maturity. Except for copper,

their final total trace element contents meet most known standards or guidelines for organic soil conditioners. Overall, 0.6% N treatment was the best to enhance DPS composting using mechanical turning, but a period of more than 24 weeks was required to reach compost maturity. This citation is from AGRICOLA.

591. Composting of pulp and paper mill fly ash with wastewater treatment sludge.

Hackett, G. A. R.; Easton, C. A.; and Duff, S. J. B.

Bioresource Technology 70(3): 217-224. (1999)

NAL Call #: TD930.A32 ; ISSN: 0960-8524

Descriptors: composting/ composts/ contaminants/ copper/ dioxins/ fly ash/ phosphorus/ polychlorinated biphenyls/ polycyclic hydrocarbons/ sludges/ sodium/ soil conditioners/ sulfate/ PCBs

Abstract: Waste water treatment sludge and power boiler fly ash were combined and composted in mixed and static windrows 50 m long, 4 m high and 6 m wide. Moisture content was maintained above 50%. The final compost had a pH of 8.5, contained high concentrations of specific nutrients, and an average C:N ratio of 43:1. All metal, PCB, chlorophenol and PAH concentrations were below levels stipulated by local regulations. Over the first 8 weeks of the composting period dioxin concentration decreased by 45% to 41 pg/g TEQ. Leachate tests indicated minimal (<0.1 mg/litre Cu and Pb; <50 mg/litre Na, P, and SO₄-2) leaching of contaminants from the composted material. Application of compost (8 cubic yards/acre) at a sod farm improved soil characteristics as measured by a number of parameters. The dioxin concentration in the final soil/compost mixture was 3 pg/g TEQ, allowing the soil/compost mixture to be classified as agricultural soil. It was concluded that composting produced an acceptable soil conditioner attractive for large volume users of inexpensive soil material (sod farms, golf courses, land reclamation sites). Reproduced with permission from the CAB Abstracts database.

592. Composting short paper fiber with broiler litter and additives. Part I: Effects of initial pH and carbon/nitrogen ratio on ammonia emission.

Ekinci, K.; Keener, H. M.; and Elwell, D. L.

Compost Science and Utilization 8(2): 160-172. (2000)

NAL Call #: TD796.5.C58 ; ISSN: 1065-657X

Descriptors: additives/ aluminium/ ammonia/ byproducts/ carbon nitrogen ratio/ composting/ composts/ decomposition/ emission/ fibres/ losses/ manures/ paper/ pH/ poultry manure/ sawdust/ sulfate/ sulfuric acid/ temperature/ ventilation/ water content/ adjuncts/ aluminum/ fibers/ hydrogen ion concentration/ potential of hydrogen/ poultry litter/ sulphuric acid

Abstract: Short paper fibre (SPF), a byproduct of the paper mill industry, was co-composted with broiler litter (BL) to determine decomposition rate and NH₃N loss as functions of C:N ratio and pH of the compost mixes. The SPF generally had a high C:N ratio >200 while the BL, consisting of bedding material (sawdust) and poultry manure, had a low C:N ratio of 10-12. A total of seven series (27 tests) of pilot-scale studies were conducted using two different SPFs mixed with BL. Additives used for pH control were alum (aluminium sulfate), HiClayReg. Alumina and sulfuric acid. Mixing ratios [SPF/(SPF+BL), kg/kg(dry basis)] used were 0.8 to 0.4. Test conditions were a C:N of 17 to 49, pH of 6.6 to 8.3, initial temperatures of -1 to 22

degrees C, composting temperature of 60 degrees C, water content of 50-55% w.b. and remixing two times per week. Composting temperature was controlled using forced ventilation with a high/low fan setting. Composting trials lasted two weeks. Ammonia loss, O₂, CO₂, compost temperatures and dry solids loss were measured. Evaluations of ammonia emissions vs. initial C:N and pH showed: (1) NH₃-N loss decreased as initial C:N increased, even above a C:N of 38; (2) NH₃-N loss decreased rapidly below pH 7 and increased rapidly for initial pH >8. Addition of alum and/or sulfuric acid decreased NH₃-N loss while HiClayReg. Alumina had little or no effect. Reproduced with permission from the CAB Abstracts database.

593. Control of nitrate leaching from a nitrate vulnerable zone using paper mill waste.

Vinten, A. J. A.; Davies, R.; Castle, K.; and Baggs, E. M.

Soil Use and Management 14(1): 44-51. (1998)

NAL Call #: S590.S68; ISSN: 0266-0032

Descriptors: application rates/ biomass/ denitrification/ depth/ immobilization/ leaching/ nitrate/ nitrogen/ nitrous oxide/ paper mill sludge/ ploughing/ pulp and paper industry/ soil/ tillage/ uptake/ wastes/ Britain/ paper industry/ plowing/ soil cultivation/ United Kingdom

Abstract: The effects on nitrate leaching of incorporation of paper mill waste at three cultivation depths in fields previously cropped to iceberg lettuce and calabrese in Scotland, UK, are reported. In the lettuce experiment, incorporation of 40 t dry matter paper mill waste/ha resulted in a decrease in N leaching (measured with suction cups) from 177 to 94 kg/ha. Deep ploughing with and without paper waste increased N leaching from 105 kg/ha (normal ploughing or surface incorporation) to 172 kg/ha. Measurements of nitrate leaching using deep soil cores showed a less clear cut effect. Nitrous oxide (N₂O) emissions were very high immediately after paper waste was ploughed in to a depth of 35 cm. Non-significant increases in biomass N content were measured in the spring following paper waste application. There was no significant reduction in plant N uptake in subsequent crops. Removal of above-ground crop residues did not have a significant effect on nitrate leaching or N₂O losses. In the calabrese experiment, application of 40 t DM paper mill waste/ha followed by summer cropping with iceberg lettuce caused a decrease in N leaching (measured using deep soil cores) from 227 to 152 kg/ha.

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594. Cyanide in paper de-inking sludge used as a soil amendment.

Mansfeldt, T.

Journal of Plant Nutrition and Soil Science 164(6): 637-641. (2001)

NAL Call #: 384 Z343A ; ISSN: 1436-8730

Descriptors: cyanides / sludges/ soil amendments/ soil pH/ soil pollution/ solubility

Abstract: Paper de-inking sludge is processed during the recycling of paper, and is sometimes used as a soil amendment. In this study, the effect of a compost application on the cyanide (CN) status in soils of a public park in Germany was investigated. The compost was a mixture of chipped limbs and paper de-inking sludge. Furthermore, the cyanide solubility was studied by

conducting batch experiments with different pH levels. Total cyanide in the amended soils ranged from 540 to 740 mg CN kg⁻¹, and water soluble cyanide from 170 to 370 micro g CN l⁻¹ as determined by means of an aqueous extract. Easily-liberatable cyanides, which include the toxic free cyanide (HCN and CN⁻) and weak metal-cyanide complexes, were not present in the soil. From this result and the fact that iron blue pigments are used during paper printing, it can be inferred that cyanides occurring here were exclusively stable iron-cyanide complexes [Fe(CN)₆]. With increasing pH the solubility of cyanide increased. In contrast to soils of coking plants, in which cyanide occur as Berlin blue, Fe₄[Fe(CN)₆]₃, the cyanide solubility in the paper de-inking sludge amended soils was substantially lower, especially in the neutral and alkaline range. Thus, cyanides in paper de-inking sludge could be present as sparingly soluble metal-cyanide compounds with the general formula A₂B[FeI(CN)₆] with A=K⁺, Na⁺ and B=Ca²⁺ or divalent transition metals and B₂[FeII(CN)₆] with B=divalent transition metals. Pollution exposure by the pathways soil → human, and soil → air → human can be neglected. However, since leaching of iron-cyanide complexes into the ground water cannot be excluded, and since they are decomposed to HCN when exposed to day light, environmental hazards by the pathway soil → ground water → surface water are possible. This is the risk arising from paper de-inking sludge applications to soils. Reproduced with permission from the CAB Abstracts database.

595. De-inking sludge and phosphorus effects on growth and symbiotic dinitrogen fixation in forage legumes.

Allahdadi, I.; Beauchamp, C. J.; Califour, F. P. ; Khalaj, H.; and Labafi H. A., M. R.

Pakistan Journal of Biological Sciences 10(14): 2379-2388. (2007)

NAL Call #: QH301 .P355; ISSN: 1028-8880

Descriptors: application rates/ lucerne/ nitrogen fixation/ nutrient uptake/ phosphorus fertilizers/ plant nutrition/ sludges/ alfalfa/ phosphate fertilizers

Abstract: The de-inking process produces a waste by-product, called de-inking paper sludge (DS), that contains paper fibers, clay particles and inks and high carbon (C) concentrations combined with low nitrogen (N) and phosphorus (P) concentrations. The use of high rates of DS to increase the soil organic matter thus requires provision of high rates of N and P for adequate plant growth. Using dinitrogen (N₂)-fixing forage legumes is an alternative to N fertilizer application under such circumstances. In a greenhouse study, DS rates of 0, 50 or 100 Mg/ha and 5 rates of P (40, 80, 120, 160 or 200 kg P₂O₅/ha) were applied to 2 soil types, a clay loam (Pintendre) and a silty clay loam (St-Augustin). N uptake and symbiotic N₂ fixation (SNF) were estimated in lucerne (*Medicago sativa*), sweet clover (*Melilotus officinalis*) and red clover (*Trifolium pratense*), bromegrass (*Bromus inermis*) and lucerne ineffective for N₂ fixation were used as the reference (non-N₂ fixing) crops. Atmospheric N₂ fixation was estimated by natural abundance of ¹⁵N (delta 15N). Under controlled conditions, high rates of DS substantially reduced delta 15N values, particularly with high rates of P. In addition, N uptake of legumes generally increased with increased P concentrations and it peaked with 120 or 160

kg P₂O₅/ha. Correlated with the trends observed with delta 15N values, it peaked with 120 or 160 kg P₂O₅/ha. The results showed that under high rates of application of DS and adequate P supply, forage legumes fixed more atmospheric N₂. delta 15N can be a good indicator of SNF under the above-mentioned conditions.

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596. Decomposition of de-inking paper sludge in agricultural soils as characterized by carbohydrate analysis.

Chantigny, M H; Angers, D A; and Beauchamp, C J
Soil Biology and Biochemistry 32(11/12): 1561-1570. (2000)

NAL Call #: S592.7.A1S6; ISSN: 0038-0717

Descriptors: agricultural soils/ analysis/ application rates/ capacity/ carbohydrates/ carbon/ characterization/ clay loam soils/ composition/ decomposition/ deficiency/ dry matter/ fractionation/ Inceptisols/ incorporation/ organic matter/ paper mill sludge/ residues/ sludges/ soil/ soil amendments/ soil fertility/ soil organic matter/ sugars/ transformation/ organic matter in soil/ saccharides
Abstract: Chemical fractionation and carbohydrate characterization to determine the transformation and decay rates of de-inking paper sludge (DPS) in different soils when large loading rates are applied. In a field experiment, DPS was added to a well-drained silty clay loam (Typic Dystrochrept) and a poorly-drained clay loam (Typic Humaquept) at rates of 0 (control), 50 or 100 t dry matter ha⁻¹. Soil samples were obtained periodically during 726 days after sludge incorporation. Soil organic matter was fractionated into hot-water extractable (HWC), mild-acid extractable (MAC) and strong-acid extractable carbohydrates (SAC), and acid-resistant carbon (ARC). The MAC fraction mostly contained hemicellulosic sugars, whereas SAC fraction included most cellulosic glucose. The contribution of microbial saccharides to the different carbohydrate fractions increased during DPS decomposition. The carbohydrate composition indicated that the chemical fractions reflected the net balance between disappearance of sludge carbohydrates and appearance of newly synthesized microbial carbohydrates. The MAC, SAC and ARC fractions in DPS-amended soils, had relative degradabilities of SAC>MAC>ARC. The sludge used, appeared to decompose according to a two-phase pattern, with an initial rapid-decay phase mostly determined by SAC and ARC disappearance (mean residence time 0.1 and 0.3 year, respectively), and a second slow-decay phase: largely characterized by ARC disappearance (mean residence time 8.5 years). DPS decomposed more slowly at the highest application rate, presumably because the capacity of soil microbes to decompose C was temporarily limited by nutrient deficiency. Chemical fractionation and carbohydrate analysis proved useful to study quantitatively and qualitatively the decomposition and transformation of wood-derived residues in agricultural soils.

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597. Decomposition of paper de-inking sludge during revegetation of a sandpit minesoil: A reply to the comments of Beyer and Mueller.

Beauchamp, C. J.; Angers, D. A.; and Fierro, A. 33(3): 415-416. (2001); ISSN: 0038-0717

Descriptors: Waste Management: Sanitation/ Soil Science/ Plantae: Plants/ Paper Industry/ Agriculture/ Ecology/ Paper De-Inking Sludge: Decomposition Mechanisms, Soil Application/ Sandpit Minesoil Revegetation/ Soils: Treatment Method
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598. Decomposition of paper de-inking sludge in a sandpit minesoil during its revegetation.

Fierro, A.; Angers, D. A.; and Beauchamp, C. J.
Soil Biology and Biochemistry 32(3): 143-150. (Feb. 2000)
NAL Call #: S592.7.A1S6; ISSN: 0038-0717 [SBIOAH]
Descriptors: disturbed soils/ mined soils/ abandoned land/ land restoration/ *Elytorgia elongata*/ degradation/ carbon/ mineralization/ nitrogen/ phosphorus/ biogeochemical cycles/ Quebec/ paper mill sludge/ organic amendments
Abstract: Paper de-inking sludge was used as an organic amendment for revegetating an abandoned sandpit in Quebec, Canada. In situ patterns of sludge decomposition and of total nitrogen and phosphorus dynamics were characterized in a litter bag study. In a one-time operation, sludge was applied at a rate of 0 or 105 Mg dry matter ha⁻¹, along with N at 3, 6 or 9 kg Mg⁻¹ sludge and P at 0.5 or 1.0 kg Mg⁻¹ sludge. Sludge and fertilizers were incorporated into the top 0.21 m of the minesoil and tall wheatgrass (*Agropyron elongatum* (Host) Beauv.) was seeded. Mass loss was well described by a double exponential model when cumulative degree-days (sum of daily temperature above 0 degrees C) were used as the independent variable. Fifty-one percent of the initial material decomposed with a half life of 0.4 yr, whereas the remaining material had a much slower rate of decay with a half life of 13 yr. The large size and slow decomposition rate of the recalcitrant pool of this material were attributed to the high lignin content and the presence of clay in the sludge. Both N and P in decomposing sludge presented a short accumulation phase followed by a long release phase which likely contributed to the successful revegetation of this disturbed sandpit site.

This citation is from AGRICOLA.

599. Deinking paper fibre application to agricultural land: Soil quality enhancer or copper polluter?

Tandy, S.; Williamson, J. C.; Nason, M. A.; Healey, J. R.; and Jones, D. L.

Soil Use and Management 24(2): 217-220. (2008)
NAL Call #: S590.S68; ISSN: 02660032 [SUMAEU]
Notes: doi: 10.1111/j.1475-2743.2008.00153.x.

Descriptors: agricultural land/ copper/ paper mill sludge/ soil organic matter/ agricultural land/ copper/ industrial waste/ pH/ pulp and paper industry/ recycling/ soil organic matter/ soil pollution/ soil quality/ soil structure/ England/ Eurasia/ Europe/ United Kingdom/ Wales/ Western Europe
Abstract: Short-fibre paper residuals (deinking paper fibre (DPF) or paper mill sludge) represents a major waste formed during the processing of recycled paper and is known to contain significant quantities of copper. It is often spread onto agricultural land to help increase soil pH and improve structure by adding soil organic matter (SOM). A number of agricultural sites in England and Wales that had received large and repeated applications were sampled to investigate the long-term effects of this practice on soil quality and plant copper content. We found that the composition of DPF waste has changed significantly between 1999 and 2006 with concentrations of Cu

increasing and organic matter content declining. Whilst repeated additions of DPF to agricultural land always increased soil Cu, an associated increase in SOM was not always apparent. There was no link between SOM and bioavailable Cu nor between soil bioavailable Cu and plant Cu. In contrast to previous reports, our findings indicate that improvement in soil quality following the long-term application of DPF was site-specific and in some cases it may have reduced soil quality rather than enhanced it. © 2008 The Authors.

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600. Direct and residual effects of pulp and paper mill sludge on crop yield and soil mineral N.

Vagstad, N.; Broch Due, A.; and Lyngstad, I.
Soil Use and Management 17(3): 173-178. (Sept. 2001)
NAL Call #: S590.S68; ISSN: 0266-0032 [SUMAEU]
Descriptors: *Hordeum vulgare*/ *Triticum aestivum*/ crop yield/ soil fertility/ nitrogen/ residual effects/ field experimentation/ carbon nitrogen ratio/ zinc/ manganese/ boron/ copper/ phosphorus/ cadmium/ nitrates/ leaching/ composts/ application rate/ chemical constituents of plants/ Norway/ evaluation/ paper mill sludge
Abstract: Paper sludge composted or stored in static piles for six months was compared to raw and lime-stabilized sludge in a three-year pot experiment (loam) and a four-year field experiment (silt loam) at rates of up to 40 t DM ha⁻¹. The original sludge contained equal amounts of fibre sludge and biological sludge, mixed with bark in 1:1 ratio to improve the structure. The N content in composted sludge (1.30%) was markedly lower than that of the uncomposted piles (1.98%), indicating significant loss during composting. The yield results were generally inversely proportionate to the C:N ratios of the sludges applied. Sludge from the uncomposted piles gave significant grain yield increases in the year following sludge application, while the other sludge types gave variable results. In the residual years there was, generally, a small but positive effect on yield from all the sludge types. The N and P content in grain generally increased with sludge application, but only the higher rates gave statistically significant increases. Sludge application also increased the Zn content in grain, while Mn, B and Cu was less affected. The increase in Cd content was very small.

The 40 t ha⁻¹ sludge rate tended to increase the residual mineral N in soil at the field site and thus the risk of nitrate leaching.

This citation is from AGRICOLA.

601. Dynamic relationships between soil properties and foliar disease as affected by annual additions of organic amendment to a sandy soil vegetable production system.

Rotenberg, D.; Cooperband, L.; and Stone, A.
Soil Biology and Biochemistry 37(7): 1343-1357. (2005)
NAL Call #: S592.7.A1S6; ISSN: 00380717 [SBIOAH].
Notes: doi: 10.1016/j.soilbio.2004.12.006.
Descriptors: aerial bacteria/ compost/ disease control/ paper mill residuals/ plant available nitrogen/ soil organic matter/ agriculture/ diseases/ fertilizers/ moisture/ nitrogen/ organic compounds/ sand/ soils/ crop diseases/ foliar diseases/ sandy-soil vegetable production/ soil carbon/ crops/ disease prevalence/ sandy soil/ soil property/ agriculture/ diseases/ farm crops/ fertilizers/ moisture/ nitrogen/ organic matter/ soil/ bacteria (microorganisms)/

cucumis sativus/ phaseolus (angiosperm)/ pseudomonas/ pseudomonas syringae pv syringae/ punctum blandianum/ solanum tuberosum

Abstract: Additions of organic amendments to agricultural soils can lead to improved soil quality and reduced severity of crop diseases. However, the relationship between disease severity and soil properties as affected by repeated additions of these amendments is poorly understood. The primary objectives of this study were to (i) resolve multivariate relationships between soil properties and foliar disease severity and (ii) identify soil properties that contribute to disease severity in an intensive irrigated vegetable production system receiving annual additions of fresh and composted paper mill residuals (PMR). Foliar diseases caused by *Pseudomonas syringae* pv. *syringae* on snap bean (bacterial brown spot) and *P. s. pv. lachrymans* on cucumber (angular leaf spot) are the focus of this report. The experiment consisted of a 3-year crop rotation of potato (1998 and 2001), snap bean (1999 and 2002), and cucumber (2000). Treatments included a non-amended fertilizer control and two rates of fresh PMR, PMR composted alone (PMRC), and PMR composted with bark (PMRB). Soil measures included total soil carbon (TC) and nitrogen (TN), particulate organic matter carbon (POMC) and nitrogen (POMN), volumetric soil moisture (VM) and in situ NO₃-N. Multiple regression (MR) and principal component analyses (PCA) were conducted to identify key soil properties that influenced the amount of disease. On average, the amount of TC in plots amended with PMR composts increased 77-178% from 1999 to 2002 compared to the non-amended soils. In 1999, a year in which compost additions reduced the amount of bacterial brown spot of bean, TC explained 42% of the total variation in disease severity in the best MR model. Midseason TN alone was inversely related to angular leaf spot incidence in 2000, while POMN explained 51% of the variation in the best MR model for that year. In 2002, a year in which PMRC-amended soils exacerbated brown spot symptoms, midseason quantities of TN explained 80% of the variation in disease severity. Unique to 2002, NO₃-N alone positively correlated with disease severity. Overall, the influence of soil carbon on disease severity was displaced by the increasing importance of TN and NO₃-N, indicating a transition from a C-dependent to an N-dependent system. © 2005 Elsevier Ltd. All rights reserved. © 2009 Elsevier B.V. All rights reserved.

602. Dynamics of nutrients in tropical acid soils amended with paper pulp sludge.

Voundi Nkana, J. C.; Tack, F. M. G.; and Verloo, M. G. *Waste Management and Research* 17(3): 198-204. (1999) NAL Call #: TD896.W37 ; ISSN: 0734242X [WMARD]. Notes: Chapter Number: Copenhagen K, Denmark doi: 10.1034/j.1399-3070.1999.00006.x. Descriptors: cameroon / dynamics/ leaching/ lime/ nutrient balance/ paper pulp sludge/ tropical acid soil/ industrial wastes/ leachate treatment/ organic compounds/ paper and pulp mills/ pH effects/ soil pollution/ dissolved organic carbon/ tropical acid soils/ sludge disposal/ calcium / calcium oxide/ carbon/ carbonic acid/ fertilizer/ magnesium/ nitrate/ rain/ sulfate/ acid soil/ nutrient/ tropical soil/ waste disposal/ cameroon/ nutrient/ paper industry/ priority journal/ recycling/ sludge/ soil treatment/ tropics **Abstract:** Paper mill sludge is characterized by high concentrations of organic matter and lime and very low

concentrations of heavy metals and organic chemicals. Interest in the recycling of paper mill residuals in developing countries is vital because the use of lime and fertilisers by small farmers is financially prohibitive. The effects of paper pulp sludge and lime on the dynamics of soil nutrients was studied in the laboratory using columns of mixed samples of top soil from three tropical acid soils (Kandiudult). The soil columns were leached over a period of 90 days with de-ionized water in amounts equivalent to the annual rainfall of the sampling site. To assess the amount of nutrient that may become available to plants, NH₄OAc-EDTA pH 4.65 soil extractant was used. For all soils, application of paper pulp sludge or lime to tropical acid soils generally resulted in an initial flush and increased concentrations of Ca, Mg, SO₄, dissolved organic carbon (DOC) and inorganic carbon in soil leachates. Compared with liming, application of paper pulp sludge reduced NO₃ leaching. The amount of leached Ca, DOC and inorganic carbon (mainly HCO₃⁻) increased substantially with the addition of paper pulp sludge or lime. In relation to nutrients, the most meaningful amendment effect that persisted after leaching was a substantially increased available Ca in the treated soil. In addition to increasing Ca levels, the addition of paper pulp sludge increased the concentrations of leached and available Ca. To sustain yield increase with paper pulp sludge, calculation of the optimum quantity to be returned to the soil should be based on losses of Ca by leaching and by plant uptake. © 2009 Elsevier B.V. All rights reserved.

603. Dynamics of physical organic matter fractions during de-inking sludge decomposition.

Fierro, A.; Angers, D. A.; and Beauchamp, C. J. *Soil Science Society of America Journal* 63(4): 1013-1018. (July 1999-Aug. 1999) NAL Call #: 56.9 So3; ISSN: 0361-5995 [SSSJD4] Descriptors: mined soils/ abandoned land/ disturbed soils/ land restoration/ Elytrigia elongata/ degradation/ soil organic matter/ nitrogen/ carbon/ spatial distribution/ mineralization/ nitrogen fertilizers/ phosphorus fertilizers/ nitrate nitrogen/ ammonium nitrogen/ nitrogen content/ soil separates/ application rate/ Quebec/ paper mill sludge/ reclamation/ particle size fractions/ particle density fractions **Abstract:** Replenishment of soil C and N is essential for sustainable revegetation of minesoils. Our study investigated paper de-inking sludge as the organic amendment for revegetating an abandoned sandpit in Quebec, Canada. Sludge was incorporated at 0 (check) and 105 Mg dry matter ha⁻¹ before seeding tall wheatgrass (*Agropyron elongatum* (Host) Beauv.). Nitrogen (at 315, 630 and 945 kg N ha⁻¹) and P (at 52.5 and 105 kg P ha⁻¹) were also applied to all plots. Distribution of C and N was determined periodically in two sizes (< 53 micrometer and > 53 micrometer) and two densities (< 1.8 g cm⁻³) and > 1.8 g cm⁻³) of soil fractions during 823 d. After 823 d, C concentrations were 43 and 69% of those of Day 5, for the low and high N rates, respectively. With time, the proportion of C in the heavy (> 1.8 g cm⁻³) fraction increased from 20 to 55%, but remained near 20% in the fine (< 53 micrometer) fraction. Increasing N rates increased C conservation mainly in the coarse (> 53 micrometer) fraction. The amount of N recovered in all fractions decreased after Day 86, in accordance with a previous litter bag study. Although inorganic N was positively correlated with total N in all fractions, the fine

fraction was the best indicator of the size of the mineral N pool. Addition of sludge to the sandpit favored the restoration of C and N pools, and high levels of mineral N increased this effect. Residues became denser but remained relatively coarse during their decomposition. This citation is from AGRICOLA.

604. Earthworms, mushrooms and zero waste in China.
Pauli, G.

Biocycle 40(2): 68-69. (1999)

NAL Call #: 57.8 C734 ; ISSN: 0276-5055

Descriptors: agricultural wastes/ brewery effluent/ coffee/ composting/ cotton/ crop residues/ edible fungi/ fuels/ husks/ mushroom compost/ mushrooms/ organic wastes/ paper mill sludge/ pulps/ rice/ rice straw/ straw/ tea/ vermiculture/ wastes/ wheat/ farm wastes/ hulls/ paddy

Abstract: The reuse of agro-industrial residues in the mushroom farming region of Qingyuan, China, is described. Mushrooms are grown on agro-industrial wastes including rice straw, coffee hulls, tea residues, cotton seeds, wheat husks, spent grain from breweries and residual fibres from paper processing. The spent substrate from mushroom growing is currently used as a fuel by farmers. However, there is increasing interest in the use of the substrate for growing earthworms, which convert the mushroom protein into humus, with recovery of animal protein. Reproduced with permission from the CAB Abstracts database.

605. Earthworms of a land restoration site treated with paper mill sludge.

Pearce, T. G.; Budd, T.; Hayhoe, J. M.; Sleep, D.; and Clasper, P. J.

Pedobiologia 47(5/6): 792-795. (2003)

NAL Call #: 56.8 P343 ; ISSN: 0031-4056

Descriptors: biomass/ copper/ paper mill sludge/ species diversity/ Britain/ United Kingdom

Abstract: Land restoration at a former landfill site, Bidston Moss, NW England, has involved heavy applications of paper mill sludge (PMS), a byproduct of paper recycling. The development of earthworm communities at the site has been assisted by earthworm inoculation. Initially low numbers of epigeic species were present, but as the restoration has progressed since 1996 a substantial number, biomass and diversity of earthworms has become established, including a variety of ecological types. In some areas there is substantial surface casting. Cast colour indicates selective consumption of PMS, and delta 13C ratios suggest that PMS is a major nutrient source for earthworms. Although concentrations of copper in the PMS are higher than those typical for soils, concentrations in earthworm tissue are relatively low. Low availability of copper will reflect the high content of organic matter and clay, and relatively high pH, of the PMS. Reproduced with permission from the CAB Abstracts database.

606. Effect of applying paper mill sludge to arable land on soil fertility and crop yields.

Aitken, M. N.; Evans, B.; and Lewis, J. G.

Soil Use and Management 14(4): 215-222. (Dec. 1998)

NAL Call #: S590.S68; ISSN: 0266-0032 [SUMAEU]

Descriptors: Linum usitatissimum/ Hordeum vulgare/ Triticum aestivum/ crop rotation/ field experimentation/ crop

yield/ nitrogen/ nutrient uptake/ soil water content/ heavy metals/ soil pollution/ degradation/ soil fertility/ nitrates/ zinc/ copper/ lead/ mercury/ magnesium/ phosphorus/ potassium/ ammonium nitrogen/ nitrate nitrogen/ land application/ application rate/ ammonium nitrate/ Wales/ sidedressing/ immobilization/ paper mill sludge

Abstract: Two field trials were established in 1991 to determine the effects on crop yield, N uptake, soil moisture content and heavy metal concentration of applying de-inked paper mill sludge (DPMS) over the period 1991 to 1993. In the first year, during decomposition of the DPMS, N immobilization occurred resulting in loss of cereal yield ($P < 0.05$) at low rates of N fertilizer. Approximately 40 kg extra N fertilizer/ha was required per 100t DPMS/ha to compensate for this N immobilization. Soil volumetric moisture content was increased ($P < 0.001$) by c. 20% at both sites by 200 and 300t DPMS/ha. DPMS did not significantly increase ($P > 0.05$) soil concentrations of total Zn, Cu and Pb. Soil nitrate concentrations after harvest were reduced ($P < 0.01$) by c. 17 mg N/kg per 100t DPMS/ha with increasing rates of DPMS up to 200t/ha. In the second year following the DPMS application, there were no significant effects on grain yield indicating that very little or no N was immobilized. By the third year, the soil N supply was 7 kg N/ha higher where a single dressing of 100t DPMS/ha had been applied compared to the control. This resulted in an overall yield increase of 7% ($P < 0.10$). Soil N supply was lower (N.S.) but crop yields were similar ($P > 0.05$) to the control where single dressings of 200 and 300t DPMS/ha had been applied. This citation is from AGRICOLA.

607. Effect of cellulose residues and manure in the soil on the development of corn (Zea mays) and bean (Phaseolus vulgaris).

Costa, A. S. V. da; Rufini, J. C. M.; Silva, M. B. da; Galvao, E. R.; and Ribeiro, J. M. O.

Revista Ceres 54(314): 339-344. (2007)

NAL Call #: 9.2 C332; ISSN: 0034-737X.

Notes: Original title: Efeito do residuo de celulose e esterco no solo sobre o desenvolvimento do milho (Zea mays) e feijao (Phaseolus vulgaris).

Descriptors: cellulose/ dry matter/ maize/ manures/ paper mill sludge/ plant development/ plant parts/ recycling/ roots/ corn/ green bean/ snap bean

Abstract: One of the main concerns on the use of industrial residues of recycled paper is the amount of produced solid residues. A study was conducted in Brazil to evaluate the effects of cellulose solid residues from paper mill in the development of bean and maize. Cellulose residue was incorporated into the soil alone or combined with manure at different proportions. The plants were sown immediately after incorporation of the mixtures of cellulose and manure in the soil and at 40 days post-incorporation. The plants were evaluated at 40 days post-germination using dry matter of the aerial part and roots. The increase in cellulose residue in the soil caused a significant drop in dry matter production of maize plants upon planting immediately after incorporation. Following a period of stabilization in the soil, these negative effects were less apparent in root development. The bean plants had the roots less affected by cellulose residues in the two tested conditions, which was not found for the aerial parts. Reproduced with permission from the CAB Abstracts database.

608. Effect of cellulose wastes upon the growth of *Phragmites australis*.

Jordan, M.; Wilken, D.; Gerth, A.; and Munoz, O.
International Journal of Phytoremediation 10(3): 195-207. (2008)

NAL Call #: TD192.75 .I58; ISSN: 1522-6514

Descriptors: ash/ benzyladenine/ boron/ cellulosic wastes/ chlorosis/ copper/ fly ash/ growth/ heavy metals/ in vitro regeneration/ industrial wastes/ iron/ manganese/ metal tolerance/ micropropagation/ phytoremediation/ plant growth regulators/ sludges/ sodium/ solid wastes/ uptake/ benzylaminopurine/ bioaccumulation/ Mn/ plant growth substances/ plant hormones

Abstract: Growth responses of *Phragmites australis* (Cav.) Trin. Ex Steud. (reed grass), a helophyte species, were examined under in vitro and greenhouse conditions in the presence of various residues from a Kraft pulp mill. Plant tolerance to solid residues (ashes, dregs, flyashes, grits, primary sludge, and brown stock rejects) was tested in vitro. Solid residues were added separately up to 30% (w/v), as well a liquid residue up to 30% (v/v), to a Murashige and Skoog (1962) sucrose-free nutrient media with (5 mg l⁻¹) 6-benzylaminopurine. After 2 mo in vitro, plantlets developed well in the presence of up to 10% solid or liquid wastes, but higher concentrations of either limited growth. This effect was mainly attributed to the plant's uptake and accumulation of various elements such as sodium, iron, copper, manganese, and boron, which are common to these waste types, thus showing an efficient phytoremediation potential. When added to MS media, the concentration of these elements generally decreased in the residual media after 2 mo of culture: the initial sodium, iron, and copper content in the growth media was reduced ca. 10-fold detected; a 5-fold reduction occurred for manganese and boron. In experiments under greenhouse conditions with in vitro propagated plantlets potted in mixtures of a commercial organic soil and residues, significant differences in plant development (plant size and fresh weight increase) were observed in the presence of ashes mixed at levels of 20% and 30%, compared to the control in organic soil. For other solid wastes, plant growth was inhibited as the concentration of each waste increased, causing chlorosis and/or plant necrosis.
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609. Effect of de-inking paper sludge compost application on soil chemical and biological properties.

Baziramakenga, R.; Simard, R. R.; and Lalande, R.
Canadian Journal of Soil Science 81(5): 561-575. (2001)
NAL Call #: 56.8 C162 ; ISSN: 0008-4271

Descriptors: application rates/ composts/ enzyme activity/ magnesium/ paper mill sludge/ phosphoric monoester hydrolases/ phosphorus fertilizers/ Podzols/ potassium/ potatoes/ poultry manure/ soil chemical properties/ soil enzymes/ soil pH/ soil properties/ soil types/ soil water content/ urease/ chemical properties of soil/ green bean/ inorganic nitrogen/ phosphatases/ phosphate fertilizers/ poultry litter/ snap bean

Abstract: A 2-year field study evaluated the effect of applying compost of de-inking paper residues and poultry manure (DSPC) on the chemical and biological properties of Tilly silt loam (Gleyed Humo-Ferric Podzol) in Sainte-

Croix de Lotbiniere, Quebec, Canada. The experiment began in 1996 with snap bean (*Phaseolus vulgaris*) and continued in 1997 on the same plots with potato (*Solanum tuberosum*). In 1996, treatments included three rates of mineral fertilizer (MF) (60, 120 and 180 kg P₂O₅-K₂O ha⁻¹), three rates of DSPC (14, 28 and 42 Mg ha⁻¹ on a dry matter basis) alone or in combination with MF, and an untreated control. In the spring of 1997, main plots were divided into four subplots and P fertilizer was applied at 0, 44, 88 and 132 kg ha⁻¹. The DSPC increased soil pH and water content. Soil inorganic N increased just after DSPC application, but this effect lasted only 1 year. Soil Mehlich-3 extractable P showed a significant increase due to DSPC application and the increase was much larger when DSPC was applied in combination with P fertilizer. Soil phosphatase [phosphoric monoester hydrolases] and urease activities were also increased by DSPC. Application of DSPC increased soil Mehlich-3 extractable K and Mg contents. Except for Mn and Zn, soil Mehlich-3 extractable heavy metal contents were not influenced by DSPC. This experiment indicates that compost derived from a mixture of de-inking papermill sludges and poultry manure is a potential source of nutrients for crops and can effectively improve chemical and biological properties of low fertility or degraded soils.
Reproduced with permission from the CAB Abstracts database.

610. Effect of deinking paper sludge compost on nutrient uptake and yields of snap bean and potatoes grown in rotation.

Baziramakenga, R. and Simard, R. R.
Compost Science and Utilization 9(2): 115-126. (2001)
NAL Call #: TD796.5.C58 ; ISSN: 1065-657X

Descriptors: application rates/ composting/ composts/ crop yield/ nutrient availability/ nutrient uptake/ paper mill sludge/ phosphorus/ phosphorus fertilizers/ plant nutrition/ Podzols/ potassium/ potatoes/ poultry manure/ residual effects/ rotations/ silt loam soils/ soil types/ crop rotation/ green bean/ phosphate fertilizers/ poultry litter/ rotational cropping/ snap bean

Abstract: A field study was conducted on a tilly silt loam (gleyed Humo-Ferric Podzol) located in Sainte-Croix de Lotbiniere, Quebec, Canada, in 1996 and 1997, to evaluate the effects of compost application on P and K uptake, and yield of snap bean (*Phaseolus vulgaris* cv. Centralia) and potatoes (*Solanum tuberosum* cv. Gold Rush). The compost was derived from a mixture of de-inking paper residues and poultry manure (DSPC). Treatments used were three rates of DSPC (14, 28 and 42 t ha⁻¹ on a dry matter basis) alone or in combination with mineral fertilizer (MF), three rates of MF (60, 120 and 180 kg P₂O₅-K₂O ha⁻¹), and an untreated control. In 1997, P fertilizer was applied in subplots at 0, 100, 200 and 300 kg P₂O₅ ha⁻¹. Snap bean yield increased significantly with both DSPC and MF application. Apparent P and K recoveries from MF by snap bean decreased with DSPC or MF rate. In combination with DSPC, P and K recoveries from MF by snap bean were smaller at all rates than those with no DSPC. Based on nutrient uptake, P and K in DSPC were more available than in MF. Potato yield in the following year was not significantly influenced by the treatments nor by supplemental P fertilizer added in the second year. Results

indicate that compost derived from a mixture of de-inking papermill sludges and poultry manure is a potential source of P and K for crops and could increase crop yield. Reproduced with permission from the CAB Abstracts database.

611. Effect of FYM, CaCO₃ and paper mill sludge on some physical properties of an acidic Alfisol of Central Brahmaputra Valley Zone of Assam.

Sarma, P. K.; Bordoloi, P. K.; and Bora, N.

Crop Research Hisar 20(1): 81-86. (2000)

NAL Call #: SB4.C66 ; ISSN: 0970-4884

Descriptors: Alfisols / bulk density/ hydraulic conductivity/ paper mill sludge/ rain/ soil amendments/ soil physical properties/ soil strength/ physical properties of soil/ rainfall
Abstract: A laboratory investigation was conducted for the improvement of physical attributes of an acidic Alfisol of the rain shadow belt of Central Brahmaputra Valley Zone of Assam, India, with unfavourable soil physical properties (wide crack pattern, high bulk density and low hydraulic conductivity) by using proven aggregating agents, FYM and CaCO₃ along with paper mill sludge (PMS) (CaCO₃=90%, Ca(OH)₂=1-2%, NaOH=1-2% and Silica=4.5%) produced as waste product at Hindustan Paper Corporation Limited, Jagiroad, Nagaon. Results showed that the aggregating agents modified the crack pattern in terms of increased number of cracks m⁻² in the smaller size range. Number of cracks m⁻² exhibited positive correlation with mean weight diameter (MWD), macroaggregate and microaggregate of 20-50 and 50-250 micron size range. The correlation was negative with microaggregate of 2-20 micron and clay size particle of <2 micron. Reduction in microaggregate and increase in macroaggregate observed was a result of aggregating agent addition. Higher values of MWD were observed where FYM+CaCO₃ and FYM+PMS were applied in combination. Bulk density correlated positively with <2 micron particle 2-20 micron size microaggregate and negatively with 20-50 and 50-250 micron aggregate. Water holding capacity correlated negatively with bulk density. Reproduced with permission from the CAB Abstracts database.

612. Effect of industrial effluents on growth and development of earthworms.

Karabphantanal, S. S. and Awaknavar, J. S.

Journal of Ecotoxicology and Environmental Monitoring 15(4): 301-307. (2005); ISSN: 0971-0965

Descriptors: biological development/ factory effluents/ growth/ industrial effluents/ industrial wastes/ paper mill sludge/ soil amendments/ soil fauna / soil invertebrates/ sugar factory waste/ toxicity/ Mysore/ sugar factory effluent
Abstract: Effluents were collected from sugar, polyfibre and paper mills in Karnataka, India, to assess their toxicity on earthworms. Among the mills, effluents from the polyfibre mill recorded high toxicity to earthworms as the lowest LC₅₀ value under laboratory condition was obtained for both juveniles (38.8%) and adults (44.3%). In pot culture condition, all effluent treated pot recorded significantly the lowest length (14.7, 11.8 and 6.4 cm), weight (929.4, 993.3 and 418.4 mg) of earthworms at 45 DAR in sugarcane, paper and polyfibre mills, respectively, compared to untreated pot, which recorded 16.9, 15.9 and 9.29 cm of length and 1010.8, 1230.2 and 601.6 mg of weight at corresponding mills. Similarly, cocoon production per worm

was highest in the pots without effluents (60.3, 54.5 and 45.5) compared to pot with effluent (50.3, 41.1 and 34.4) in sugarcane, paper and polyfibre mills, respectively. However, no significant difference was observed between the treated and untreated pots in terms of tomato yield per plant. The toxicity pattern of effluents to earthworms were polyfibre > paper mill > sugar factory. Reproduced with permission from the CAB Abstracts database.

613. Effect of lime on sabaigrass based intercropping system in slopy lands.

Tripathy, S. K.; Mohapatra, S.; Sahoo, S.; and Sahu, S. K. *Range Management and Agroforestry* 26(2): 116-119. (2005); ISSN: 0971-2070

Descriptors: acid soils/ biomass production/ black gram/ cost benefit analysis/ cowpeas/ crop yield/ cropping systems/ green gram/ intercropping/ lime / lime requirement/ liming/ liming materials/ nitrogen/ nitrogen content/ nutrient uptake/ organic amendments/ paper mill sludge/ phosphorus/ potassium/ returns/ sloping land/ soil acidity/ soil amendments/ soil fertility/ soil types/ black eyed peas/ mung bean/ southern peas
Abstract: Field experiment was conducted at the research farm of the Orissa University of Agriculture and Technology, Chhenahua, India, to investigate the effect of lime on the biomass yield of sabaigrass (*Eulaliopsis binata*). Paper mill sludge containing 75% CaCO₃ was used as liming material. It was applied at half the lime requirement (LR=4 t/ha) 10 days before sowing in moist soil. The experiment was initiated in July 2001 with four cropping treatments, namely: sole sabaigrass (S); sabaigrass+green gram (S+GG) in 1:2 row ratio; sabaigrass+black gram (S+BG) in 1:2 row ratio; and sabaigrass+cowpea (S+C) in 1:1 row ratio compared under control and lime application. Results showed that the average annual dry matter production of sabaigrass ranged from 4.89 to 28.63 q/ha in control plots and from 5.66 to 37.65 q/ha in plots limed at 0.5 LR. Sole sabaigrass produced higher dry matter yield (6.11 to 41.05 q/ha) than inclusion of legumes as the intercrop in between sabaigrass. Cowpea produced the maximum seed yield amounting to 4.64 and 2.94 q/ha during 2001 and 2002, respectively. Nitrogen concentration in grass under sole planting was low but its uptake was maximum due to accumulation of higher biomass. Sabaigrass in association with green gram showed higher N uptake than the other legumes. The maximum net returns Rs10 663/ha was obtained under intercropping of green gram with sabaigrass in limed plot. Reproduced with permission from the CAB Abstracts database.

614. The effect of mixing organic biological waste materials and high -N crop residues on the short -time N₂O emission from horticultural soil in model experiments.

Chaves, B.; Neve, S. de; Cabrera, M. del C. L.; Boeckx, P.; Cleemput, O. van; and Hofman, G.

Biology and Fertility of Soils 41(6): 411-418. (Aug. 2005) NAL Call #: QH84.8.B46; ISSN: 0178-2762

Descriptors: horticultural soils/ sandy loam soils/ nitrous oxide/ gas emissions/ celery/ crop residues/ organic wastes/ soil amendments/ pulp and paper sludge/ straw/ sawdust/ yard waste composts/ nitrate nitrogen/ leaching/ tannins

Abstract: Manipulating the N release from high-N crop residues by simultaneous mixing of these residues with organic biological waste (OBW) materials seems to be a possible method to reduce NO₃- leaching. The aim of this study was to examine whether the incorporation of OBW materials together with a high-N crop residue (celery) had also an effect on N₂O emission from horticultural soil under short-term and optimised laboratory conditions. A sandy loam soil and celery residues were mixed with different OBW materials and brought into PVC tubes at 80% water-filled pore space and 15pC. Every 2.5 h, a gas sample was taken and analysed by gas chromatography for its N₂O concentration. The soil amended with only celery residues had a cumulative N₂O emission of 9.6 mg N kg⁻¹ soil in 50 h. When the celery residues were mixed with an OBW material, the N₂O emission was each time lower than the emission from the celery-only treatment (between 3.8 and 5.9 mg N kg⁻¹ soil during maximum 77 h), except with paper sludge (17.2 mg N kg⁻¹ soil in 100 h). The higher N₂O emission from the paper sludge treatment was probably due to its unusually low C:N ratio. Straw, green waste compost 1 (GWC1) and 2 (GWC2), saw dust, and tannic acid reduced the N₂O emission of the celery treatment by 40 to 60%. Although the N₂O reduction potential can be expected to be lower and with differing dynamics under field conditions, this study indicates that apart from reducing NO₃- leaching, OBW application may at the same time reduce N₂O emissions after incorporation of high-N crop residues.

This citation is from AGRICOLA.

615. Effect of organic amendments on soilborne and foliar diseases in field-grown snap bean and cucumber.

Stone, A. G.; Vallad, G. E.; Cooperband, L. R.; Rotenberg, D.; Darby, H. M.; James, R. V.; Stevenson, W. R.; and Goodman, R. M.

Plant Disease 87(9): 1037-1042. (2003); ISSN: 0191-2917
Descriptors: cucumbers/ cultural control/ fungal diseases/ organic amendments/ paper mill sludge/ plant diseases/ plant pathogenic bacteria/ plant pathogenic fungi/ plant pathogens/ potatoes/ Coelomycetes/ gherkins/ green bean/ Peronosporomycetes/ phytopathogens/ Pythiaceae/ Saprolegniaceae/ snap bean/ Straminipila/ United States of America

Abstract: Several paper mills in Wisconsin have programs for spreading paper mill residuals (PMR) on land. A growing number of vegetable farmers recognize the agronomic benefits of PMR applications, but there have been no investigations on the use of PMR for control of vegetable crop diseases. Our objective was to determine the effect of PMR amendments on soilborne and foliar diseases of cucumber and snap bean grown on a sandy soil. Raw PMR, PMR composted without bulking agent (PMRC), or PMR composted with bark (PMRBC) were applied annually in a 3-year rotation of potato, snap bean, and pickling cucumber. Several naturally occurring diseases were evaluated in the field, along with in situ field bioassays. All amendments suppressed cucumber damping-off and Pythium blight and foliar brown spot of snap bean. Both composts reduced the incidence of angular leaf spot in cucumber. In a separate field experiment planted with snap bean for two consecutive years, all amendments reduced common root rot severity in the second year. In a greenhouse experiment, the high rate of PMRBC

suppressed anthracnose of snap bean. These results suggest that the application of raw and composted PMR to sandy soils has the potential to control several soilborne and foliar diseases.

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616. Effect of paper mill effluent on germination of agricultural crops.

Dhevagi, P. and Oblisami, G.

Journal of Ecobiology 12(4): 243-249. (2000)

NAL Call #: QH540.J56 ; ISSN: 0970-9037

Descriptors: black gram/ castor beans/ germination/ green gram/ groundnuts/ growth/ irrigation/ irrigation water/ maize/ nutrients/ paper mill sludge/ sesame/ soybeans/ sunflowers/ waste water/ beniseed/ corn/ Madras/ mung bean/ peanuts/ soybeans/ watering

Abstract: Industrial waste water is being used for irrigation in dry areas. These effluents not only contain nutrient that enhances the growth of crop plants but also have other toxic materials. An experiment was carried out to study the effect of paper mill effluent on germination and growth behaviour of crops like maize, groundnut, sunflower, soybean, black gram, green gram, gingelly [sesame] and castor beans in Tamil Nadu, India [date not given]. The effluent analyses showed the presence of low concentration of major inorganic nutrients. The results obtained after the germination study showed that raw effluent affected the germination percentage of maize, groundnut, soybean and black gram by 19, 5.4, 13, and 9.9%, respectively. The highest reduction in vigour index was observed in castor beans (56.5%) and gingelly (47.6%). Growth behaviour of the crops showed increasing trend towards increase in dilution of the effluent.

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617. Effect of paper mill effluent on seed germination and seedling growth of six varieties of groundnut (arachis hypogaea).

Sundaramoorthy, P. and Kunjithapatham, J.

Journal of Ecotoxicology & Environmental Monitoring 10(1): 53-57. (Jan. 2000); ISSN: 0971-0965

Descriptors: alkalinity/ biochemical oxygen demand/ growth/ industrial effluents/ paper industry wastes/ plant physiology/ pulp and paper industry/ seedlings/ toxicity testing/ trees/ wastewater analysis/ wastewater disposal/ Arachis hypogaea

Abstract: To find the effect of paper mill effluent on six varieties of groundnut (*Arachis hypogaea*), different concentrations (10,25,50,75 and 100%) of paper mill effluents were selected and germination experiments were carried out. Paper mill effluent was alkaline in nature and it contained higher amount of suspended and dissolved solids which resulted in high Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD). The seed germination percentage, seedling growth and their dry weight were taken into consideration for varietal screening experiment. These parameters were found to decreased with the increase of effluent concentrations. On the basis of data obtained from germination studies, the variety CO.2 showed the lowest percentage decrease over control values (34%, 57.5% and 24% for seed germination, seedling growth and seedling dry weight) than the other varieties studied for paper mill effluent treatment.

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618. Effect of paper mill effluent on soil properties and performance of maize in Mollisols of Uttaranchal.

Singh, A. P. and Room Singh

Journal of the Indian Society of Soil Science 53(2): 267-269. (2005)

NAL Call #: 56.9 IN2; ISSN: 0019-638X

Descriptors: biomass production/ clay loam soils/ electrical conductivity/ growth/ irrigation/ maize/ Mollisols/ nitrogen/ nutrient availability/ nutrient uptake/ organic carbon/ paper mill sludge/ phosphorus/ plant height/ plant nutrition/ potassium/ pulp mill effluent/ sandy loam soils/ seed germination/ soil bacteria / soil fertility/ soil fungi/ soil organic matter/ soil pH/ soil types/ waste disposal/ waste management/ waste utilization/ corn/ kraft mill effluent/ organic matter in soil/ watering

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619. Effect of paper mill effluent on spermosphere microflora.

Dhevagi, P.; Rajannan, G.; and Oblisami, G.

Journal of Ecobiology 12(2): 149-152. (2000)

NAL Call #: QH540.J56 ; ISSN: 0970-9037

Descriptors: effluents/ green gram/ groundnuts/ maize/ microorganisms/ paper mill sludge/ soyabeans/ sunflowers/ corn/ micro organisms/ mung bean/ peanuts/ soybeans/ spermosphere

Abstract: An experiment studied the effect of treated paper mill effluent on spermosphere microflora of maize, sunflower, green gram [*Vigna radiata*], black gram [*V. mungo*], soyabean and groundnut. The effluent used was light brown in colour with alkaline pH having an EC of 0.36 dS m⁻¹. The treated effluent had a good amount of hardness, bacteria, actinomycetes and fungi. The population of spermosphere microflora was lower (4.1 to 95.7x10⁶/g of soil) at higher concentration (100%) of treated effluent irrigation; whereas higher counts (104.1x10⁶/g of soil) were recorded at lower effluent concentration (50%).

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620. Effect of paper sludge application on carbon dynamic in two soils from Valencia lake basin (Venezuela) .

Martinez, Y. and Rivero, C.

Revista de la Facultad de Agronomia, Universidad Central de Venezuela 32(1): 41-52 . (2006); ISSN: 0041-8285.

Notes: Original title: Efecto de la aplicacion de lodos papeleros sobre la dinamica del carbono en dos suelos de la Cuenca del Lago de Valencia.

Descriptors: agricultural soils/ biological activity in soil/ carbon dioxide/ microbial activities/ organic carbon/ sludges/ soil types

Abstract: An experiment was carried out at the Biology and Fertility greenhouse of Facultad de Agronomia of the Universidad Central de Venezuela, during 66 days to evaluate organic C dose, culture presence and time. The first centimetres of the profile of two representative agricultural soils from the Valencia lake basin were used.

The organic carbon was determined by humid oxidation and the soil respiration by capture of the CO₂ produced with NaOH trap. The content of organic carbon did not show significant differences in the treatments with and without cultivation, neither any tendency with the time. The quantity of produced C-CO₂ in both soils was dependent of the treatment. The highest production in C-CO₂, in the first stages, was observed in the Guacara soil, with rapid and higher mineralization.

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621. The effect of pulp unit effluent on agriculture.

Sundari, S. and Kanakarani, M. S. P.

Journal of Industrial Pollution Control 17(1): 83-97. (2001); ISSN: 09702083 [JIPCE]

Descriptors: crop production/ ground water/ land value/ plant diseases/ pulp industry effluent/ rehabilitation/ soil quality/ agricultural application/ pulp and paper industry/ waste management/ wastewater/ India

Abstract: In this study an attempt is made to assess the impact of pulp unit wastewater discharge on the environment particularly agriculture. The analysis shows that the partially treated effluent has adversely affected the ground water resources, soil fertility, crop production, land value and has also resulted in the death of livestock. As the partially treated effluent is not adequate to safeguard the environment, the pulp industry should go in for that technology that would ensure 100% treatment of wastewater. The government should assist the industry in the acquisition of the technology for complete treatment of the wastewater.

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622. Effect of solid waste disposal from paper mill on the productivity of rice (oryza sativa L. Var mahsuri) plant.

Dutta, S. K.

Ecology, Environment and Conservation 11(3-4): 531-535. (2005)

NAL Call #: QH183.E238; ISSN: 0971765X [EECOF]

Descriptors: grain yield/ particle/ productivity/ solid waste/ crop performance/ productivity/ pulp and paper industry/ rice/ soil amendment/ waste disposal/ Asia/ assam/ Eurasia/ India/ South Asia/ oryza sativa

Abstract: The solid waste disposal system of Nagaon paper Mill, Jagiroad, Assam is one of the major problem in the Jagiroad area. An attempt was made to investigate the physical and chemical properties of solid waste and soil in order to evaluate their effectiveness on productivity on rice plant. For the purpose, solid waste were taken and its particulate size pH, organic matter, texture, porosity, water holding capacity, water retaining capacity, sodium absorption ratio (SAR), exchangeable sodium percentage (ESP), Total Alkalinity and water soluble anions and cations, carbonates, Bi-carbonates and chlorides, sodium, calcium, magnesium, potassium, sulphur, phosphorus and iron were analysed. Similarly, plant height, root characters, number of flower and fertilized flower and grain yield were estimated on rice plants. The plant growing on solid waste/soil mixture were compared with those growing on control soil. On the basis of physical and chemical properties of solid waste, grain produced by the plants growing in solid waste/soil mixture failed to produce the expected yield. It may be concluded that use of solid waste/

soil mixture for paddy cultivation could not be recommended. Hence, for the disposal of solid waste an alternative arrangement should be made, such as disposal of solid waste for landfilling operations in the non-cultivated lands and wetlands may be recommended. Copyright Enviromedia.

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623. Effect of spring application of a paper mill soil conditioner on corn yield.

Curnoe, W. E.; Irving, D. C.; Dow, C. B.; Velema, G.; and Unc, A.

Agronomy Journal 98(3): 423-429. (May 2006-June 2006)
NAL Call #: 4 AM34P; ISSN: 0002-1962

Descriptors: Zea mays / corn/ grain yield/ soil conditioners/ pulp and paper sludge/ application timing/ spring / sandy soils/ nitrogen content/ soil fertility/ phosphorus/ potassium/ magnesium/ soil organic matter/ soil pH/ soil quality/ application rate/ ammonium nitrate/ mineral fertilizers/ plant nutrition/ nitrate nitrogen/ leaching/ waste utilization/ Ontario

Abstract: Use of paper mill residuals as soil amendment on farmland is believed to have a beneficial impact on crop yields and soil quality. The objective of our study was to evaluate the effect of spring applying Domtar Soil Conditioner (SC) (pulp and paper mill waste water treatment residue) to a sandy soil in eastern Ontario, Canada. The effects of SC on corn (*Zea mays* L.) yields, N concentrations in plants, and post-harvest levels in soil of NO₃, P, K, Mg, organic matter (OM), and pH were investigated. The experimental design was a randomized complete block with five treatments, replicated four times. The treatments included two SC rates (15 and 25 Mg ha⁻¹ dry matter: SC15 and SC25), 150 kg ha⁻¹ NH₄NO₃-N (N150), a composite SC and mineral fertilizer treatment (15 Mg ha⁻¹ dry matter SC and 75 kg ha⁻¹ NH₄NO₃-N: SC15N75), and a control. The experiment was repeated annually from 1997 to 2001. Addition of SC the spring before planting increased grain yield by 2360 kg ha⁻¹ for SC15 and by 2908 kg ha⁻¹ for SC25 vs. the control. When N was also added (SC15N75), the average increase vs. the control was 3406 kg ha⁻¹. More total N was measured in the corn plants from the plots amended with SC than the control. The SC amendments temporarily increased soil OM but did not increase NO₃-N leaching risk. Annual spring application of SC improved corn yield but had little impact on soil nutrient levels, OM, and pH.

This citation is from AGRICOLA.

624. Effect of various substrates on the growth and quality of mushrooms.

Ponmurugan, P.; Sekhar, Y. N.; and Sreesakthi, T. R.
Pakistan Journal of Biological Sciences 10(1): 171-173. (2007)

NAL Call #: QH301 .P355; ISSN: 1028-8880

Descriptors: amino acids/ biomass production/ calcium/ cane molasses/ chemical composition/ crop quality/ dry matter accumulation/ edible fungi/ growth/ lipids/ magnesium/ nutritive value/ organic wastes/ paper mill sludge/ phosphorus/ potassium/ protein content/ rice/ rice straw/ sawdust/ straw/ substrates/ sugars/ Lentinaceae/ lipins/ nutritional value/ paddy/ Poriales/ quality for nutrition
Abstract: The effect of different biowastes such as rice straw, sorghum straw, sugarcane molasses, sawdust and

paper waste on the growth and biochemical constituents of oyster mushroom (*Pleurotus florida*) was studied.

Favourable conditions were created to attain the maximum yield of mushrooms. The results revealed that mushroom growth was best in rice straw followed by sugarcane molasses and least in wood sawdust and paper waste. The growth of mushrooms may be coincided with type of substrates used that leads to tremendous utilization of nutrients in the biowastes. The results further indicated that the biometric parameters such as fresh weight, dry weight and dry matter accumulation and biochemical constituents such as total sugars, protein, amino acids and lipids were also highest in mushrooms grown in rice straw followed by sugarcane molasses and least in wood sawdust and paper waste. The microelements such as phosphorous, potassium, calcium and magnesium were also highest in mushrooms grown in rice straw when compared to the other substrates.

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625. The effect of waste water on root growth and mitosis in onion (*Allium cepa*) root apical meristem.

Dane, F.; Ekici, N; and Aktas, Y. K.

Asian Journal of Plant Sciences 5(2): 331-334. (2006);
ISSN: 1682-3974

Descriptors: apical meristems/ genotoxicity/ growth/ mills/ mitosis/ onions/ paper mill sludge/ phytotoxicity/ root tips/ textile mills/ waste water

Abstract: In this study, the phytotoxic and genotoxic effects of waste waters and also mitotic index were investigated in onion (*Allium cepa*) root tip cells during germination. Samples of water from effluent channels of Olmuksa paper, paddy and textile thread mills were collected in Edirne-Turkey on March 2002. The mineral content of the effluent was monitored by flame AAS and pH values of samples were measured. Tap water was used as control. The mitotic frequency of the onion root tip meristematic cells increased in samples of water from effluent channels. On the basis of present findings it may be concluded that low concentrations of minerals in waters of effluent channels of textile thread, paddy and Olmuksa paper mills has some positive effects on the root growth and mitotic divisions in onion root tip cells.

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626. Effect on deinking paper sludge compost on nutrient uptake and yields of snap bean and potatoes grown in rotation.

Baziramakenga, R. and Simard, R. R.

Compost Science and Utilization 9(2): 115-126. (2001)
NAL Call #: TD796.5.C58 ; ISSN: 1065657X [CSUTE]

Descriptors: Canada/ composting/ concentration (parameters)/ crop rotation/ cultivar/ fertilizer application/ growing season/ nutrient uptake/ paper industry/ phaseolus vulgaris/ plant growth/ plant residue/ plant yield/ rural area/ soil/ solanum tuberosum/ waste disposal/ compost/ crop yield/ nutrient uptake/ pulp and paper industry/ vegetable

Abstract: The paper industry in Canada faces a challenge of economically sound and environmentally safe disposal of massive amounts of residues. A field study was conducted in 1996 and 1997 to evaluate the effects of application of a compost derived from a mixture of deinking paper residues

and poultry manure (DSPC) on P and K uptake, and yields of snap bean (*Phaseolus vulgaris* L. cv. Centralia), and potato (*Solanum tuberosum* L. cv. Gold Rush). The experiment was conducted on a Tilly silt loam (Gleyed Humo-Ferric Podzol) located in Sainte-Croix de Lotbiniere, Quebec, Canada. The DSPC was applied in the spring 1996 at 0, 14, 28 and 42 Mg ha⁻¹ on a dry matter basis, and supplemented or not with mineral fertilizer (MF) at 0, 60, 120 and 180 kg P₂O₅-K₂O ha⁻¹. In 1997, P fertilizer was applied in subplots at 0, 100, 200 and 300 kg P₂O₅ ha⁻¹. Snap bean yield increased significantly with DSPC and MF application. Apparent P and K recoveries from MF by snap bean decreased with DSPC or MF rate. In combination with DSPC, P and K recoveries from MF by snap bean were smaller at all rates than those with no DSPC. Based on nutrient uptake, P and K in DSPC were more available than in MF. Potato yield in the following year was not significantly influenced by the previous treatments nor by supplemental P fertilizer added in the second year. This experiment indicates that compost derived from a mixture of deinking papermill sludges and poultry manure is a potential source of P and K for crops and will increase crop yields in the application year.

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627. Effects of amendments of paper mill sludge and nutrients on soil surface CO₂ flux in northern hardwood forests.

Wang ChuanKuan; Feldkirchner, D. C.; Gower, S. T.; Ferris, J.; and Kruger, E. L.

Journal of Forestry Research 16(4): 265-269. (2005); ISSN: 1007-662X

Descriptors: application to land/ carbon dioxide/ fertilizers/ industrial wastes/ paper mill sludge/ soil amendments/ soil temperature/ soil water content/ land application/ United States of America

Abstract: Safe and economical disposal of paper mill sludge is a key consideration for forest products industry. A study was conducted to examine the effects of amendments of sludge and nutrients on soil surface CO₂ flux (R_s) in northern hardwood forests and to quantify the relationship among R_s, soil temperature, and moisture in these stands. The experiment was a randomized complete block design that included sludge-amended, fertilized, and control treatments in sugar maple (*Acer saccharum* Marsh) dominated hardwood forests in the Upper Peninsula of Michigan, USA. Results showed that R_s was positively correlated to soil temperature (R²=0.80, p<0.001), but was poorly correlated to soil moisture. Soil moisture positively affected the R_s only in the sludge-amended treatment. The R_s was significantly greater in the sludge-amended treatment than in the fertilized (p=0.033) and the control (p=0.048) treatments. The maximum R_s in the sludge-amended treatment was 8.8 micro mol CO₂.m⁻².s⁻¹, 91% and 126% greater than those in the fertilized (4.6 micro mol CO₂.m⁻².s⁻¹) and control (3.9 micro mol CO₂.m⁻².s⁻¹) treatments, respectively. The R_s did not differ significantly between the fertilized and control treatments. The difference in R_s between sludge-amended and the other treatments decreased with time following treatment. Reproduced with permission from the CAB Abstracts database.

628. Effects of composted pulp and paper industry wastewater treatment residuals on soil properties and cereal yield.

Sippola, J.; Makela Kurtto, R.; and Rantala, P. R.

Compost Science and Utilization 11(3): 228-237. (2003) NAL Call #: TD796.5.C58 ; ISSN: 1065-657X

Descriptors: application rates/ barley/ bulk density/ calcium/ carbon nitrogen ratio/ clay soils/ composting/ composts/ crop yield/ fertilizers/ heavy metals/ mineralization/ nitrogen/ oats/ paper mill sludge/ phosphorus/ porosity/ potassium/ pulp mill effluent/ silty soils/ sludges/ soil chemical properties/ soil density/ soil physical properties/ soil types/ waste management/ waste utilization/ waste water/ waste water treatment/ chemical properties of soil/ kraft mill effluent/ physical properties of soil

Abstract: The aim of this study was to investigate effects of pulp and paper industry wastewater treatment sludge composts on soil and cereal crops. Five forest industry wastewater sludge composts were tested in a field study which was conducted in a silty clay soil in southern Finland with barley in 1998, with oats in 1999 and with barley in 2000. Two composts contained only pulp mill biosludge and bark in a ratio of 1:4 and 1:2, respectively. Two other composts were mixtures of biosludge and primary sludge with the addition of bark in a ratio of 1:2 and 3:4, respectively. These two wastewater sludges originated from a pulp mill and from a recycled paper mill. The fifth compost consisted of biosludge and primary sludge from a board mill. Two application rates of each compost were studied: the low rate was based on an annual P fertilization rate recommended for barley, 50-200 m³/ha; and the high rate was a double or triple the low rate depending on the mineral N concentration of the compost, 150-600 m³/ha. Based on the Finnish fertilizer recommendations, nutrient demands of the test plants were annually fulfilled by mineral fertilizers depending on the treatment. Total contents of N, P, K and Ca in composts were 8.8-17.5, 0.7-3.9, 1.5-6.5, and 4-25 g/kg dry matter, respectively. Especially at high doses, composts had beneficial effects on soil bulk density, porosity, C and N contents and C:N ratio. Despite the high total N rates applied with the composts, the mineralization following crop harvest did not significantly increase soil nitrate late autumn or following spring as compared to the soils that received mineral fertilization. There was no significant difference in the grain yields between plots that received mineral fertilization and compost treatments supplemented with mineral fertilizers. However, there was a decreased fertilization effect of some composts on straw yields during the first experimental year, indicating immobilization of mineral N. Heavy metals added in soil with the composts did not significantly increase their concentrations in the grain crops. All the composts had relatively low nutrient contents and low fertilizing value, but beneficial effects on soil properties and were regarded as soil conditioners. Soil improving and fertilizing effects of the composts varied annually depending on the weather conditions during the growing season. Heavy metal concentrations of the composts studied were far below the limit values set for the soil conditioners in the Finnish government regulations.

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629. Effects of de-inking paper sludges on soil properties and crop yields.

Simard, R. R.; Baziramakenga, R.; Yelle, S.; and Coulombe, J.

Canadian Journal of Soil Science 78(4): 689-697. (1998)
NAL Call #: 56.8 C162 ; ISSN: 0008-4271

Descriptors: barley/ nitrogen fertilizers/ nutrient availability/ paper mill sludge/ phosphorus/

potassium/ pulp and paper industry/ silt loam soils/ soil amendments/ soil chemistry/ soil types/ soil water/ strawberries/ yields/ paper industry/ soil moisture

Abstract: The effects of the use of raw de-inking paper sludges (RDS) as a soil amendment on soil chemical properties, barley (*Hordeum vulgare*) growth, nutrient uptake and yields, and their residual effect on a subsequent strawberry (*Fragaria x ananassa*) crop were investigated on a Tilly silt loam (gleyed humo-ferric Podzol) from 1994 to 1996 in Ste-Croix (46 degrees 39' N, 72 degrees 06' W), Quebec, Canada. Four rates of RDS (0, 15, 30 and 45 t/ha) on a wet-weight basis were combined with four rates of supplemental N-mineral fertilizer (0, 45, 90 and 135 kg/ha) as NH_4NO_3 . The soluble inorganic N content of soil sampled 30 d after treatment application was significantly lower in plots treated with 45 t RDS/ha at all N rates. However, soluble inorganic N concentrations increased significantly with RDS rate to 20-cm depth in June 1995.

The RDS application increased soil water content and Mehlich-3-extractable P, K, and Ca in the first year. Barley yields were reduced by 50% when 45 t RDS/ha was applied without supplemental N-mineral fertilizer. The amount of N-mineral fertilizer needed to overcome N immobilization resulting from RDS increased with RDS rates. Strawberry yields were not significantly affected by residual RDS or N-mineral fertilizer. Changes in plant tissue metal contents were not significant. The results indicate that RDS has a positive short-term effect on soil water, P and K availability but reduces plant-available soil N in the growing season after spring application. The RDS may be used effectively as soil amendment if the crop receives adequate supplemental N-mineral fertilizer.

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630. Effects of diverse amounts of deinking residues on the stability of pore structure of three types of soils in Quebec, Canada.

Nemati, Mohammad-Reza

Canada: Universite Laval, Sainte-Foy, QC, Canada (CAN), 1999.

Notes: Original title: Effets de diverses doses de residus de desencrage sur la stabilite du reseau poral de trois types de sol du Quebec (Canada). Language of article: French.

Descriptors: Canada/ Eastern Canada/ hydraulic conductivity/ loam/ models/ Quebec/ soils/ stability/ soils
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631. Effects of five non-agricultural organic wastes on soil composition, and on the yield and nitrogen recovery of Italian ryegrass.

Douglas, J. T.; Aitken, M. N.; and Smith, C. A.

Soil Use and Management 19(2): 135-138. (2003)

NAL Call #: S590.S68; ISSN: 0266-0032

Descriptors: application to land/ clay loam soils/ crop yield/ dairy wastes/ distillery effluent/ dry matter accumulation/

organic wastes/ paper mill sludge/ recovery/ soil composition/ soil types/ Britain/ land application/ United Kingdom

Abstract: We studied the effects of five diverse non-agricultural organic wastes on soil composition, grass yield and grass nitrogen use in a 3-year field experiment. The applied wastes were distillery pot ale, dairy salt whey, abattoir blood and gut contents, composted green waste (two annual applications each), and paper-mill sludge (one annual application). With the exception of N immobilization in the paper-mill sludge treatment, the wastes had no unfavourable effects on the soil. In the 2-year treatments, grass dry matter yields from the abattoir and distillery wastes (26.3 t ha⁻¹) were larger than those from a NH_4NO_3 fertilizer treatment (24.3 t ha⁻¹) and from the dairy waste (20.4 t ha⁻¹) and composted waste (22.8 t ha⁻¹). Yield and N recovery were impaired markedly after the single application of paper-mill sludge, both in the year of application and in the following year. The results demonstrated clear differences in the ability of the applied wastes to provide crop-available N. We conclude that in order to improve prediction of both the benefits and risks from waste recycling to land, more information should be gathered on soil/waste/crop interactions.

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632. Effects of fresh paper mill sludges and their composts on soil macro-aggregates.

Bipfubusa, M; N'Dayegamiye, A; and Antoun, H

Canadian Journal of Soil Science 85(1): 47-55. (2005)

NAL Call #: 56.8 C162 ; ISSN: 0008-4271.

Notes: Original title: Effets de boues mixtes de papeteries fraiches et compostees sur l'agregation du sol, l'inclusion et la mineralisation du C dans les macro-agregats stables a l'eau.

Descriptors: aggregates/ application/ application rates/ carbon/ chemical composition/ composts/ diameter/ Humic Gleysols/ maize/ maize silage/ mineralization/ nitrogen fertilizers/ paper mill sludge/ silage/ silt loam soils/ soil amendments/ soil physical properties/ soil structure/ soil types/ corn/ physical properties of soil

Abstract: Soil aggregation is influenced by physical and chemical properties of organic materials applied to the soil.

The objective of this study was to evaluate the effects of fresh paper mill sludges and their composts, and their application frequency on soil aggregation, mean weight diameter of aggregates (MWD) and on the C content and C mineralization from water-stable aggregates. The experiment was established on a Le Bras silt loam (Humic Gleysol) under silage corn (*Zea mays* L.) production, and was designed as a split-plot experiment with six treatments in the main plots that were applied at two frequencies (annual and biennial) in the sub-plots. Paper mill sludges and their composts were applied at 40 t ha⁻¹ on a wet basis, alone or completed with 120 kg N ha⁻¹. Those treatments were compared to mineral N fertilization (160 kg ha⁻¹) recommended for silage corn, and the control. Soil aggregation was assessed by wet soil sieving on a nest of 5-mm, 2-mm, 1-mm and 0.25-mm sieves. Soil C contents and mineralization were determined on whole soil and on >5 mm, 2-5 mm and 0.25-2 mm aggregate classes. Fresh and composted paper mill sludges significantly ($P < 0.05$) increased the proportion of water-stable aggregates >5

mm, the MWD of aggregates and the C content of aggregate fractions, compared to the control and the mineral N fertilizer treatment. However, the abundance of >5 mm aggregates and the MWD of aggregates were significantly decreased when fresh paper mill sludges were combined with mineral N fertilizer, suggesting a fast mineralization of binding agents. In contrast, N fertilizer application has not reduced soil macro-aggregates >5 mm and the MWD of aggregates in paper mill compost treatments, probably due to resilience to degradation of humic substances brought by the composts. On average, carbon mineralization was highest in all aggregates in soils with paper mill sludges, than for their composts, which suggests that paper mill sludge C was more labile than compost C. Therefore, more frequent fresh paper mill sludge applications would be necessary for a sustainable effect on soil aggregation.

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633. Effects of iron precipitation and organic amendments on porosity and penetrability in sulphide mine tailings.

Forsberg, Lovisa Stjernman and Ledin, Stig
Water, Air and Soil Pollution 142(1-4): 395-408. (2003)

NAL Call #: TD172 .W36; ISSN: 0049-6979

Descriptors: pollution assessment control and management/ soil science/ waste management: sanitation/ plantae: plants/ laboratory experiment: laboratory techniques/ boliden mineral Ab/ hard pan formation/ mechanical resistance/ organic amendments: paper mill sludge, peat moss, sewage sludge/ oxidation processes: soil amendment magnification/ plant available water/ plant habitat requirements/ pore size distribution/ soil water potential/ sulfide mine tailings: fertilized/ sludge amended/ iron precipitation effects/ organic amendment effects/ oxidized/ penetrability/ porosity/ unaltered

Abstract: This paper evaluates the effects of organic amendments and iron precipitation on pore size distribution and mechanical resistance in sulphide mine tailings, as related to plant habitat requirements. Unaltered tailings, oxidised tailings collected from untreated, fertilized and sludge-amended plots in the field, and mixtures of unaltered tailings and organic amendments prepared in the laboratory, were analysed for pore size distribution. The organic amendments (sewage sludge, peat moss and paper mill sludge) were each applied at the rates of 0, 16 and 33% by volume. A difference in pore-size distribution between untreated and treated samples was shown in both field and laboratory samples. Both inorganic and organic amendments caused a decrease in pores holding water at soil water potentials -10 to -60 kPa, but increased the pores holding water at tensions below -60 kPa. This resulted in a decreased or unchanged content of plant available water (W_a) in all laboratory samples and in the fertilized field samples. Penetration studies in the field showed that additions of fertilizer, without any organic matter, had resulted in hard pans in the oxidised tailings that significantly increased the mechanical resistance in the surface horizon. Thus, this study indicates that the physical influence of the oxidation processes taking place in sulphide mine tailings can be magnified by additions of soil amendments. The aggregation of iron oxides and

negatively charged particles such as organic substances or phosphate anions may cement the tailings, which can result in impeded root growth.

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634. Effects of located application of papermill residues on crop yields and soil quality.

Cambouris, A. N.; Nolin, M. C.; and Simard, R. R.

In: *Proceedings of the 5th International Conference on Precision Agriculture*. Bloomington, Minnesota, USA.; pp. 1-16; 2001.

Descriptors: bulk density/ crop yield/ nutrients/ paper mill sludge/ porosity/ potatoes/ precision agriculture/ sandy soils/ soil density/ soil organic matter/ soil types/ sustainability/ topsoil/ water holding capacity/ wheat/ organic matter in soil/ precision farming/ site specific crop management/ soil quality

Abstract: Improving yield crops and maintaining soil quality are major concerns of sustainable agriculture. Sandy soils in intensive potato (*Solanum tuberosum*) production are very sensitive to soil organic matter (SOM) depletion. Low SOM contents in sandy soils often mean reduced water storage capacity, nutrient holding capacity, yield potential and high risks of water and wind erosion. A 24-ha field in Quebec City, Canada, was chosen for a precision agriculture study as the 1996 yield map showed a high spatial variability. Soyabean yields were spatially related to SOM content suggesting that SOM is linked with yield limiting factors. The objective of this study was to evaluate the efficiency of located application of five paper mill residues (PR) as a SOM source on tuber yield and soil quality. The PR were applied in May 1997 before planting at rates according to the initial SOM content (estimated by kriging): ≥5% (no PR applied), 4.0-4.9% (low rate), 3.0-3.9% (medium rate) and <3% (high rate). In 1997, PR application increased potato yields in areas of <3% SOM. In 1998, PR application had a positive residual effect on spring wheat (*Triticum aestivum*) yield. Improving trends were also observed one year after PR application on the topsoil bulk density, total porosity and water storage capacity but this was only significant for the high C/N PR applied at a high rate (<3% SOM). Precision application of PR is an efficient way to improve crop yields and the quality of these sandy soils.

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635. Effects of organic mulches on soil microfauna in the root zone of apple: Implications for nutrient fluxes and functional diversity of the soil food web.

Forge, T. A.; Hogue, E.; Neilsen, G.; and Neilsen, D.

Applied Soil Ecology 22(1): 39-54. (2003)

NAL Call #: QH541.5.S6 A67; ISSN: 0929-1393

Descriptors: apples/ composts/ diversity/ food webs/ hay/ lucerne/ lucerne hay/ microbial flora/ mineralization/ mulches/ nitrogen/ paper mill sludge/ phosphorus/ roots/ sewage sludge/ soil fauna/ alfalfa/ alfalfa hay/ Diplogasteridae/ fluxes/ microbial biomass/ microflora/ mulching materials

Abstract: A variety of organic materials (e.g. composts, paper recycling wastes, hay) can be used as in-row mulches in perennial horticultural cropping systems such as high density apple orchards. As organic materials with

variable properties, such mulches can be expected to have variable effects on structure of the soil food web and mineralization of N and P in the root zone. The overall objectives of this study were to: (1) assess the effects of a selection of organic mulches on the abundance of protozoa and nematode trophic groups; (2) use the model of Hunt et al. [See Biol. Fertil. Soils (1987) 3 393] to assess the implications of changes in microfaunal abundance for microbial turnover and N mineralization; and (3) determine effects of the mulches on nematode indicators of increased microbial production/turnover and functional diversity of the soil food web. Organic mulch treatments commenced in 1994 and included shredded office paper, municipal sewage sludge, shredded paper applied over municipal sewage sludge, shredded paper applied over municipal compost, lucerne hay, and black polyethylene fabric. The control was conventional tree-row weed management with glyphosate. Sewage sludge and municipal compost treatments were re-applied in 1997. Protozoan abundance was determined in 1998, 1999 and 2000. Nematode community structure was assessed in 1998, 1999, and twice in 2000. Nematode community parameters evaluated included: abundance of bacterivorous, fungivorous, omnivorous and predacious nematodes; abundance of the root-lesion nematode, *Pratylenchus penetrans*; absolute and relative abundances of enrichment opportunist nematodes *Rhabditidae*+*Diplogasteridae*+*Panagrolaimidae*; Simpson's diversity; evenness; and the indices of nematode community enrichment (EI) and structure (SI) described by Ferris et al. [See Appl. Soil Ecol. (2001) 18 13]. Measurements of the abundance of enrichment opportunists and the EI were evaluated as indicators of enhanced nutrient fluxes. Diversity and the SI were evaluated as indicators of changes in functional diversity of the soil food web. The abundance of protozoa and bacterivorous nematodes, and estimated fluxes of N and P through the microfauna, were greater under all combinations of sewage sludge or municipal compost and shredded paper than under the control and plastic mulch. The abundance of enrichment opportunist nematodes and the EI were also consistently greater under combinations of sewage sludge or municipal compost and shredded paper. The abundance of enrichment opportunists and EI were both also correlated with leaf P, providing additional evidence to support the use of these parameters as indicators of enhanced turnover of microbial biomass and nutrients. The SI was greatest under shredded paper and shredded paper applied over municipal compost, and least under municipal sewage sludge and lucerne hay. Population densities of *P. penetrans* were reduced under shredded paper mulch relative to the control and sewage sludge alone.

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636. Effects of paper mill sludge application on early growth of *Acer palmatum* thubn and soil physicochemical properties of forest nursery.

Park, H. and Lee, D. K.

Journal of Korean Society of Soil Science and Fertilizer 3(1): 39-45. (Mar. 1998); ISSN: 0367-6315.

Notes: 1 illu.; 4 tables; 17 ref. Summaries (En, Ko). Citation notes: KR (Korea-Republic-of).

Descriptors: paper mill sludge/ application/ early growth/ *Acer palmatum*/ soils/ forest nursery

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637. Effects of paper mill sludge on potassium, sodium, calcium, and magnesium concentrations in different soybean cultivars.

Yan XiangKui; Chang, K. W.; and Xu, H. L.

Pedosphere 15(1): 84-94. (2005)

NAL Call #: S590 .P43 ; ISSN: 1002-0160

Descriptors: calcium/ chemical composition/ cultivars/ magnesium/ paper mill sludge/ plant composition/ potassium/ sodium/ soil amendments/ soyabeans/ chemical constituents of plants/ cultivated varieties/ South Korea/ soybeans

Abstract: A field experiment was conducted on a sandy loam soil at an Experimental Farm in Taejon, South Korea, to determine the effects of paper mill sludge compost application rates on K, Na, Ca and Mg concentrations of soyabean (*Glycine max* (L.) Merr.) aboveground tissues and the genotypic effects on the concentrations of these elements. Sludge compost treatments of 0, 75, and 150 t ha⁻¹ were applied to 30 diverse soyabean cultivars. Concentrations of K, Na, Ca, and Mg in aboveground tissues harvested 69 days after planting (DAP) varied with the genotype and the application rate of paper-mill sludge compost, with the sludge compost application rate exerting stronger influence on these concentrations than the genotype. The magnitude of variation caused by both genotype and sludge compost application was in the order of Mg > K > Ca > Na. Significantly positive correlations were observed between K and Na (P<0.01), Na and Ca (P<0.05), and Ca and Mg (P<0.01). Also, the lower the sludge compost application rate, the larger the variation in the concentrations of K, Na, and Ca. From this several cultivars were identified for use as an accumulator for one or more of these elements.

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638. Effects of pulp fibre on soil physical properties and soil erosion under simulated rainfall.

Chow, T. L.; Rees, H. W.; Fahmy, S. H.; and Monteith, J. O. *Canadian Journal of Soil Science* 83(1): 109-119. (2003)

NAL Call #: 56.8 C162 ; ISSN: 0008-4271

Descriptors: application rates/ bulk density/ composting/ composts/ erosion/ erosion control/ heavy metals/ horizons/ loam soils/ macropores/ organic matter/ paper mill sludge/ runoff/ saturated hydraulic conductivity/ sediment yield/ soil amendments/ soil conservation/ soil density/ soil fertility/ soil physical properties/ soil types/ soil water content/ soil water movement/ soil water retention/ waste management/ waste utilization/ physical properties of soil

Abstract: Pulp fibre, a primary type of sludge of pulp and paper mills containing approximately 40% organic C, is usually disposed of in landfills causing a potential environmental problem. This material may be used as a soil amendment to restore the productivity of organic-matter-depleted potato-producing soils in Atlantic Canada. The effect of incorporating this material at rates equivalent to 0.5, 1.0, 2.0, and 4.0% organic matter in the plow layer of a gravelly loam soil on selected soil physical properties and soil erosion was evaluated. The objectives were to determine the effect of pulp fibre additions on selected soil

properties, which are pertinent to water retention and movement and to evaluate its effectiveness in reducing runoff and soil loss, major contributing processes to soil degradation. Chemical analysis of pulp fibre revealed that all heavy metal concentrations were well below allowable concentrations for Category A compost. One year after incorporation, bulk density of the Ap horizon had decreased with increasing rates of organic matter addition. On the other hand, the saturated hydraulic conductivity and specific moisture content increased with increasing rates of treatments. Results on water-stable aggregates revealed that the organic matter in the pulp fibre combined smaller aggregates to form larger aggregates, resulting in a larger proportion of macropores as compared to micropores. In the 4% organic matter treatment, a 27% increase was found in the 1.0 to 5.0 mm-diameter aggregates whereas a 23% reduction was found in aggregates smaller than 1.0 mm diameter. In spite of the higher specific moisture content of the organic-matter-treated soils, soil moisture content measured immediately prior to the erosion test indicated that field soil moisture contents were lower than those of the control. Time of runoff initiation, rates of runoff and soil loss were greatly improved with the amendments. The beneficial effects of the 4% organic matter treatment include 2.1 times delay in runoff initiation, and 23 and 71% reduction in runoff and soil loss, respectively. Although the beneficial effects in soil and water conservation are apparent, a minor drawback appears to be lower field soil moisture content. Large-scale implementation of the addition of this material in potato fields should proceed only with caution.

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639. Effects of soil on trace metal leachability from papermill ashes and sludge.

Xiao, C.; Ma, L. Q.; and Sarigumba, T.

Journal of Environmental Quality 28(1): 321-333. (1999)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: ash/ cadmium/ chromium/ copper/ leachates/ leaching/ lead/ metals/ paper mill sludge/ selenium/ soil/ soil amendments/ trace elements/ wastes/ zinc/ microelements

Abstract: Trace metal leachability from paper mill ashes (Ash 1 and Ash 2) and paper mill sludge (Sludge), and the effects of a soil on their leachability were determined by leaching the three paper mill residues packed on top of a soil in a column. The leachates were analysed for pH, electrical conductivity (EC), dissolved organic carbon (DOC), and concentrations of six metals (Cd, Cr, Cu, Pb, Se, and Zn). Ash 1 behaved significantly differently from Ash 2 during the leaching experiment, primarily due to its high pH and Na contents. Application of paper mill residues significantly increased the pH, EC, and DOC concentrations in leachates, with Ash 1 having significantly greater impacts than Ash 2 and sludge. Soil columns under alkaline leaching of Ash 1 appeared bleached due to the dissolution of solid-phase organic matter. Significant amounts of Zn were leached from all paper mill residues, whereas significant amounts of Cr, Se, and Cu were leached only in the Ash 1 treatments. The presence of a soil (especially a Bh horizon) generally enhanced metal leachability in the Ash 1 treatments due to the extremely high pH of Ash 1, whereas it decreased metal leachability in the Ash 2 and sludge treatments. Thus, organic matter enhances metal

sorption when present as a solid phase, but it increases metal leachability when present in dissolved form under alkaline conditions.

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640. Effects of soil on tree metal leachability from papermill ashes and sludge.

Xiao, C.; Ma, L. Q.; and Sarigumba, T.

Journal of Environmental Quality 28(1): 321-333. (Jan. 1999-Feb. 1999)

NAL Call #: QH540.J6; ISSN: 0047-2425 [JEVQAA]

Descriptors: leaching / land application/ soil chemistry/ forest soils/ paper mill sludge

Abstract: Understanding trace metal leachability is important for successful land application of papermill residues. Trace metal leachability from papermill ashes (Ash 1 and Ash 2) and papermill sludge (Sludge), and the effects of a soil on their leachability were determined by leaching the three papermill residues packed on top of a soil in a column. The leachates were analyzed for pH, electrical conductivity (EC), dissolved organic carbon (DOC), and concentrations of six metals (Cd, Cr, Cu, Pb, Se, and Zn). Ash 1 behaved significantly differently from Ash 2 during the leaching experiment, primarily due to its high pH and Na contents. Application of papermill residues significantly increased the pH, EC, and DOC concentrations in leachates, with Ash 1 having significantly greater impacts than Ash 2 and sludge. Soil columns under alkaline leaching of Ash 1 appeared bleached due to the dissolution of solid-phase organic matter. Significant amounts of Zn were leached from all papermill residues, whereas significant amounts of Cr, Se, and Cu were leached only in the Ash 1 treatments. The presence of a soil (especially a Bh horizon) generally enhanced metal leachability in the Ash 1 treatments due to the extremely high pH of Ash 1, whereas it decreased metal leachability in the Ash 2 and sludge treatments. Thus, organic matter enhances metal sorption when present as a solid phase, but it increases metal leachability when present in dissolved form under alkaline conditions.

This citation is from AGRICOLA.

641. Envirobed: An environmental outlet for papermill sludge.

Paper Technology 47(1): 11-12. (2006); ISSN: 0306252X [PATEE]

Descriptors: biodegradation/ cost effectiveness/ paper and pulp mills/ research and development management/ bedding materials/ envirosystems (co)/ farmers/ sewage sludge/ biodegradation/ cost effectiveness/ paper mills/ pulp mills/ sludge

Abstract: EnviroSystems of Lancashire, UK, has developed Envirobed from a two year research and development project. Envirobed is used as a bedding material for animals throughout the UK. The sludge is derived from Bridgewater and Shotton and processed at the Ceshire plant of EnviroSystems. Then it is treated in two stages and the process produces a soft adsorbent product which biodegrades easily and can be spread on land after use. It provides farmers with cost-effective alternative to traditional bedding.

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642. Environmental effects of deinking sludge application on soil and soil water quality.

Trepanier, L.; Gallichand, J.; Caron, J.; and Theriault, G. *Transactions of the ASAE* 41(5): 1279-1287. (Sept. 1998-Oct. 1998)

NAL Call #: 290.9 Am32T; ISSN: 0001-2351 [TAAEAJ]

Descriptors: land application/ soil types/ chemical analysis/ monitoring/ soil pollution/ waste utilization/ *Solanum tuberosum*/ *Hordeum vulgare* / crop yield/ application rate/ sludges

Abstract: The pulp and paper industry produces deinking sludge, a waste by-product rich in organic matter and potentially beneficial to agricultural soils. Field experiments were performed with deinking sludge and a mix of deinking and secondary (combined) sludge to measure the environmental impact associated with landspreading. Treatments consisted of three application rates of deinking (6, 12, and 18 dry t/ha) or combined sludge (8, 16, and 24 dry t/ha) associated with three rates of supplementary mineral nitrogen fertilizer, and a control plot. Chemical analyses of deinking and combined sludge indicated that no organic and inorganic contaminants were present at problematic levels, except for copper (191 microgram/g). Soil monitoring of the nutrients and heavy metals in experimental plots showed no significant difference ($p = 0.05$) between sludge treatments and the control after two years of sludge application. Monitoring of nitrate in the soil water indicated a linear relationship (p less than or equal to 0.08) with the additional nitrogen level. High sludge and low nitrogen application rates were associated with reduced nitrate concentration in the soil water. Detrimental environmental effects were not observed with deinking and combined sludge. Compared to the control, potato yield tended to decrease with deinking and combined sludge applications while barley yield increased with combined sludge applications.

This citation is from AGRICOLA.

643. Environmental risk assessment of heavy metal extractability in a biosludge from the biological wastewater treatment plant of a pulp and paper mill.

Pöykiö, R.; Nurmesniemi, H.; and Keiski, R. L.

Environmental Monitoring and Assessment 128(1-3): 153-164. (2007)

NAL Call #: TD194 .E5 ; ISSN: 01676369 [EMASD].

Notes: doi: 10.1007/s10661-006-9301-y.

Descriptors: extraction/ heavy metals/ paper mill/ pulp mill/ sequential extraction/ sludge/ biological sewage treatment/ environmental impact assessments/ environmental protection/ extraction/ heavy metals/ risk assessment/ sewage sludge/ biological wastewater treatment plant/ biosludge/ heavy metal extractability/ sequential extraction/ wastewater treatment/ acetic acid/ ammonium acetate/ arsenic/ barium/ cadmium/ calcium/ chromium/ cobalt/ copper/ heavy metal/ hydrogen peroxide/ hydroxylamine/ iron/ lead/ magnesium/ manganese/ nickel/ nitrogen/ phosphorus/ potassium/ sodium/ sulfur/ vanadium/ zinc/ environmental protection/ european union/ heavy metal/ pulp and paper industry/ risk assessment/ sludge/ waste treatment/ wastewater/ agriculture/ alkalinity/ concentration (parameters)/ controlled study/ dry weight/ electric conductivity/ environmental health/ environmental protection/ european union/ finland/ metal extraction/ oxidation/ paper industry/ ph measurement/ pulp mill/ risk

assessment/ sludge treatment/ soil quality/ solubility/ waste water treatment plant/ industrial waste/ metals, heavy/ risk assessment/ sewage/ textile industry/ water pollutants, chemical/ eurasia/ europe/ finland/ northern europe/ scandinavia

Abstract: A five-stage sequential extraction procedure was used to fractionate heavy metals (Cd, Cu, Pb, Cr, Zn, Fe, Mn, Ni, Co, As, V and Ba) in a biosludge from the biological wastewater treatment plant of Stora Enso Oyj Veitsiluoto Mills at Kemi, Northern Finland, into the following fractions: (1) water-soluble fraction, (2) exchangeable fraction, (3) easily reduced fraction, (4) oxidizable fraction, and (5) residual fraction. The biosludge investigated in this study is a combination of sludge from the primary and secondary clarifiers at the biological wastewater treatment plant. Extraction stages (2)-(4) follow the protocol proposed by the Measurements and Testing Program (formerly BCR Programme) of the European Commission, which is based on acetic acid extraction (stage 2), hydroxylamine hydrochloride extraction (stage 3), and hydrogen peroxide digestion following the ammonium acetate extraction (stage 4). The residual fraction (stage 5) was based on digestion of the residue from stage 4 in a mixture of HF + HNO₃ + HCl. Although metals were extractable in all fractions, the highest concentrations of most of the metals occurred in the residual fraction. From the environmental point of view, it was notable that the total heavy metal concentrations in the biosludge did not exceed the maximal allowable heavy metal concentrations for sewage sludge used in agriculture, set on the basis of environmental protection of soil by European Union Directive 86/278/EEC, and by the Finnish legislation. The Ca (98.6 g kg⁻¹; dry weight) and Mg (2.2 g kg⁻¹; dry weight) concentrations in the biosludge were 62 and 11 times higher than the typical values of 1.6 and of 0.2 g kg⁻¹ (dry weight), respectively, in arable land in Central Finland. The biosludge had a slightly alkaline pH (8.30), a high loss-on-ignition value (78%) and a liming effect of 10.3% expressed as Ca equivalents (dry weight). This indicates its potential as a soil conditioner and improvement agent, as well as a pH buffer. © Springer Science+Business Media B.V. 2006. © 2009 Elsevier B.V. All rights reserved.

644. Evaluation of paper sludge as organic fertilizer for the growth of ryegrass on a Belgian clay soil.

Demeyer, A. and Verloo, M.

Agrochimica 43(5/6): 243-250. (1999)

NAL Call #: 385 AG84; ISSN: 0002-1857

Descriptors: amendments/ application rates/ characteristics/ clay soils/ degradation/ extracts/ immobilization/ microbial degradation/ nitrate/ nitrogen/ nutrient content/ paper mill sludge/ plant composition/ responses/ sludges/ soil/ yields/ chemical constituents of plants

Abstract: A pot experiment examined the effect of application of increasing doses of primary paper sludge to a Belgian clay soil on the yield and nutrient content of ryegrass (*Lolium perenne*). Results showed that high amounts of N were immobilized from the microbial degradation of sludge inducing a yield decrease. Nitrate accumulation in the plant and NO₃ concentration in the soil extract decreased with increasing doses of sludge. Reproduced with permission from the CAB Abstracts database.

645. Evaluation of the soil organic matter dynamics model MOTOR, for predicting N immobilization/mineralization following field incorporation of paper mill sludge in a horticultural soil.

Vinten, A. J. A.; Martin Olmedo, P.; Sattar, S.; Kuikman, P. J.; and Whitmore, A. P.

In: Sustainable Management of Soil Organic Matter/ Rees, R. M.; Ball, B. C.; Campbell, C. D.; and Watson, C. A. Wallingford (United Kingdom): CABI, 2001; pp. 126-134.

Descriptors: soil organic matter/ N-immobilization/ N-mineralization/ paper mill sludge/ horticultural soils

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646. Evaluation of traditional windrow-composting and vermi-composting for the stabilization of waste paper sludge (WPS).

Short, J. C. P.; Frederickson, J.; and Morris, R. M. *Pedobiologia* 43(6): 735-743. (1999)

NAL Call #: 56.8 P343 ; ISSN: 0031-4056

Descriptors: biomass/ capacity/ coir/ comparisons/ composting/ cultivation/ evaluation/ mortality/ nitrate/ nitrogen/ nutrients/ nutritive value/ paper mill sludge/ properties/ radishes/ sludges/ stabilization/ stabilizing/ vermicomposting/ waste paper/ wastes/ Britain/ Capparales/ coconut fibre/ death rate/ *Dendrobaena veneta*/ nutritional value/ plant growth/ quality for nutrition/ United Kingdom

Abstract: Trials evaluating the processing of a waste paper sludge (WPS) using a traditional windrow-composting system, and a modular vermicomposting unit (VCU) system are described. The VCU system utilized the earthworm *Dendrobaena veneta* at near carrying capacity. Both composting processes produced good levels of stabilization in WPS after 8 weeks. Windrow-composting achieved a 70.4% reduction in volatile solids, significantly more than the VCU system, which achieved a 52.7% reduction ($P < 0.01$). This was reflected in total-fibre contents of 37.2% for windrow-composted WPS, significantly lower than 43.8% observed for VCU-composted WPS ($P < 0.05$). A total nitrogen loss of 41.3% in the VCU-composted WPS was significantly lower than the 70% loss observed for windrow-composted WPS ($P < 0.05$). VCU-composted WPS resulted in a product much higher in water-soluble (available) nutrients, especially nitrate ($P < 0.001$). A mean increase in earthworm biomass of 36.6%, with a mean mortality of 22.3%, occurred in the VCU system, indicating the high nutritional value of WPS for *D. veneta* cultivation. Radish plant growth trials using the final, matured, windrow-composted WPS showed significantly higher levels of plant growth than for VCU-composted WPS ($P < 0.05$), although plant growth increased significantly when VCU-composted WPS was diluted with coir ($P < 0.01$). Although both composting systems proved technically suitable for processing WPS, they are clearly different processes. These differences are reflected in the unique properties of composted WPS products, the implications of which require further investigation.

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647. Evidence of sequential decay in recycled paper sludge and pig manure mixtures.

Hobbs, P. J.; Johnson, R.; and Chadwick, D. *Animal, agricultural and food processing wastes. Proceedings of the Eighth International Symposium, Des Moines, Iowa, USA, 9-11 October, 2000.* 2000; 321-328(2000)

Descriptors: animal manures/ animal wastes/ conferences/ decay/ paper mill sludge/ pig manure/ pollution control/ pulps/ storage/ storage decay/ storage life/ deterioration in storage/ livestock wastes

Abstract: Recycled paper sludge was added to fresh pig slurry to monitor biochemical changes and to assess this approach as means of reducing the potential of pig slurry to pollute while in storage. Complex decay patterns emerged, some of which occurred at set times and independent of the ratio of the mixtures used, although higher storage temperature gave larger concentrations of decay products. Concentrations of acetic and propanoic acid peaked simultaneously through the study and products of proteolysis which were the branched chain VFAs, phenols and indoles peaked later, but less at lower storage temperatures. After maximum concentrations of VFAs at about 10 and 70 to 100 days, increasing amounts of ammoniacal N were observed with a subsequent increase of pH. Plant material appeared to be digested before proteolysis occurred, with the latter being temperature dependent. Recycled paper sludge reduced the soluble phosphate concentration and ammonia emissions from pig slurry. Explanations of sequences of decay and the time of sampling and volume of the experimental vessel in relationship to microbial communities are proposed. Reproduced with permission from the CAB Abstracts database.

648. Examination of environmental quality of raw and composting de-inking paper sludge.

Beauchamp, C. J.; Charest, M. H.; and Gosselin, A. *Chemosphere* 46(6): 887-895. (2002)

NAL Call #: TD172 .C54; ISSN: 0045-6535

Descriptors: aromatic hydrocarbons/ arsenic/ boron/ cadmium/ chemical composition/ chromium/ cobalt/ composting/ composts/ dioxins/ fatty acids/ furans/ halogenated hydrocarbons/ lead/ manganese/ mercury/ molybdenum/ naphthalene/ nickel/ nitrogen/ paper mill sludge/ phosphorus/ polluted soils/ polychlorinated biphenyls/ polycyclic hydrocarbons/ potassium/ resin acids/ selenium/ soil amendments/ soil pollution/ soil types/ waste paper/ zinc/ Mn/ Mo/ PCBs/ polycyclic aromatic hydrocarbons/ soil quality

Abstract: Paper sludges were traditionally landfilled or burned. Over the years, the use of paper sludges on soils has increased, as well as the concerns about their environmental effects. Therefore, the chemical characterization of paper sludges and their young (immature) compost needed to be investigated, and over 150 inorganic and organic chemicals were analysed in de-inking paper sludge (DPS). In general, nitrogen, phosphorus and potassium contents were low but variable in raw DPS and its young compost. The contents of arsenic, boron, cadmium, cobalt, chromium, manganese,

mercury, molybdenum, nickel, lead, selenium, and zinc were also low and showed low variability. However, the copper contents were above the Canadian compost regulation for unrestricted use and required a follow-up. The fatty- and resin acids, and polycyclic aromatic hydrocarbons were the organic chemicals measured at the highest concentrations. For resinic acids, care should be taken to avoid that leachates reach aquatic life. For polycyclic aromatic hydrocarbons, naphthalene should be followed until soil content reaches 0.1 micro g g⁻¹, the maximum allowed for soil use for agricultural purposes according to Canadian Environmental Quality Guidelines. In young compost, the concentration of these chemical families decreased over time and most compounds were below the detection limits after 24 weeks of composting. In raw DPS, among the phenol, halogenated and monoaromatic hydrocarbons, dioxin and furan, and polychlorinated biphenyl families, most compounds were below the detection limits. The raw DPS and its young compost do not represent a major threat for the environment but can require an environmental follow-up. Reproduced with permission from the CAB Abstracts database.

649. Examination of the contaminants and performance of animals fed and bedded using de-inking paper sludge.

Beauchamp, C. J.; Boulanger, R.; Matte, J.; and Saint Laurent, G.

Archives of Environmental Contamination and Toxicology 42(4): 523-528. (2002); ISSN: 0090-4341

Descriptors: aluminium/ broilers/ copper/ litter/ paper mill sludge/ polycyclic hydrocarbons/ poultry/ tissue distribution/ aluminum/ chickens/ domesticated birds/ hogs/ swine

Abstract: In the noncereal-producing areas, there is not enough straw to supply the amount required for animal bedding. However, pulp and paper mills produce tonnes of wood fibre wastes, including de-inking paper sludge (DPS), in which most toxic compounds are at their detection limit. Among the detected compounds in DPS, aluminium, copper and polycyclic aromatic hydrocarbons (PAHs) are present and were selected as model molecules. In this context, broilers were submitted to a diet containing 0, 5, and 10% of their ration as DPS. In addition, broilers and pigs were grown on de-inking paper sludge and wood shavings beddings. The presence of aluminium and copper were evaluated in blood and bones, whereas the presence of PAHs was evaluated in fat, liver, meat and urine or blood of broilers and pigs. Animal performances were also investigated. DPS bedding did not increase aluminium or copper contents of blood or bones or PAHs in animal tissues. Animal performances and health were similar on DPS and wood shaving beddings. Using DPS as bedding material provides an integrated source of disposal of DPS and animal manure.

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650. Experiences with the utilization of wastes in nursery potting mixes and as field soil amendments.

Chong, C.

Canadian Journal of Plant Science 79(1): 139-148. (1999)
NAL Call #: 450 C16; ISSN: 0008-4220

Descriptors: animal wastes/ apple pomace/ bark/ composting/ food/ growing media/ industrial wastes/

marginal land/ mushroom compost/ organic wastes/ ornamental plants/ paper mill sludge/ plant residues/ planting stock/ refuse compost/ rehabilitation/ research/ reviews/ shade trees/ soil amendments/ trees/ wood chips/ woody plants/ livestock wastes/ nursery plants / nursery stock/ ornamentals/ planting materials/ potting composts/ rooting media/ studies/ town compost

Abstract: The nursery/landscape industry has been one of the fastest growing agricultural sectors in Canada. Since the 1980s, the Ornamental Nursery Research Program at the Horticultural Research Institute of Ontario (HRIO) has been conducting research which focuses on environmentally friendly production practices. Emphasis is on the use of composted or uncomposted organic wastes as amendments in container potting mixes. The results of the research programme are reviewed. Various projects have evaluated mixes derived from wastes such as spent mushroom compost, paper mill sludge, apple pomace, and various types of barks. In the late 1980s and early 1990s, the scope of the research expanded to include composting and a wider assortment of wastes such as waxed corrugated cardboard, municipal solid waste compost, wood chips from pallets and furniture and demolition wastes, food wastes, and organic fertilizers manufactured from meat by-products, and selected industrial wastes. Presently, paper mill sludge is being evaluated as a field soil amendment for growing nursery shade trees and also for use in rehabilitating marginal, non-agricultural land. Reproduced with permission from the CAB Abstracts database.

651. Experiences with wastes and composts in nursery substrates.

Chong, C.

HortTechnology 15(4): 739-747. (2005)

NAL Call #: SB317.5.H68; ISSN: 1063-0198

Descriptors: agricultural wastes/ animal manures/ composts/ container grown plants/ growing media/ industrial wastes/ nurseries/ organic amendments/ paper mill sludge/ plant residues/ refuse/ wastes/ farm wastes/ municipal wastes/ potting composts/ rooting media/ trash

Abstract: During the past 20 years, the Ornamental Nursery Research Program at the former Horticultural Research Institute of Ontario (now part of the University of Guelph) has been conducting applied research dealing with environmentally friendly and sustainable nursery production practices with emphasis on container production. The use of farm, industrial, and consumer waste by-products as amendments in nursery substrates has been a major focus. The program has evaluated hundreds of potting mixes derived from individual or combined, raw or composted waste by-products including spent mushroom compost, turkey litter compost, paper mill sludge, municipal waste compost, corrugated cardboard, apple pomace, wood chips from pallets, pulverized glass, and various types of tree barks. With few exceptions, all the above waste by-products tested under our cultural conditions provided acceptable to excellent container-growing media, often in amounts exceeding 50% and sometimes up to 100% by volume in No. 2 containers (6 L), even despite initially elevated and potentially toxic contents of soluble salts [expressed in terms of electrical conductivity measured up to 8.9 dS.m⁻¹ in 1 substrate: 2 water (by volume) extracts] in many of the substrates. A key to these successful results

is that salts leach quickly from the containers to benign levels (~1.0 dS.m⁻¹) with normal irrigation practices. High initial pH in most waste-derived substrates (up to 8.9) has had little or no discernible effect on growth of a wide assortment of deciduous nursery species. By-products such as paper mill sludge and municipal waste compost with soluble salts contents typically ranging from 0.8 to 2.0 dS.m⁻¹, also provide acceptable rooting media provided salts are leached before use to values <=0.2 dS.m⁻¹. The porosity and aeration characteristics of waste-derived substrates tend to be comparable to, or better than, those of bark.

Reproduced with permission from the CAB Abstracts database.

652. Exploring the value of sludge.

Lagace, Pascale; Steinback, Brian; Bourdages, Gaetan; and Levis, Cathy. Vol. Pt B. Montreal, Can: CPPA; 1998.

Notes: Chapter Number: Montreal, Canada

Conference code: 48341.

Descriptors: composting/ cost effectiveness/ costs/ drying/ economic and social effects/ land fill/ sewage sludge/ sludge disposal/ waste incineration/ anaerobic conditioning/ sludge dryer/ sludge management/ paper and pulp mills

Abstract: Abitibi-Price performed an evaluation of the sludge management practices for six mills with activated sludge treatment systems to identify which mills could best benefit from capital spending for sludge management, and how it should be used to provide the greatest company-wide benefit. The effluent treatment and sludge dewatering systems, as well as the sludge disposal methods were reviewed at each mill in order to identify ways of reducing operating costs and environmental liabilities. The sludge management alternatives evaluated included combinations of improved dewatering, drying, combustion, agricultural or silvicultural land spreading, composting and landfilling. As part of the project, anaerobic conditioning, a new, low-cost technology to reduce biological sludge production, was also reviewed. The various sludge management options were evaluated on the basis of return on investment, long-term sustainability, social impact and technological feasibility. The best options for each mill were selected using criteria developed for the specific mill. These options were then compared overall to determine which opportunities presented the greatest benefit to the company and should be explored further. Two projects were selected for more detailed study: the anaerobic conditioning project at Alma and the installation of a sludge dryer at the Beupre mill.

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653. Growing substrates amended with raw or composted paper mill primary sludge.

Dubsky, M and Sramek, F

Zahradnictvi Horticultural Science. 1999; 26(3): 103-106(1999)

Descriptors: bark/ chrysanthemums/ composts/ growing media/ nutrient deficiencies/ ornamental herbaceous plants/ ornamental plants/ paper mill sludge/ peat/ plant nutrition/ pot plants/ Balsaminales/ *Dendranthema morifolium*/ ornamentals/ potting composts/ rooting media/ Saxifragales

Abstract: Peat-bark growing substrates amended with 33.3% by volume of paper mill primary sludge, raw or composted with decomposed bark (3 or 6 weeks), were

tested in experiments in 1998 with 3 pot plant species (New Guinea Impatiens, *Dendranthema grandiflora* [D. morifolium] and *Kalanchoe blossfeldiana*). As a control, peat-bark substrate was used. All prepared substrates had suitable physical and chemical properties; the substrates with primary sludge were only higher in pH and in calcium content. Tested plant species did as well in the substrates with composted primary sludge as in the control substrate. However, in the substrate with raw primary sludge, growth retardation and nutrient deficiency symptoms were observed in Impatiens. The experiments with all 3 species showed the possibility of using paper mill primary sludge as a substrate component after composting with decomposed bark for at least 3 weeks.

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654. Growth and nutrient concentrations in the lettuce tissue by lime and paper residues application in an acid soil.

Balbinot Junior, A. A.; Torres, A. N. L.; Fonseca, J. A. da; and Teixeira, J. R.

Revista de Ciencias Agroveterinarias 5(1): 9-15. (2006); ISSN: 1676-9732.

Notes: Original title: Crescimento e teores de nutrientes em tecido de alface pela aplicacao de calcario e residuos de reciclagem de papel num solo acido.

Descriptors: acid soils/ application rates/ application to land/ biomass/ boron/ cadmium/ calcium/ chromium/ copper/ growth/ heavy metals/ iron/ lead/ lettuces/ lime/ liming/ magnesium/ manganese/ mercury/ mineral content/ nickel/ nitrogen/ nutrient content/ organic amendments/ paper mill sludge/ phosphorus/ plant composition/ plant tissues/ potassium/ sodium/ soil acidity/ soil amendments/ soil types/ sulfur/ waste utilization/ zinc/ chemical constituents of plants/ elemental sulphur/ land application/ Mn/ sulphur

Abstract: The residues produced by paper recycling industries, commonly known as paper mill sludge, present some constituents that can correct soil acidity and act as nutrients source, mainly calcium. However, these residues may also have heavy metals, which can cause environmental impact. The aim of this work was to evaluate the effect of different rates of lime and two kinds of recycling paper industry residues on the growth and mineral composition (nutrients and heavy metals) of lettuce tissue. The effect of lime and two kinds of recycling paper industry residues, applied in five doses, on lettuce dry mass and lettuce tissue levels of nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, copper, zinc, iron, manganese, sodium, boron, cadmium, chromium, nickel, lead and mercury were evaluated. The application of lime and two kinds of recycling paper industry residues increased lettuce dry mass and did not affect lettuce tissue levels of nutrients and heavy metals concentration.

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655. Growth of corn in varying mixtures of paper mill sludge and soil.

O' Brien, T. A.; Herbert, S. J.; and Barker, A. V.

Communications in Soil Science and Plant Analysis 33(3-4): 635-646. (2002)

NAL Call #: S590.C63; ISSN: 0010-3624 [CSOSA2]

Descriptors: Zea mays / seed germination/ seedling emergence/ dry matter accumulation/ nitrogen content/ phosphorus/ nutrient content/ nitrogen fertilizers

Abstract: To evaluate different levels of paper mill sludge as a soil amendment for the production of corn (*Zea mays* L.), sludge was added to 15-cm pots of soil in a greenhouse experiment. Mixtures were made from paper mill sludge (0 to 560 Mg ha⁻¹ wet weight) mixed with field soil (Hadley fine sandy loam with coarse, mixed, mesic, Fluventic, Dystrochrept deposits). Nitrogen (N) was added as ammonium nitrate at 0 or 200 kg N ha⁻¹. Eight corn seeds of 'Pioneer Max 21' were seeded into each pot immediately after mixing the paper mill sludge and soil or at 21 days after mixing the media. Seven days after sowing, seedlings were counted in each pot to assess germination (emergence). Delaying of sowing of seeds for 21 days increased the number of seeds that germinated. Corn plants were harvested after 35 days of growth. Plant biomass declined as amounts of sludge increased. Adding N and delaying sowing for 21 days produced the greatest amount of dry mass. Tissue (leaf) total N decreased with increasing amounts of sludge. Addition of N to the mixtures increased the average total N in corn leaves. However, leaf total N still decreased with increasing amounts of sludge added even if N at 200 kg ha⁻¹ was added to the media. Sowing immediately after setup showed the highest leaf total N if no sludge was added to the mixture. Sowing immediately after setup of the experiment and adding paper mill sludge at 560 Mg ha⁻¹ produced the lowest total N in corn leaves. Generally, the phosphorus (P) concentration in plants increased as the amount of paper sludge increased, but the increase was less with N added than in treatments without N added. At 21 days, carbon:nitrogen, pH, and salinity of the media declined relative to the initial values. Total N in the media was higher after a 21-day delay than immediately after setup. Organic matter content increased with increasing amounts of paper sludge. Results indicated that addition of paper sludge to soil increased media organic matter and P contents. Germination was hindered when seeds were sown immediately after setup of the experiment, but delaying seeding for 21 days eliminated the germination problem. Nitrogen deficiency was problematic, and more than 200 kg ha⁻¹ of supplemental N is recommended to overcome immobilization of N. This citation is from AGRICOLA.

656. Growth of evergreen shrubs in potting mixes made with de-inked paper sludge.

Tripepi, Robert R. and George, Mary W.

In: 97th Annual International Conference of the American Society for Horticultural Science. Lake Buena Vista, Florida, USA.; Vol. 35(3): 429.; 2000.

NAL Call #: SB1.H6

Descriptors: horticulture/ waste management: sanitation/ Coniferopsida: gymnosperms, plants, spermatophytes, vascular plants/ Ericaceae: angiosperms, dicots, plants, spermatophytes, vascular plants/ Rosaceae: angiosperms, dicots, plants, spermatophytes, vascular plants/ de-inked paper sludge: potting mix/ plant growth: biomass, height, width

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657. Impact of de-inking paper sludge on crop yields and soil fertility.

Baziramakenga, R. and Simard, R. R.

In: 1999 Annual Meeting of the Canadian Society of Soil Science. Charlottetown, Prince Edward Island, Canada.; Vol. 79(4); pp. 640; 1999.

NAL Call #: 56.8 C162

Descriptors: Horticulture/ Agriculture/ Nutrition/ Waste Management: Sanitation/ Soil Science/ Leguminosae: Angiosperms, Dicots, Plants, Spermatophytes, Vascular Plants/ Crop Yield/ De-Inking Paper Sludge: Soil Amendment/ Environmental Safety/ Soil Fertility/ Abstracts © Thomson Reuters

658. Impact of industrial effluents on soil health and agriculture. Indian experience: Part I. Distillery and paper mill effluents.

Chhonkar, P. K.; Datta, S. P.; Joshi, H. C.; and Pathak, H.

Journal of Scientific and Industrial Research 59(5): 350-361. (2000)

NAL Call #: 475 J82; ISSN: 0022-4456

Descriptors: application to land/ chemical composition/ distillery effluent/ effluents/ irrigation water/ paper mill sludge/ rivers/ soil amendments/ soil properties/ waste water/ land application

Abstract: In India, a large amount of waste water generated from distillery and paper industries is discharged on land or into the running water. Distillery waste water is characterized by low pH, high BOD [biochemical oxygen demand] and COD [chemical oxygen demand] values and contains a high percentage of organic and inorganic materials. This waste water also contains considerable amounts of elements like N, P, K, Ca and S. The paper mill effluents are characterized by high values of BOD, COD and wide range of pH, depending upon the source of origin. The N, P and K contents are lower as compared to those in distillery waste waters. Impact of use of these effluents on soil, plant and waterbodies is discussed. Use of distillery effluents indicates a significant increase in electrical conductivity, organic carbon, exchangeable Na as well as available N, P and K in soils. Similarly, pH, organic carbon, cation-exchange capacity, available N, P, K and micronutrient contents of soils irrigated with paper factory effluents are reported to be increased. Besides, the use of this waste water increases the exchangeable Na content of soils. Some of the field crops show positive response to post-methanation effluent application with irrigation water. Paper mill effluents are found to adversely affect the seed germination and seedling growth of various crops, whereas, these aspects of crops are stimulated due to the application of these effluents after proper dilution. Increase in organic load, depletion of oxygen content and destruction of aquatic life in water course are some of the major problems created due to disposal of these effluents in river. Methods of control and treatment of these effluents are indicated. Manurial potential, strategies and constraints of utilization of these industrial effluents in agriculture are mentioned. Reproduced with permission from the CAB Abstracts database.

659. Impact of paper mill effluent on seed germination and seedling growth of phaseolus aureus cv. Pant m -4.

Kumar, S.

Flora and Fauna (Jhansi) 11(2): 189-193. (Dec. 2005); ISSN: 0971-6920

Descriptors: effluents/ fauna/ germination/ growth/ industrial wastewater/ inhibition/ pulp and paper industry/ seedlings/ seeds

Abstract: The study was carried out to see the impact of paper mill effluent on germination percentage and seedling growth of *Phaseolus aureus* cv. Pant M-4. The studies were done with different concentrations of effluent. The results showed that lower concentration was in favour of germination and seedling growth while there was gradual decrease in germination and seedling growth on higher concentration. The maximum inhibition both in seed germination and seedling growth was found in pure effluent. Abstract reproduced from the Water Resources Abstracts database with permission from ProQuest LLC. © 2007 ProQuest LLC; all rights reserved. Further reproduction is prohibited without permission.

660. Impact of paper mill industry effluent on germination and early growth performance of some medicinal plants.

Sandhya Sharma and Kavita Tyagi

Plant Archives 7(1): 261-263. (2007); ISSN: 0972-5210

Descriptors: industrial effluents/ industrial wastes/ medicinal plants/ paper mill sludge/ roots/ seed germination/ seedling growth/ seedlings/ seeds/ shoots/ soil amendments/ waste management/ waste utilization/ drug plants/ medicinal herbs/ officinal plants/ *Solanum virginianum*

Abstract: This paper summarizes the effects of various concentrations of the paper mill effluent on seed germination and seedling growth of *Calotropis procera* and *Solanum xanthocarpum*. The effluent samples were collected from Pragati Paper Mill Industry Pvt. Ltd., Site-IV, Sahidabad, Uttar Pradesh, India, and diluted to 25, 50 and 100%. The germination was completely inhibited in 100% concentration upto 7th day but slight germination and seedling growth was observed in both the plants on 9th day after sowing. The findings also revealed that the shoot length, root length, fresh weight and dry weight of the selected medicinal plants were maximum in 25% effluent concentration on 5th, 7th and 9th day but not more than control.

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661. Impact of paper mill treated effluent irrigation and solid wastes amendment on the productivity of cumbu napier (co. 3): A field study.

Devakumari, M. S. and Selvaseelan, D. A.

Asian Journal of Experimental Sciences 22(3): 285-293. (2008); ISSN: 0971-5444

Descriptors: effluents/ fodder/ grasses/ impaired water use/ industrial wastewater/ pulp and paper industry/ solid wastes/ wastewater irrigation/ yield

Abstract: In this investigation productivity of Cumbu Napier (CO- 3) fodder grass under effluent irrigation and solid waste application was evaluated. The field experiment with solid waste incorporation coupled with effluent irrigation for Cumbu Napier grass revealed that effluent irrigation increased the biomass yield of the grass by 7.35 % in the second harvest and 10.35 % in the third harvests over well water irrigation, even though, lower yield was obtained in the first harvest due to initial establishment problem under effluent irrigation. This suggests that growing Cumbu Napier grass under treated paper mill effluent for enhanced

fodder production to support dairy units is a viable option which needs a positive consideration. The increase in grass biomass yield under I_2T_4 (Effluent irrigation coupled with Fly ash 10 t ha^{-1} + Bio sludge 6 t ha^{-1} + 75% NPK over I_1T_1 (100% NPK) was 44.7 percent during II cutting and 52.6 percent in III cutting. The soil available N, and organic carbon were also significantly the highest under Fly ash 10 t ha^{-1} + Bio sludge 6 t ha^{-1} + 75% NPK treatment as compared to 100% NPK alone.

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662. Impact of potato-cereal rotations and slurry applications on nitrate leaching and nitrogen balance in sandy soils.

Gasser, M. O.; Laverdiere, M. R.; Lagace, R.; and Caron, J. *Canadian Journal of Soil Science* 82(4): 469-479. (2002)

NAL Call #: 56.8 C162 ; ISSN: 0008-4271

Descriptors: arable soils/ barley/ cattle manure/ crop production/ environmental impact/ groundwater/ groundwater pollution/ leaching/ nitrate/ nitrogen balance/ nitrogen fertilizers/ nutrient uptake/ oats/ paper mill sludge/ pig slurry/ potatoes/ risk assessment/ rotations/ sandy soils/ soil types/ water quality/ wheat/ crop rotation/ environmental effects/ rotational cropping/ water composition and quality

Abstract: Groundwater quality is at risk when high levels of N fertilizers are used on sandy soils. A monitoring programme was initiated in the summer of 1995, to quantify nitrate leaching in sandy soils used for potato production near Quebec City, Canada. Three drainable lysimeters were installed in each of five fields, for a total of 15 lysimeters. During a 5-year monitoring period, crop N uptake, mineral and organic N fertilizers use, nitrate concentrations and fluxes from drainage water at 1-m soil depth were assessed under potato, cereal and hay crops. In one field, a clover and timothy sod that received low mineral N fertilizer inputs generated the lowest annual nitrate leaching losses ranging from 7 to 20 kg $\text{NO}_3\text{-N ha}^{-1}$. High nitrate leaching losses ($116 \pm 40 \text{ kg N ha}^{-1}$) were measured under potato crops receiving high mineral N fertilizer inputs. Cereals, including barley and wheat receiving moderate mineral N fertilizer inputs and in some instance N from pig slurry, dairy cow manure or paper mill sludge, also generated high nitrate leaching losses ($88 \pm 45 \text{ kg N ha}^{-1}$). Only sod and oat crops generated annual flux averaged nitrate concentrations lower than 10 mg $\text{NO}_3\text{-N litre}^{-1}$, the accepted standard for drinking water, while higher concentrations, ranging from 13 to 52 mg $\text{NO}_3\text{-N litre}^{-1}$, were recorded under barley, wheat and potato crops receiving moderate to high amounts of mineral N fertilizer. Nitrate flux concentrations were moderate during the cropping season (May-August), highest in autumn (September-December) and lowest in the winter-early spring period (January-April). After 5 years of survey, use of pig slurry and paper mill sludge in potato-cereal crop rotations (51 to 192 kg N ha^{-1} per year) with mineral N fertilizers (103 to 119 kg N ha^{-1} per year) resulted in nitrate leaching losses (87 to 132 kg N ha^{-1} per year), at least 20 kg N ha^{-1} more than N exported by crop at harvest. More than 60% of N applied as pig slurry seemed to be unaccounted for in the partial N balance that included crop N uptake and nitrate leaching, suggesting that

important losses probably occurred through ammonia volatilization, denitrification, or N immobilization in soil organic matter and crop residues.
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663. Impact of raw and composted paper mill sludge on potato disease incidence.

Stone, A. G.; Stevenson, W. R.; James, R. V.; and Cooperband, L. R.

In: Annual Meeting of the American Phytopathological Society. Montreal, Quebec, Canada.; Vol. 89 (6 Suppl.); pp. S75-S76; 1999.

Descriptors: horticulture: agriculture/ infection/ pest assessment control and management/ enterobacteriaceae: bacteria, eubacteria, microorganisms/ solanaceae: angiosperms, dicots, plants, spermatophytes, vascular plants/ aerial black leg/ bacterial disease/ early blight/ fungal disease/ silver scurf/ fungal disease/ paper mill sludge: composted material, raw material, disease impact/ meeting abstract

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664. Improvement of soil properties and fruit yield of native lowbush blueberry by papermill sludge addition.

Gagnon, B.; Simard, R. R.; Lalande, R.; and Lafond, J.

Canadian Journal of Soil Science 83(1): 1-9. (2003)

NAL Call #: 56.8 C162 ; ISSN: 0008-4271

Descriptors: acid phosphatase/ application rates/ arylsulfatase/ chemical composition/ crop yield/ enzyme activity/ fertilizers/ fruits/ leaching/ manganese/ nitrate nitrogen/ paper mill sludge/ phosphorus/ Podzols/ soil amendments/ soil chemical properties/ soil composition/ soil enzymes/ soil fertility/ soil pH/ waste management/ waste utilization/ acid phosphomonoesterase/ arylsulphatase/ chemical properties of soil/ inorganic nitrogen/ Mn

Abstract: Combined primary and secondary papermill sludge (PS) is a good potential source of C and other nutrients to restore low organic matter sandy soils supporting native lowbush blueberry (*Vaccinium angustifolium* Ait.). A 3-yr field study was conducted to compare the effect of PS with mineral fertilizers (MF) on the blueberry yield and soil chemical properties and enzyme activities of a l'Afrique sand (Humo-Ferric Podzol) in the Saguenay-Lac Saint-Jean area (Quebec, Canada). The PS was applied in the spring of the sprout year at 0, 8.5, 17 and 34 Mg ha⁻¹ and MF was applied at 0, 13, 26 and 52 kg N ha⁻¹. The highest fresh fruit yields were obtained at 8.5 and 17 Mg PS ha⁻¹. The 34 Mg PS ha⁻¹ treatment produced berry yield comparable to the control. This PS rate reduced pH, but increased inorganic N, Mehlich-3 extractable P and Mn in the 0- to 15-cm soil layer. The NO₃-N content of the 15- to 30-cm and 30- to 60-cm soil layers was also increased by PS, suggesting leaching. The MF significantly affected soil inorganic N content only at 3 wk after its application in the first year. The PS rate linearly increased the soil acid phosphatase activity in the first year. The arylsulfatase activity was also higher in PS than in MF treatment, but was severely depressed by 34 Mg PS ha⁻¹ in the last 2 yr. This study indicated that PS, when used at low rates, improves lowbush blueberry yield and the soil enzyme activity on this low fertility sand.

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665. Incorporation of organic residues to peat-lite substrates for production ofimpatiens and gernaniums.

Gauthier, Fabienne; Gagnon, Serge; and Dansereau, Blanche

Canadian Journal of Plant Science 78(1): 131-138. (1998)

NAL Call #: 450 C16; ISSN: 0008-4220

Descriptors: Horticulture: Agriculture/ Balsaminaceae: Angiosperms, Dicots, Plants, Spermatophytes, Vascular Plants/ Geraniaceae: Angiosperms, Dicots, Plants, Spermatophytes, Vascular Plants/ subirrigation: irrigation method/ Crop Industry/ Composted Waste/ Growth/ Peat Moss/ Peat Lite Substrate/ Water Treated Sludge

Abstract: During winter 1994 and spring-summer 1994, seedlings of *Impatiens wallerana* 'Accent Coral' and *Pelargonium X hortorum* 'Orbit Hot Pink' were grown in a commercial substrate (PRO-MIX 'BX') or in one of 24 substrates composed of perlite (35% by volume), peat moss and of six organic residues (composted water-treated sludge, forestry compost, fresh or composted used peat extracted by biofilter during treatment of municipal water, and fresh or composted paper sludge). The purpose of the study was to determine the maximal proportion of these residues to be incorporated into a peat substrate to obtain quality plants. Growth parameters (growth index, top dry weight, and visual quality) generally decreased with increasing proportion (5, 10, 25 or 40% per volume). During the winter experiment, growth of control plants was superior to growth of plants grown in substrates composed of residues. An incorporated proportion of 25% per volume was shown to be maximal for the production of *impatiens* and *geraniums*.

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666. The increase of iron phytoavailability in soils ammended with paper mill sludge.

Calace, N.; Croce, G.; Petronio, B. M.; and Pietroletti, M.

Annali Di Chimica 96(3-4): 137-145. (2006)

NAL Call #: 385 AN7 ; ISSN: 00034592 [ANCRA].

Notes: doi: 10.1002/adich.200690014.

Descriptors: iron/ atomic absorption spectrometry/ barley/ bioavailability/ conference paper/ metabolism/ plant root/ sensitivity and specificity/ sewage/ soil/ textile industry/ biological availability/ hordeum/ iron/ plant roots/ sensitivity and specificity/ sewage/ soil/ spectrophotometry, atomic/ textile industry / hordeum vulgare subsp vulgare

Abstract: In soils characterized by low organic matter and high pH values (7.5-8.59) iron availability to plants is limited even if the content of total Fe(III) is high. We have studied by *Hordeum distichum* plants the capability of paper mill sludge to increase the iron phytoavailable fraction in an alkaline soil. The effect of paper mill sludges adding to an iron-deficient soil was evaluated both considering the phyto-available fraction of iron and the distribution of organic carbon (hydrophobic, fulvic and humic carbon) in the soil before and after sludge adding. Iron concentration was determined in the different portions of *Hordeum distichum* plants grown on soils with and without paper mill sludges. Application of paper mill sludge induces an increase in the concentration of available Fe. This effect is probably due to the production of Fe chelators by soil microorganisms acting on sludge organic matter. The Fe chelators produced result in the solubilization of not soluble Fe-complexes present in the soil.

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667. Increasing cotton yield on drought-prone soils by mulching paper mill sludge.

Boquet, D. J. and Breitenbeck, G. A.

Louisiana Agriculture 42(2): 12-13. (1999); ISSN: 0024-6735

Descriptors: application methods/ application rates/ cotton/ decomposition/ fertilizers/ industrial wastes/ irrigation/ mulches/ mulching/ nitrogen fertilizers/ paper mill sludge/ sludges/ soil/ waste utilization/ mulching materials/ United States of America/ watering

Abstract: Methods of reducing excessive soil N immobilization when paper mill sludge is applied to fields of cotton grown at Macon Ridge, Winnsboro, Louisiana were investigated in 1996 and 1997. The advantage of paper mill sludge application was that it increased irrigation water infiltration and soil water-holding capacity. Paper mill sludge was applied at rates of 10 or 20 tons/acre with 0, 60, 120, 320 or 640 lbs N/acre, with irrigation. 320 lbs N was required for sludge decomposition and for the cotton crop, and this N rate was uneconomic and environmentally unacceptable. However, the highest cotton lint yields were obtained if the sludge was surface applied and a lower rate of N (80 lb) was injected below the mulch. Further irrigated trials with paper mill sludge and moderate N rates applied using the same technique in the very hot and dry year increased cotton yields by 30-35%.

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668. Influence of meliorants on colonization of sugarbeet roots by fungus vector of rhizomania.

Matsevetskaya, N. M.

Zashchita i Karantin Rastenii 3: 44. (2000)

Descriptors: crop yield/ fungal diseases/ industrial wastes/ infection/ oil refinery wastes/ paper mill sludge/ plant disease control/ plant diseases/ plant pathogenic fungi/ plant pathogens/ plant viruses/ soil/ soil amendments/ spread/ sugarbeet/ phytopathogens

Abstract: An increase in the incidence of rhizomania (beet necrotic yellow vein virus transmitted by *Polymyxa betae*), first observed on sugarbeet 25 years ago, is reported from the Ukraine. The effect of this disease on yield, the infection process, spread, biology and the dynamics of *P. betae* infestation of sugarbeet are outlined. Soil application of wastes from the oil-chemical industry and from paper manufacturing decreased the numbers of *P. betae* cysts and cystosori in soil and sugarbeet.

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669. Influence of paper mill sludges on corn yields and N recovery.

N'Dayegamiye, A.; Huard, S.; and Thibault, Y.

Canadian Journal of Soil Science 83(5): 497-505. (2003)

NAL Call #: 56.8 C162 ; ISSN: 0008-4271

Descriptors: application rates/ crop yield/ Gleysols/ maize/ nitrate nitrogen/ nitrogen fertilizers/ nutrient uptake/ paper mill sludge/ plant nutrition/ residual effects/ silt loam soils/ soil types/ use efficiency/ corn

Abstract: Mixed paper mill sludges are an important source of N for crop production. An estimate of direct and residual N recovery is necessary for their efficient management. A 3-yr field study (1997-1999) was conducted in central Quebec, Canada, to evaluate mixed paper mill sludges

(PMS) effects on corn (*Zea mays* L.) yields and N nutrition, N recovery and N efficiency. The effects of PMS on soil NO₃-N and total N levels were also determined. The study was situated on a silt loam Baudette soil (Humic Gleysol). The treatments included 3 PMS rates (30, 60 and 90 t ha⁻¹ on wet basis) applied alone or in combination with N fertilizer (90 and 135 kg N ha⁻¹, respectively, for 60 and 30 t ha⁻¹). Treatments also included a control without PMS or N fertilizer, and a complete mineral N fertilizer (180 kg N ha⁻¹) as recommended for corn. The previous plots were split beginning with the second year of the experiment, for annual and biennial PMS applications. Similar treatments as above were made on an adjacent site to evaluate N recovery under climatic conditions in 1999. In all years, PMS applied alone significantly increased corn yields by 1.5-5 t ha⁻¹, compared to the unfertilized control. However, corn yields and N uptake were highest from the application of PMS in combination with N fertilizer. Biennial PMS applications at 60 to 90 ha⁻¹ significantly increased corn yields and N uptake, which suggest high PMS residual effect; however, these increases were lower than those obtained with annual PMS applications. The N efficiency varied in 1997 from 13.0 to 15.4 kg grain kg N⁻¹ for mineral N fertilizer and ranged from 3 to 13.7 kg grain kg N⁻¹ for PMS, decreasing proportionally to increasing PMS rates. Apparent N recovery ranged from 13 to 19% in 1997 and from 10 to 14% in the residual year (1998), compared to 30 and 49%, respectively, for mineral N fertilizer. Depending on the PMS rate, N recovery varied from 13 to 21% in 1999. The results indicate high N supplying capacity and high residual N effects of PMS, which probably influenced corn yields and N nutrition. Annual PMS applications alone or combined with mineral N fertilizer had no significant effect on soil NO₃-N and total N levels. This study demonstrates that application of low PMS rate (30 t ha⁻¹) combined with mineral N fertilizer could achieve high agronomic, economic and environmental benefits on farms. Reproduced with permission from the CAB Abstracts database.

670. Influence of papermill sludge on growth of medicago sativa, festuca rubra and agropyron trachycaulum in gold mine tailings: A greenhouse study.

Green, S. and Renault, S.

Environmental Pollution 151(3): 524-531. (2008)

NAL Call #: QH545.A1E52; ISSN: 02697491 [ENPOE].

Notes: doi: 10.1016/j.envpol.2007.04.016.

Descriptors: biological stabilization/ gold mine tailings/ papermill sludge/ reclamation/ biomass/ crops/ gold mines/ pigments/ tailings/ agropyron trachycaulum/ bulk density/ festuca rubra/ medicago sativa/ papermill sludges/ photosynthetic pigments/ greenhouse effect/ gold/ alfalfa/ fertilizer application/ gold mine/ grass/ growth response/ photosynthesis/ phytomass/ sludge/ stabilization/ tailings/ agropyron/ alfalfa/ alkalinity/ biomass/ bulk density/ fertilization/ greenhouse/ mining/ nonhuman/ plant leaf/ plant root/ shoot/ sludge/ sludge treatment/ tall fescue/ agropyron/ biodegradation, environmental/ biomass/ canada/ ecology/ festuca/ gold/ industrial waste/ medicago sativa/ mining/ paper/ plant roots/ plant shoots/ sewage/ elymus trachycaulus trachycaulus/ festuca rubra/ medicago sativa

Abstract: A greenhouse study was undertaken to

determine the suitability of adding papermill sludge to neutral/alkaline gold mine tailings to improve the establishment of *Festuca rubra*, *Agropyron trachycaulum* and *Medicago sativa*. *Festuca rubra* root and shoot biomass and *A. Trachycaulum* shoot biomass were increased with papermill sludge amendment. The addition of papermill sludge and fertilizer drastically increased the shoot and root biomass of *M. sativa* (20-30 times) while *A. trachycaulum* and *F. rubra* showed a more moderate increase in growth. Photosynthetic pigment content of the leaves was higher in papermill sludge treatments than in the treatments without papermill sludge. The organic carbon content, macro-aggregate content and field capacity of the gold mine tailings were increased while the bulk density was decreased by the addition of papermill sludge. This study suggests that addition of papermill sludge and adequate fertilization can alleviate some of the adverse conditions of neutral/alkaline gold mine tailings. © 2007 Elsevier Ltd. All rights reserved.

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671. Influence of residue management and soil tillage on second rotation eucalyptus growth.

Dedecek, R. A.; Bellote, A. F. J.; and Menegol, O. *Scientia Forestalis/Forest Sciences*(74): 09-17. (2007); ISSN: 14139324.

Notes: Original title: Influência do manejo dos resíduos e dos sistemas de preparo do solo no crescimento de eucalyptos em segunda rotação. Language of Original Document: Portuguese.

Descriptors: paper and pulp sludge/ soil chemical properties/ soil penetrometer resistance/ soil physical properties/ wood ash/ biological materials/ fertilizers/ forestry/ harvesting/ soils/ paper and pulp sludge/ soil chemical properties/ soil penetrometer resistance/ soil physical properties/ wood ash/ waste management/ eucalyptus/ fertilizers/ harvesting/ sludge/ waste management

Abstract: Harvesting residue management can change many soil chemical and physical properties, considering the mechanical operations involved and the impact on the organic matter content of the soil. Soil tillage systems and the use of paper and pulp sludge and wood ash as fertilizers can help maintain productivity and reduce the effect of the harvesting system being used. This work was set up after harvesting a 12 year old commercial plantation of *Eucalyptus grandis* Hill ex Maiden, in the Mogi Guacẽçu district, State of São Paulo, Brazil, on a red-yellow latosol with less than 25% of clay and low fertility level. The influence of removal and maintenance of tree harvesting residues, soil fertilization with pulp and paper residues, and soil tillage systems was tested on eucalypts tree development and on alterations of soil chemical and physical properties. Although the difference was not significant, tree growth (height and DBH) was greater with industrial residue addition compared to maintenance of harvesting residues on soil surface. Industrial residues added to soil changed the fertility capacity, increasing pH and Ca+Mg content, reducing H+Al content, and had a small effect on K and P levels. Keeping tree-harvesting residues on soil surface increased the water content available on surface layer, compared to soil where all residues had been removed. Reducing tillage had greater effect on tree growth than increasing the amount of waste

material added as fertilizer. Tilling a wider row for planting lines increased soil compaction at levels considered harmful for plant root growth.

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672. Influence of vermicompost on the growth and yield of black gram (*phaseolus mungo*).

Umamaheswari, S. and Vijayalakshmi, G. S. *Ecology, Environment and Conservation* 12(1): 53-56. (2006)

NAL Call #: QH183.E238; ISSN: 0971765X [EECOF] Descriptors: cow dung / eudrilus eugeniae/ paper mill sludge/ phaseolus mungo/ vermicompost/ composting/ growth response/ industrial waste/ sludge/ vermiculture/ yield response/ eudrilus eugeniae/ vigna mungo

Abstract: The present work aims to utilize industrial waste (paper mill sludge) for vermiculture, which give value added vermicompost to the input for the organic agriculture to save the soil from chemicals and to produce more. Based on the previous works and recommendations epigeic earthworm species *Eudrilus eugeniae* was selected for decomposition. Studies have been-made to ascertain the physical and chemical characterization of the paper mill sludge + cow dung mixture before and after composting. Further, a plant growth study on black gram is also carried out. The analysis of physico chemical properties of vermicompost shows that the pH was uniformly brought to neutral level and insignificant increase of EC was recorded. The chemical analysis of the vermicompost clearly indicated that the compost was rich in N, P, K, essential nutrient for the growth of the plants. Reduction of Organic Carbon and C:N ratio during vermicomposting is the main index to assess the rate of organic matter decomposition. With regard to growth studies of black gram (*Vigna mungo*) was carried out employed it was observed that the morphological and yield parameters were found to increase significantly ($P < 0.05$) over control. Copyright © Enviromedia.

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673. Influences of lignin from paper mill sludge on soil properties and metal accumulation in wheat.

Zhang, S.; Wang, S.; Shan, X. Q.; and Mu, H. *Biology and Fertility of Soils* 40(4): 237-242. (Sept. 2004) NAL Call #: QH84.8.B46; ISSN: 0178-2762

Descriptors: bioaccumulation/ soil pollution/ soil amendments/ phosphorus/ potassium/ fractionation/ soil chemical properties/ pulp and paper mill effluents/ copper/ zinc/ cadmium/ lead/ chromium/ nickel/ China

Abstract: The influences of lignin application on soil properties of three different soils, Jiangxi soil (Ultisol, Hapludult), Heilongjiang soil (Alfisol, Entioboralf) and Beijing soil (Alfisol, Haplustalf), and metal accumulation in wheat (*Triticum aestivum* L.) were studied in a pot experiment. By lignin amendment, soil pH, organic matter (OM) and cation exchange capacity (CEC) increased, except for CEC in the Beijing soil. Analysis showed that available P and K in lignin-amended soils were also elevated, except for P in the Jiangxi soil. A three-step sequential extraction procedure proposed by the Standards, Measurements and Testing Programme (formerly BCR) of the European Commission was used to investigate the fraction redistribution of heavy metals in soils with lignin application. The fractions were specified as

B1: water soluble, exchangeable and carbonate bound, and weakly adsorbed; B2: Fe-Mn oxide bound; and B3: organic matter and sulfide bound. Generally, the heavy metal content of the B2 fraction decreased whereas that of the B3 fraction increased. Lignin application to arable soils can not only improve plant growth in vitro, but also reduce the accumulation of the heavy metals Cu, Zn, Cd, Pb, Cr and Ni in wheat plants.

This citation is from AGRICOLA.

674. Investigations of paper mill sludge as a component of container medium.

Ou Yang Wei and Wu WenShi

Plant Pathology Bulletin 11(1): 19-24. (2002); ISSN: 1021-9544

Descriptors: chlorophyll/ composts/ growth/ leaves/ paper mill sludge/ peat/ roots/ seed germination/ seedlings

Abstract: Paper mill sludge (PMS), commercial peat and a commercial container medium (BVB No. 4) were compared in the greenhouse for use as container media. Composted PMS mixed with peat at ratio of 80% PMS (volume basis) supported plant growth, and relative leaf chlorophyll content of periwinkles comparable to commercial container medium (BVB No. 4). Container medium amended with 50% composted PMS supported similar or better growth of ten different plant species than BVB No. 4, except the root length of cosmos and chrysanthemum. Raw PMS supernatant inhibited seed germination of periwinkle. The inhibitory effect was eliminated when the raw PMS was well composted. Composted PMS was compatible with the amended antagonistic microorganism and was good for production healthy periwinkle seedlings.

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675. Kraft mill sludge to improve vegetal production in chilean andisol.

Gallardo, F.; Mora, M. L.; and Diez, M. C.

Water Science and Technology(6): 31-37. (2007); ISSN: 02731223 [WSTED].

Notes: doi: 10.2166/wst.2007.209.

Descriptors: andisol soil/ sludge application/ vegetal production/ biomass/ greenhouses/ microbiology/ nutrients/ paper and pulp mills/ soils/ kraft mill sludge/ sludge application/ vegetal production/ sludge disposal/ calcium/ carbon dioxide/ magnesium/ phosphorus/ potassium/ biomass/ greenhouses/ microbiology/ nutrients/ paper and pulp mills/ sludge disposal/ soils/ andisol/ biomass/ greenhouse effect/ sludge/ toxicity/ volcanic ash/ wheat/ activated sludge/ biomass production/ chile/ conference paper/ controlled study/ germination/ greenhouse/ nutrient content/ plant growth/ plant root/ soil pollution/ temperature dependence/ vegetation/ volcanic ash/ wheat/ biomass/ carbon dioxide/ chile/ crops, agricultural/ particulate matter/ plant components, aerial/ plant roots/ seeds/ sewage/ soil pollutants/ triticum/ volcanic eruption/ biomass/ greenhouses/ kraft mills/ microbiology/ nutrients/ sludge disposal/ soil/ triticum aestivum

Abstract: The effect of kraft mill sludge addition (25 to 75 ton/ha) to soil derived from volcanic ashes (Andisol) on wheat (*Triticum aestivum* L.cv. Puken) biomass production, and in the nutrient absorption by the plants was evaluated. Respiration activity and seed germination tests were carried out on the soil/sludge mixtures, in order to evaluate possible toxic effects due to the sludge addition to the soil.

Soil without sludge was used as a control treatment. The plants were grown in a greenhouse (25°C, 14 h-photoperiod) during 120 days, then the plants were collected and dried at 65°C for 72 h for the determination of biomass production (root and aerial) and analyzed for mineral content (Ca, Mg, K and P). The mixtures of soil/sludge showed no toxicity. Seed germination and respiration activity increased with the increment of the sludge. The accumulated CO₂ in the soil without sludge was 41.66 mg CO₂/100; this value shows a low microbial activity. The biomass increased with the increment of sludge addition to the soil and five times more biomass was obtained when 75 ton/ha sludge was added to the soil. The nutrient absorption efficiency was also improved with the sludge addition. © IWA Publishing 2007.

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676. Land application of mechanical pulp mill sludges in Alberta: Research and operational activities.

Macyk, Terry M. Vol. 2.

Vancouver, Can: TAPPI Press; pp. 569-578; 1998.

Notes: Chapter Number: Norcross, GA, United States Conference code: 48747.

Descriptors: crops/ cultivation/ environmental impact/ environmental protection/ frozen soils/ harvesting/ sludge disposal/ standards/ lodgepole pine/ mechanical pulp mill sludges/ sludge amended haul road soils/ white spruce/ paper and pulp mills

Abstract: Research regarding land application of mechanical mill sludges was undertaken by the Alberta Research Council in June 1991. The objective of the research is to provide industry, government regulators and the public with information on the impact of sludge application on agricultural and forest land and to provide a basis for adopting operational landspreading guidelines. The results of detailed sludge characterization work, greenhouse studies, decomposition work and column leaching studies demonstrated that land application was feasible and provided guidance for implementation of relevant and practically designed field studies. Two field trials were established to evaluate the impact of single and multiple applications of sludges from different mills on agricultural crops and soil quality in 1992 and 1993 and are monitored to obtain long-term data relative to crop yields and soil quality. The sludge amended treatments have demonstrated yield increases from two-to-five-fold greater than control and that increased yields have been sustained for at least five growing seasons. Three experiments were established in the forest beginning in 1993. The first involved application and incorporation of four rates of two sludge types in a replicated experiment on a recently harvested cut-block. Height and diameter increases up to 2.5 fold for white spruce (*Picea glauca*) and lodgepole pine (*Pinus contorta* var. *latifolia*) seedlings planted in the sludge amended plots compared to the control plots have been observed during the past five growing seasons. Another experiment involved application of three rates of sludge on frozen and non-frozen soil on haul roads, borrow areas, and wellsites to assess the efficacy of the sludge in reclaiming disturbed areas in the forest and returning forest productivity. The bulk density of the sludge amended haul road soils was reduced by 30%, soil water holding capacity was increased by 25% and lodgepole pine seedling growth increased three-fold over control treatments.

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677. Land application of mechanical pulp mill sludges in Alberta: Research and operational activities. Deinked and non-deinked sludges are beneficial in soil application.

Macyk, T. M.

Pulp and Paper Canada 100(6): 34-37. (1999); ISSN: 0316-4004

Descriptors: application rates/ application to land/ crop yield/ crops/ paper mill sludge/ research/ sludges/ soil fertility/ yields/ land application/ studies

Abstract: Research into the land application of mechanical pulp mill sludges was undertaken in June 1991. The results of detailed sludge characterization work, greenhouse studies, decomposition work and column leaching studies showed that land application was feasible, and this conclusion led to the implementation of field studies. Field trials to evaluate the effects of single and multiple applications of sludges on agricultural crops and soil quality have demonstrated yield increases from two-to-five-fold greater than control. These trials have also shown that increased yields have been sustained for at least five growing seasons. Experiments established in the forest have demonstrated height and diameter increases up to 2.5-fold for white spruce (*Picea glauca*) and lodgepole pine (*Pinus contorta* var. *latifolia*) seedlings planted in the sludge-amended plots compared to the control plots. Reproduced with permission from the CAB Abstracts database.

678. Leachability of metals in fly ash from a pulp and paper mill complex and environmental risk characterisation for eco-efficient utilization of the fly ash as a fertilizer.

Poykio, R.; Nurmesniemi, H.; Peramaki, P.; Kuokkanen, T.; and Valimäki, I.

Chemical Speciation and Bioavailability 17(1): 1-9. (2005); ISSN: 0954-2299

Descriptors: arsenic/ barium/ bioavailability/ cadmium/ chromium/ cobalt/ copper/ environmental degradation/ fly ash/ heavy metals/ leaching/ lead/ liming materials/ nickel/ polluted soils/ potassium/ pulp and paper industry/ pulp mill effluent/ risk/ risk assessment/ soil amendments/ soil degradation/ soil pollution/ soil types/ titanium/ vanadium/ waste management/ waste utilization/ zinc/ kraft mill effluent/ paper industry

Abstract: A five-stage, sequential leaching procedure was used to determine the distribution of metals (Cd, Cu, Pb, Cr, Zn, Ni, Co, As, V, Ba, Ti and K) in fly ash from a pulp and paper mill complex between the water-soluble fraction (H_2O), exchangeable fraction (CH_3COOH), easily reduced fraction ($HONH_3Cl$), oxidizable fraction ($H_2O_2+CH_3COONH_4$), and the residual fraction ($HF+HNO_3+HCl$). The possible environmental risk associated with the eco-efficient utilization of fly ash as a fertilizer, especially the Cd load, was estimated. In addition, the mobility (i.e. bioavailability) of Cd, Cu, Pb, Zn, Ni and Cr was evaluated. The fly ash was derived from an electrostatic precipitator of a fluidized bed boiler in the co-combustion (55% bark and wood residues, 45% peat) process at pulp and paper mill in Northern Finland. The accuracy of the leaching procedure was tested using a certified reference material SRM 1 633b (Coal Fly Ash). The metals were determined by graphite furnace atomic absorption spectrometry (GFAAS) or by inductively coupled plasma atomic emission spectrometry (ICP-AES). The

mobility factors (i.e. bioavailability) of the metals followed the order: Cd, Cu, Zn, Ni, Pb and Cr. The fly ash from the pulp and paper mill was enriched in Ca, Mg, P and K, and could therefore be used as a soil amendment for liming purposes.

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679. Lettuce (*Lactuca sativa* L.) and cabbage (*Brassica oleracea* L. var. *capitata* L.) growth in soil mixed with municipal solid waste compost and paper mill sludge composted with bark.

Brito, L. M.

Acta Horticulturae 563: 131-137. (2001)

NAL Call #: 80 Ac82; ISSN: 0567-7572

Descriptors: application rates/ cabbages/ composts/ dry matter accumulation/ electrical conductivity/ growth/ lettuces/ mortality/ nutrient uptake/ paper mill sludge/ soil amendments/ solid wastes/ Capparales/ death rate

Abstract: Crop responses to soil amended with municipal solid waste compost and paper mill sludge composted with bark was investigated in pot experiments using lettuce (*Lactuca sativa*) cultivars Animo and Jory and summer cabbage (*Brassica oleracea* var. *capitata*) cv. Lima. Dry matter accumulation generally increased with increasing concentrations of composted paper mill sludge. Municipal waste compost severely reduced plant growth compared to composted paper mill sludge, and caused complete crop mortality unless leached beforehand with water. The main cause of death or growth inhibition of experimental plants observed with municipal solid waste compost is likely to be the result of its poor stability and high electrical conductivity. Lettuce dry matter accumulation increased when composted paper mill sludge treatments were amended with ammonium nitrate up to between 0.1 and 0.2 g N l⁻¹ but declined with further amounts. Dry matter accumulation of lettuce and nitrogen accumulation of cabbage could be described as a function of compost nitrogen content and electrical conductivity. Possible methods for improving the characteristics of such composts as substrates for horticultural crops are discussed. Reproduced with permission from the CAB Abstracts database.

680. Management and benefits of pulp and paper mill residuals.

Velema, G.

In: Proceedings of the 2003 TAPPI International Environmental Conference and Exhibit. Portland, OR; pp. 306-316; 2003.

Notes: Conference code: 61670. Sponsors: TAPPI; NCASI; PAPTAC; FSDA.

Descriptors: industrial management/ industrial wastes/ recycling/ soil amendments/ paper and pulp mills/ industrial wastes/ paper mills/ pulp mills/ recycling

Abstract: Domtar Inc. operates a comprehensive land application program for two of its pulp and/or paper mills located in Ontario. Solid organic residues known as Pulp and Paper Mill Biosolids (PPMB) generated by the effluent treatment plants of both

mills are used as soil amendments, fertilizer or mulch in agriculture, silviculture and land rehabilitation projects. The 10-year-old program has developed to sustainably recycle 100 percent of PPMB organic type residues that were formerly managed as waste and landfilled. Landfilling and

incineration is still a common management option for most of the Pulp and Paper industry in Canada. The Pulp and Paper Research Institute of Canada determined, from the results of a survey in 1995, that industry generated 7.1 million dry tones of residues; 23% of which were PPMB. An estimated 119,000 dry tones of PPMB were land applied in Canada, representing 7% of the total available. A 2001 follow-up survey indicated that this had increased to where 42% practised some degree of land application. Land application of PPMB is safe, ecologically sustainable, environmentally responsible, agronomically beneficial, and economically sensible. Although the regulatory regimes in Canada at the provincial and federal levels discourage the recycling of "industrial wastes", many opportunities exist for the wise use of these resources through land application, provided programs deal with their communities and publics in an open and proactive manner.

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681. **Management and benefits of pulp and paper mill residuals at Domtar Cornwall.**

Velema, G.

Pulp and Paper Canada 105(7): 26-30. (2004); ISSN: 03164004 [PPCAA]

Descriptors: agriculture/ fertilizers/ industrial wastes/ land reclamation/ mulch/ organic materials/ silviculture/ soil conditioners/ accident prevention/ ecology/ health care/ industrial management/ land fill/ sustainable development/ biosolids/ biotreatment/ community relations/ corwall mill/ paper and pulp mills/ ecology/ land fill/ paper mills/ pulp mills/ safety

Abstract: Domtar Inc. operates a comprehensive land application program for two of its pulp and/or paper mills located in Ontario. Solid organic residues are used as soil amendments, fertilizer or mulch in agriculture, silviculture and land rehabilitation projects. Land application of PPMB is safe, ecologically sustainable, environmentally responsible, agronomically beneficial, and, economically sensible. Opportunities exist for the wise use of "industrial wastes" as resources through land application, provided programs deal with their communities and publics in an open and proactive manner.

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682. **Management of treated pulp and paper mill effluent to achieve zero discharge.**

Asghar, M. N.; Khan, S.; and Mushtaq, S.

Journal of environmental management 88(4): 1285-1299. (2008)

NAL Call #: HC75.E5J6; ISSN: 03014797 [JEVMA].

Notes: doi: 10.1016/j.jenvman.2007.07.004.

Descriptors: closed water cycle/ effluent reuse/ groundwater pollution/ irrigation/ paper mill/ soil contamination/ stream flows/ zero discharge/ ground water/ discharge/ effluent/ environmental impact assessment/ environmental monitoring/ groundwater pollution/ irrigation/ pulp and paper industry/ streamflow/ wastewater/ water management/ agricultural land/ consumer attitude/ controlled study/ crop/ effluent/ environmental impact assessment/ irrigation (agriculture)/ paper industry/ pulp mill/ soil pollution/ waste water management/ waste water recycling/ water pollution/ water quality/ water supply/ industrial waste/ paper/ textile industry/ water pollutants, chemical/ animalia

Abstract: Pulp and paper mills are one of the major effluent generating industries in the world. In most cases, mill effluent (treated or raw) is discharged back into a river, creek, stream or other water body; resulting in negative environmental impacts, as well as social concerns, among the downstream users. Pulp and paper mill effluent management, which could result in zero discharge into downstream water bodies, would present the best management option to address socio-environmental concerns. This paper presents such an effort aimed at closing the water cycle by using treated effluent from the mill to irrigate forage and fodder crops for producing animals feed. The treated effluent is delivered from the mill through gravity into a winter storage dam of 490 ML capacity. For irrigation applications on 110 ha of farmland, which is 42% of the total farmland, the water is pumped from the winter storage dam to five individual paddocks with Centre Pivot (CP) irrigators and one rectangular paddock with a Soft Hose Travelling (SHT) irrigator. From October 2001 to June 2006, a total of 2651 mm of wastewater was applied at the farm. The impact assessment results, obtained from field monitoring, investigations and analysis, indicated that the closed water cycle effluent management strategy described had resulted in a lessening of the impact on water resources usually associated with paper mills. However, social attitudes to the use of crops that have been irrigated with recycled waters and the resulting impact on market value of the produce may still be a major consideration. © 2007 Elsevier Ltd. All rights reserved. © 2009 Elsevier B.V. All rights reserved.

683. **Microbial biomass C, N, P dynamics in a meadow amended with papermill sludges.**

Arfaoui, M. A.; Simard, R. R.; Laverdiere, M. R. ; Chabot, R.; and Antoun, H.

In: 1999 Annual Meeting of the Canadian Society of Soil Science..Charlottetown, Prince Edward Island, Canada.); Vol. 79(4).; pp. 639; 1999.

NAL Call #: 56.8 C162; ISBN: 0008-4271

Descriptors: nutrition/ waste management: sanitation/ soil science/ microorganisms: microorganisms/ humic gleysol/ meadow/ microbial biomass/ nutrient dynamics/ papermill sludge: soil / amendment/ abstracts

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684. **Mixed paper mill sludge effects on corn yield, nitrogen efficiency, and soil properties.**

N' Dayegamiye, A.

Agronomy Journal 98(6): 1471-1478. (Nov. 2006-Dec. 2006)

NAL Call #: 4 AM34P; ISSN: 0002-1962

Descriptors: Zea mays / corn/ grain yield/ nitrogen/ nutrient uptake/ nutrient use efficiency/ pulp and paper mill effluents/ land application/ plant nutrition/ soil fertility/ field experimentation/ organic fertilizers/ fertilizer rates/ soil aggregates/ diameter/ soil density/ bulk density/ soil physical properties/ soil biological properties/ soil microorganisms/ alkaline phosphatase/ urease/ enzyme activity/ Quebec

Abstract: Large quantities of mixed paper mill sludges (PMS) are applied annually to agricultural soils in North America. However, little information exists in the literature delineating the impact of land application of PMS on crop N

nutrition and soil properties. In a 3-yr field study, (1997-1999), we evaluated PMS effects on corn (*Zea mays* L.) yields and soil property changes. The study included annual and biennial PMS applications of 20, 40, and 60 Mg ha⁻¹ on wet basis, applied alone or in combination with N fertilizer at reduced rates (90 and 135 kg N ha⁻¹ for 40 and 20 Mg PMS ha⁻¹, respectively), complete N fertilizer for corn (180 kg N ha⁻¹) and a control. Plots were split beginning with the second year for annual and biennial PMS and N fertilizer application. Annual or biennial applications of PMS alone resulted in grain yield increase of 1500 to 3000 kg ha⁻¹ as compared to the unfertilized control. The applications of 20 to 40 Mg ha⁻¹ PMS with N fertilizer at reduced rates (135 and 90 kg ha⁻¹ respectively) achieved higher corn yields compared to PMS applied alone. The PMS applications combined with N fertilizer at reduced rates produced highest corn yields, similar to those obtained with complete N fertilization for corn (180 kg N ha⁻¹). Corn apparent N recoveries (ANR) ranged from 17 to 21% in year of application and from 15 to 22% in residual year, depending of PMS rates. Three PMS applications at 40 to 60 Mg ha⁻¹ yr⁻¹ significantly increased the soil C content by 22 and 26%, and by 18 and 22%, compared to the control and N fertilizer, respectively. Those PMS applications also significantly increased the mean-weight diameter (MWD) of aggregates, and reduced soil bulk density as compared to the control and fertilizer alone treatment. The soil microbial biomass C and the alkaline phosphatase and urease activities were also increased in soils that received PMS. Our results suggest that the applications of PMS with low C/N (19-24) benefit corn growth possibly due to a combination of the higher nutrient availability and the improvement of the soil properties. This citation is from AGRICOLA.

685. Mixed papermill residues affect yield, nutritive value and nutrient use of a grass-alfalfa sward.

Arfaoui, M. A.; Simard, R. R.; Belanger, G.; Laverdiere, M. R.; and Chabot, R.

Canadian Journal of Soil Science 81(1): 103-111. (2001)
NAL Call #: 56.8 C162 ; ISSN: 0008-4271

Descriptors: calcium ammonium nitrate/ crop yield/ dry matter/ Gleysols/ grass sward/ lucerne/ nitrate nitrogen/ nitrogen/ nutrient uptake/ nutritive value/ paper mill sludge/ soil types/ alfalfa/ ammonium nitrate/ calcium carbonate/ calcium carbonate/ ammonium nitrate/ CAN/ nitrochalk/ nutritional value/ quality for nutrition

Abstract: Mixed paper mill residues (MPR) can improve soil quality, but their impact on forage yield and quality is not well documented. Three MPR were applied to mixed grass-lucerne (*Medicago sativa*) sward in an experiment conducted at the Université Laval Agronomic Centre located at Sainte-Croix de Lotbinière during 1997 and 1998 at near 100, 200 and 400 kg N ha⁻¹ and were compared to calcic ammonium nitrate (CAN) at 0, 50, 100 and 200 kg N ha⁻¹ on a Bedford clay loam (Humic Gleysol). The MPR and CAN induced a significant linear increase in forage dry matter yield and relative yield. The sward response to MPR addition in 1997 was related to the MPR C:NH₄⁺ ratio. MPR and CAN increased the forage neutral detergent fibre concentration in 1998, but there was no effect in 1997. Nitrogen concentration in forage tissues was increased by MPR and CAN inputs in 1997, but was decreased in 1998.

In all treatments, NO₃⁻ tended to accumulate in forage tissues when the N nutrition index exceeded the optimum level. Forage nutritive value from the MPR was comparable to CAN. The results of this study suggest that MPR can be an efficient N source for grass-lucerne swards on fine-textured soils.

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686. Mixtures of papermill biosolids and pig slurry improve soil quality and growth of hybrid poplar.

Lteif, A.; Whalen, J. K.; Bradley, R. L.; and Camire, C.

Soil Use and Management 23(4): 393-403. (2007)
NAL Call #: S590.S68; ISSN: 0266-0032

Descriptors: application rates/ biological activity in soil/ calcium/ calcium ammonium nitrate/ forest plantations/ Gleysols/ growth/ microbial flora/ nitrate nitrogen/ nitrification/ organic amendments/ organic farming/ organic fertilizers/ paper mill sludge/ phosphorus/ pig slurry/ potassium/ soil fertility/ soil pH/ soil types/ triple superphosphate/ use efficiency/ ammonium nitrate/ calcium carbonate/ calcium carbonate/ ammonium nitrate/ CAN/ eco agriculture/ ecological agriculture/ microbial biomass/ microbial communities/ microflora/ nitrochalk/ organic culture / *Populus balsamifera* subsp *trichocarpa*/ soil quality/ soil respiration

Abstract: Hybrid poplar plantations in Quebec, Canada, are generally established on marginal agricultural lands characterized by low pH and low inherent soil fertility. Here, we tested the hypothesis that two potential organic fertilizer (OF) sources, papermill biosolids (PBs) and liquid pig slurry (LPS), would improve soil quality and the growth performance of hybrid poplars (*Populus trichocarpa* x *Populus deltoides*), especially if applied in mixtures rather than separately. The fertilizer treatments included an unfertilized control, inorganic fertilizer (IF) (calcium ammonium nitrate and triple superphosphate) and OFs (PBs alone, LPS alone and two combinations of PBs and LPS) applied at two rates. Fertilizers were broadcast within 1 m of tree trunks and unincorporated, to prevent damage to tree roots. Hybrid poplar growth was the greatest in plots fertilized with a combination of PBs and LPS, suggesting that the two OFs complemented themselves and/or interacted to improve soil nutritional quality. PBs were the most efficient at raising soil pH, providing plant-available Ca and increasing nitrification rates over the long term, whereas LPS provided more readily available NO₃-N, P and K. Applied together, PBs and LPS interacted to provide more extractable P and mineralizable NH₄-N than when applied separately. OFs increased soil biological activity, notably basal respiration, microbial biomass, metabolic quotient and mineral N production rates. Community-level catabolic profiles of the extractable soil microflora in plots with OFs differed significantly from the control and IF treatments. This implies that surface-applied OFs may induce fundamental changes to the diversity and composition of microbial communities in the underlying rooting zone. Although this study has shown beneficial effects of OF mixtures on soil quality and hybrid poplar growth, further research should focus on their possible environmental impacts.

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687. Modeling aggregate internal pressure evolution following immersion to quantify mechanisms of structural stability.

Zaher, H.; Caron, J.; and Ouaki, B.

Soil Science Society of America Journal 69(1): 1-12. (Jan. 2005-Feb. 2005)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Descriptors: soil aggregates/ aggregate stability/ soil structure/ wetting front/ swelling (materials)/ organic matter/ pulp and paper sludge/ soil amendments/ saturated hydraulic conductivity

Abstract: Identification of the key components controlling aggregate stability is important in soil structure research. The deterioration of soil aggregates during rapid wetting has often been attributed to the swelling and internal pressure buildup resulting from the compression of entrapped air by the advancing wetting front. Organic matter is known to reduce the extent of slaking, but the different modes of action have not yet been quantified. The objective of the study was to use theoretical three-dimensional models to quantify the effect of paper sludge amendment on the key processes controlling internal pressure evolution. A clay loam and a silty-clay loam were incubated for a 2-wk period with different amounts and types of paper sludge. Aggregates were then selected, air dried, and then fixed to a hypodermic needle connected to a pressure transducer, and the whole system was immersed in distilled water while images and pressure evolution were recorded. For both soils, the maximum internal pressure was lower in the sludge-amended aggregates. From the models fitted to the observed data, it appears that the addition of paper sludge resulted in an increase of the potential at the wetting front and a decrease of the near saturated hydraulic conductivity. This result suggests that sludge addition reduces pressure buildup by reducing the rate of water entry, lowering the potential at the wetting front and reducing the hydraulic conductivity of the aggregate.

This citation is from AGRICOLA.

688. Multiple applications of paper mill sludge in an agricultural system: Soil effects.

Zibilske, L. M.; Clapham, W. M.; and Rourke, R. V.

Journal of Environmental Quality 29(6): 1975-1981. (Nov. 2000-Dec. 2000)

NAL Call #: QH540.J6; ISSN: 0047-2425 [JEVQAA]

Descriptors: soil properties/ land application/ agricultural soils/ paper mill sludge

Abstract: Little information exists regarding the effects of field-scale application of paper mill sludge on soil properties. A 5-yr field study determined the long-term effects of land application of paper mill sludge on an agricultural soil. The goal of this study was to determine the responses of soil chemical and physical properties to multiple applications of sludge. Five rates of sludge application were tested, ranging from 0 to 225 Mg ha⁻¹ in multiple applications under three management protocols: applied once, applied in alternate years, or applied annually. Results indicate strong relationships between added sludge C and several soil physical properties. Increases or maintenance of soil C were observed when sludge was applied annually or biennially, but little residual effect of the single application was seen after 5 yr. Significant increases were observed in soil aggregation and moisture holding properties at higher rates of sludge

application and when cumulative C additions reached 225 Mg ha⁻¹ in other sludge application rates. It was concluded that long-term paper mill sludge application can be managed to effect positive changes in soil physical properties that are correlated to soil quality. This citation is from AGRICOLA.

689. Net nitrogen immobilization in soil induced by small additions of energy sources.

Hamner, K and Kirchmann, H

Acta Agriculturae Scandinavica Section B, Soil and Plant Science. 2005; 55(3): 177-185(2005)

NAL Call #: 11 Ac82 ; ISSN: 0906-4710

Descriptors: agricultural land/ agricultural soils/ ammonium/ application rates/ application to land/ biological activity in soil/ carbon/ chemical composition/ energy sources/ Entisols/ glucose/ hemicelluloses/ immobilization/ leaching/ microbial activities/ microbial flora/ nitrate/ nitrogen/ paper mill sludge/ sludges/ soil types/ wood fibres/ dextrose/ farmland/ inorganic nitrogen/ land application/ microbial biomass/ microflora/ soil respiration

Abstract: This study investigated whether small additions to soil of primary paper-mill sludge, a wood fibre residue from paper production (fibre sludge), caused temporary N immobilization and thereby reduced the amount of inorganic nitrogen leached from agricultural land. This was achieved by measuring respiration and immobilization of N in incubation studies at 8 degrees C, with fibre sludge added at rates varying from 63 to 1000 mg C kg⁻¹ soil. Glucose added at rates of 63-250 mg C kg⁻¹ soil was used as a reference. Respiration in soil after glucose addition followed an exponential course with the highest rates on days 2-4. During this period maximum peaks of net N immobilization were measured. Even addition of only 63 mg glucose-C kg⁻¹ soil caused significant immobilization of N in soil. Fibre sludge additions to soil caused lower respiration activities, characterized by two initial peaks followed by somewhat higher respiration rates during the remaining incubation than for glucose. It was likely that hemicellulose, which amounted to 14% of the total C, was the initial available energy source in the sludge as concentrations of water-soluble C were very low. Addition of at least 250 mg C kg⁻¹ soil as fibre sludge was required to cause significant N immobilization in soil corresponding to 5 kg N ha⁻¹. Both nitrate and ammonium were immobilized. Relating maximum N immobilization data during days 2 to 10 to corresponding respiration data for glucose and fibre sludge revealed that microbes utilised similar amounts of C per unit N immobilized. On average, 175.6±74.8 mg CO₂-C were respired to immobilize 1 mg N and the relationship between C respiration and N immobilization was linear (R²=0.984). To make soil application of fibre sludge a realistic counter-measure against N leaching from agricultural soils, pre-treatment is necessary to increase the content of energy readily available to microbes.

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690. Nitrogen mineralization and nitrate leaching of a sandy soil amended with different organic wastes.

Burgos, P.; Madejon, E.; and Cabrera, F.

Waste Management and Research 24(2): 175-182. (2006)

NAL Call #: TD896.W37 ; ISSN: 0734-242X

Descriptors: aerobic conditions/ carbon nitrogen ratio/ composts/ immobilization/ leaching/ mineralization/ moisture content/ nitrate/ nitrate nitrogen/ nitrogen/ organic wastes/ paper mill sludge/ refuse/ sandy soils/ soil amendments/ soil types/ solid wastes/ temperature/ municipal wastes/ trash

Abstract: Organic wastes can be recycled as a source of plant nutrients, enhancing crop production by improving soil quality. However, the study of the dynamic of soil nutrient, especially the N dynamic, after soil application of any organic material is vital for assessing a correct and effective use of the material, minimizing the losses of nitrate in leachates and avoiding the negative environmental effects that it may cause in groundwater. To estimate the effect of three organic materials, a municipal solid waste compost (MWC), a non-composted paper mill sludge (PS), and an agroforest compost (AC) on the N dynamic of a sandy soil two experiments were carried out: an incubation experiment and a column experiment. The incubation experiment was conducted to estimate the N mineralization rate of the different soil-amendment mixtures. The soil was mixed with the organic amendments at a rate equivalent to 50 000 kg ha⁻¹ and incubated during 40 weeks at constant moisture content (70% of its water-holding capacity) and temperature (28 degrees C) under aerobic conditions. Organic amendment-soil samples showed an immobilization of N during the first weeks, which was more noticeable and longer in the case of PS-treated soil compared to the other two amendments due to its high C/N ratio. After this immobilization stage, a positive mineralization was observed for all treatment, especially in MWC treated soil. Contemporaneously a 1-year column (19 cm diameter and 60 cm height) experiment was carried out to estimate the nitrate losses from the soil amended with the same organic materials. Amendments were mixed with the top soil (0-15 cm) at a rate equivalent to 50 000 kg ha⁻¹. The columns were periodically irrigated simulating rainfall in the area of study, receiving in total 415 mm of water, and the water draining was collected during the experimental period and analysed for NO₃-N. At the end of the experimental period NO₃-N content in soil columns at three depths (0-20, 20-35 and 35-50 cm) was determined. The nitrate concentration in drainage water confirmed the results obtained in the incubation experiment: nitrate leaching was higher in soil treated with MWC due to its higher N-mineralization rate. Nevertheless, the nitrate losses represented a low amount compared with the total nitrogen added to soil. No clear signs of water-draining contamination were observed during the first year after the application of AC and PS; however, the nitrate leaching in soil treated with MWC slightly exceeded the limit allowed for the Drinking Water Directive 98/83/CE. Reproduced with permission from the CAB Abstracts database.

691. Nitrous oxide release from soils receiving N-rich crop residues and paper mill sludge in eastern Scotland.

Baggs, E. M.; Rees, R. M.; Castle, K.; Scott, A.; Smith, K. A.; and Vinten, A. J. A.

Agriculture, Ecosystems and Environment 90(2): 109-123. (2002)

NAL Call #: S601.A34 ; ISSN: 0167-8809

Descriptors: broccoli / Cambisols/ crop residues/ denitrification/ diurnal variation/ emission/ lettuces/ nitrogen/

nitrous oxide/ organic carbon/ paper mill sludge/ ploughing/ soil amendments/ soil temperature/ soil types/ Britain/ Calabrese/ Capparales/ microbial biomass/ plowing/ United Kingdom

Abstract: Incorporation of crop residues and other organic material to agricultural soils may increase nitrous oxide (N₂O) emissions, depending on the quantity and quality of the incorporated material. The effects of combining materials of contrasting quality on these emissions have still to be investigated. In this paper, the effects of applying paper mill sludge (PMS), incorporating plant residues, and cultivation on emissions of N₂O are reported. Two field experiments were undertaken on Cambisol soils (FAO classification), previously cropped to iceberg lettuce (*Lactuca sativa* var. *saladin*) and calabrese (*Brassica oleracea italica* var. *cymosa*) in Fife, eastern Scotland. Emissions were measured using both automated and manual closed chambers and comparisons were made between these techniques. Nitrous oxide emissions were high after incorporation of PMS; with up to 4.9 kg N₂O-N ha⁻¹ emitted over the first 3 weeks. These increased emissions were probably due to the high input of organic C for denitrification. Emissions from deep ploughed PMS treatments were higher (P<0.05) than from rotary tilled and conventional ploughed treatments. Application of PMS resulted in an increase in microbial biomass C, but not biomass N. Measurements using autochambers recorded higher N₂O emissions than those obtained by less frequent manual measurements, partly due to diurnal variations in N₂O with soil temperature. High Q₁₀s (up to 4.0) for this temperature response were recorded in one period in July. It is recommended that diurnal temperature variations be recorded when sampling from manual closed flux chambers so that corrections can be made for diurnal variation in N₂O.

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692. Nursery crop response to substrates amended with raw paper mill sludge, composted paper mill sludge and composted municipal waste.

Chong, C. and Purvis, P.

Canadian Journal of Plant Science 84(4): 1127-1134. (2004)

NAL Call #: 450 C16; ISSN: 0008-4220

Descriptors: bark/ composting/ composts/ dry matter/ farmyard manure/ growth/ hemp/ nurseries/ paper/ paper mill sludge/ peat/ poultry manure/ refuse/ regression analysis/ sawdust/ substrates/ FYM/ municipal wastes/ Oleales/ poultry litter/ trash

Abstract: Silverleaf dogwood (*Cornus alba* L. 'Argenteo-marginata'), forsythia (*Forsythia* x *intermedia* Zab. 'Lynwood Gold'), and weigela (*Weigela florida* Bunge A.DC. 'Red Prince') were grown in #2 (6-L) containers filled with 100% bark or bark mixed with 20, 40 or 60% by volume each of raw paper mill sludge (RB group), Bio Soil compost containing 100% paper mill sludge (BCB group), Waterdown compost containing 40% paper sludge, 40% chicken manure and 20% sawdust (WCB group), and municipal compost consisting of leaf and yard waste (MCB group). A fifth substrate group (MCH) consisted of 100% hemp chips or hemp chips mixed with the same rates of municipal compost. The containers were trickle-irrigated and fertilized with a controlled-release fertilizer. Regression analysis indicated that growth among the bark-amended

groups was highest for dogwood and forsythia with WCB, increasing dramatically and peaking at about the 40% rate (68 and 94 g plant⁻¹ aboveground dry weight, respectively). Growth of these species was intermediate with MCB and BCB and least with RB, increasing to rates $\geq 50\%$ in these groups. There was no significant response of dogwood to RB. Growth of weigela increased equally with WCB and MCB substrates up to about 40% (117 g plant⁻¹), but was not influenced by varying rates of RB and BCB. With the hemp-amended MCH group, growth of all three species increased to rates $\geq 50\%$ (62, 93, and 116 g plant⁻¹ for dogwood, forsythia and weigela, respectively). Growth of the three species over most rates of all substrate groups was similar to, or exceeded that in 80% bark: 15% peat: 5% topsoil, a proven nursery mix. Aboveground dry weight of all three species was positively correlated with soluble salts concentrations in the substrates sampled at planting and on other sampling dates during the season. Reproduced with permission from the CAB Abstracts database.

693. Nutrient leaching potential following application of papermill lime-sludge to an acidic clay soil.

Vettorazzo, S. C.; Amaral, F. C. S.; and Chitolina, J. C. *Revista Brasileira de Ciencia do Solo* 25(3): 755-763. (2001)

NAL Call #: S590 .R44 ; ISSN: 0100-0683

Descriptors: acid soils/ application rates/ application to land/ biomass production/ chemical composition / clay soils/ crop yield/ growth/ leachates/ leaching/ lime/ mineral nutrition/ paper mill sludge/ soil composition/ soil fertility/ *Eucalyptus grandis* x *Eucalyptus urophylla*/ land application

Abstract: This experiment was carried out under greenhouse conditions with soil pots during 210 days, to evaluate the effect of calcitic paper mill lime-sludge application (at the rates 0, 773, 1.547, and 2.320 mg kg⁻¹ or respective equivalents to control, 2, 4, and 6 t ha⁻¹), on chemical composition of soil leachate and its effects on *eucalypt* (*Eucalyptus grandis* x *E. urophylla*) growth and yield. Highest soil leachate pH, SO₄, and Na concentrations occurred in the 4 and 6 t ha⁻¹ treatments. Soil leachate nitrate concentrations decreased with increasing lime-sludge rate. Soil leachate phosphate remained low (below the detection limit) in all treatments until 120 days, while the concentration increased in the lime-sludge treatments at 210 days (last sampling) in about 600 mg litre⁻¹. Lime-sludge decreased leachate Mg concentration, but had no significant effect among rates. Soil leachate Ca, K, B, Cu, Fe, and Zn did not change significantly for any lime-sludge application rates. The maximum NO₃, Ca, Mg, K, and Na concentrations in the soil leachate occurred at 60 days after lime-sludge application (leaching equivalent to 1 pore volume), but for pH and SO₄, the maximum occurred at 210 days (leaching equivalent to 4 pore volumes). Lime-sludge application decreased the concentration of exchangeable Al in the soil. Plant diameter growth and dry matter yield were increased with increasing lime-sludge rate. Beneficial effects on mineral nutrition (P, K, Ca, B, and Zn) of *eucalyptus* were also obtained by the application of 4 and 6 t ha⁻¹ of lime-sludge.

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694. Optimization of reed residue substrate formula for tomato plug seedling production.

Li QianSheng; Bu ChongXing; Ye Jun; Guo ShiRong; and Li ShiJun

Acta Agriculturae Shanghai 19(4): 73-75. (2003); ISSN: 1000-3924

Descriptors: growing media/ optimization/ paper mill sludge/ plant residues/ porosity/ seedling growth/ seedlings/ substrates/ tomatoes/ waste utilization/ water holding capacity/ water uptake/ potting composts/ rooting media

Abstract: Reed residue substrate, a new local organic substrate made from solid wastes of paper mill, was developed and extended in East China as peat alternative for soilless culture and nursery production. Ten formulas based on composted reed residue were used in tomato plug seedling production and Cornell complex was used as the control. Results showed that the substrate consisting of 75% composted reed residue and 25% vermiculite was the best. This substrate had a 21% aeration porosity, 57% water holding capacity, and high water absorbing and retaining capacity which enabled a vigorous growth of the plants.

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695. Optimizing composting of paper mill sludge and hardwood sawdust under optimum conditions.

Champagne, P.; Marche, T.; Dinel, H.; Schnitzer, M.; and Paré, T.

In: Joint 2002 CSCE/ASCE International Conference on Environmental Engineering: An International Perspective on Environmental Engineering.

Niagara Falls, Ont.; pp. 931-942; 2002.

Notes: Conference code: 65425. Sponsors: Canadian Society for Civil Engineering; ASCE, Environment and Water Resources Institute.; ISBN: 088955532X

Descriptors: bio-available C/ N/ biostabilization/ composting/ paper mill sludge/ sawdust/ composting/ concentration (process)/ hardwoods/ optimization/ paper and pulp mills/ recycling/ sawdust/ spectroscopic analysis/ bio-available c/ n/ biostabilization/ composted materials/ paper mill sludge/ sludge disposal/ composting/ hardwoods/ optimization/ paper mills/ pulp mills/ recycling/ saw dust/ sludge disposal

Abstract: Recycling of paper mill sludge by means of composting is becoming an acceptable practice for converting organic residues into useful soil amendments, while eliminating negative environmental impacts. The main chemical structures of paper mill sludge composted materials produced by industrial-scale and pilot-scale in-vessel processes were investigated in order to better understand the chemical changes occurring during composting. Chemical and spectroscopic methods were used to characterize the composition of the paper mill sludge composted materials. The spectroscopic data revealed that the major components identified in the paper mill sludge were lipids, sterols, lignins, nitrogen-compounds, and carbohydrates. In the pilot-scale process, organic matter loss was approximately 50% higher than in the industrial-scale process. By the end of composting, the concentrations of nitrogen-compounds remained relatively unchanged in the pilot-scale process, whereas in the industrial-scale process, nitrogen-compounds continually

decreased indicating that the biochemical transformations of organic matter were not completed. Thus, composting of paper mill sludge can be successfully achieved if key operating parameters are optimized to reduce losses of nitrogen.

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696. Organic soil amendments: Impacts on snap bean common root rot (*Aphanomyces euteiches*) and soil quality.

Céspedes Leon, M. C.; Stone, A.; and Dick, R. P. *Applied Soil Ecology* 31(3): 199-210. (2006)

NAL Call #: QH541.5.S6 A67; ISSN: 0929-1393

Descriptors: aggregates/ application rates/ arylsulfatase/ beta glucosidase/ bioassays/ biological indicators/ carbon/ composts/ enzyme activity/ fungal diseases/ hydrolysis/ incidence/ microbial flora/ organic amendments/ paper mill sludge/ plant disease control/ plant diseases/ plant pathogenic fungi/ plant pathogens/ root rots/ sandy loam soils/ soil amendments/ soil enzymes/ soil fertility/ soil properties/ soil types/ suppression/ temporal variation/ arylsulphatase/ beans *Phaseolus*/ green bean/ microbial biomass/ microflora/ *Peronosporomycetes*/ phytopathogens/ *Saprolegniaceae*/ snap bean/ soil quality/ *Straminipila*/ United States of America

Abstract: Common root rot (causal agent *Aphanomyces euteiches*) [*Aphanomyces euteiches*] is a major disease of commercially grown snap bean (*Phaseolus vulgaris* L.). Organic amendments hold potential to suppress plant diseases, which may be due to changes in soil biology and other soil properties. The objective of this study was to determine the potential of paper-mill residual by-products to suppress common root rot of snap bean in relation to soil properties. The study was done on soil (Plainfield sandy loam, Hancock, WI) from a field trial comparing annual applications of fresh paper-mill residuals (0, 22 or 33 dry Mg ha⁻¹) or composted paper-mill residuals (0, 38 or 78 dry Mg ha⁻¹). Soil was removed from each treatment that had been in place 3 years in April 2001 (1 year after last amendment) and on September 2001 (4 months after last amendment) and brought to the laboratory. Soils were incubated at field moisture content (25 degrees C) and periodically bioassayed with bean seedlings (9, 44, 84, 106, 137, 225 or 270 days after removal from the field) for snap bean root rot. Soils were sampled on the same day as the root rot bioassay and assayed for beta -glucosidase, arylsulfatase and fluorescein diacetate hydrolysis activities (FDA), microbial biomass-C (MB_c) (by chloroform fumigation), water stable aggregation, and total C. There were large differences in snap bean root rot incidence between the field amendment treatments. The unamended field soil had high levels of disease incidence throughout the experiment but disease incidence tended to decrease over time in amended soils. The disease was suppressed by both fresh and composted paper-mill residuals, but the composted residuals at high rates had the lowest disease incidence (<40%) and produced healthiest plants. Root rot severity was strongly negatively correlated with total C (0.001<=p) and arylsulfatase activity (0.001<=p). beta - Glucosidase activity was negatively correlated (0.05<=p) with disease severity while soil MB_c showed inconsistent negative correlations with disease severity over the incubation sampling periods. Arylsulfatase activity was the best indicator for reflecting disease suppression. The amendments improved soil quality, which was

exemplified by improved aggregation.

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697. Organic wastes for improving soil physical properties and enhancing plant growth in container substrates.

Nkongolo, N. V.; Caron, J.; Gauthier, F.; and Yamada, M. *Journal of Crop Production* 3(1): 97-112. (2000); ISSN: 1092-678X

Descriptors: growing media/ growth/ ornamental plants/ paper mill sludge/ peat/ perlite/ porosity/ pot plants/ saturated hydraulic conductivity/ sewage sludge/ soil physical properties/ ornamentals/ physical properties of soil/ potting composts/ rooting media

Abstract: Increasing rates (5, 10, 25 and 40% v/v) of 6 sources of organic wastes were substituted for peat to assess changes in the physical properties of peat-perlite substrates and investigate the relationship between plant response and these properties. Wastes were either fresh or composted bio-filter sludge (FBF and CBF), sewage sludge (FSS and CSS), and de-inked paper sludge (FDP and CDP). Geranium plants (*Pelargonium x hortorum* cv. Orbit Hot Pink) were grown in the substrates. Growing media saturated hydraulic conductivity (K_s), air-filled porosity (f_a), pore tortuosity (τ), and relative gas diffusivity (D_s/D_o) all increased linearly as the rate of organic wastes increased. Geranium plant height (PHT), shoot dry mass (SDM) and root dry mass (RDM) were either linearly or quadratically decreased as the amount of waste increased in the substrates. During both growing seasons, geranium SDM and RDM were either linearly or quadratically correlated with D_s/D_o and τ . Organic waste types and their rate of application strongly affected the aeration status of the substrates. D_s/D_o and τ better expressed the relationship between plant growth and the physical conditions of the root zone.

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698. Outlook for the production of organic fertilizers from pulp and paper industrial waste.

Sidorenko, O. D.

Agrokhimiya 6: 64-65. (2003); ISSN: 0002-1881

Descriptors: animal manures/ cattle dung/ cellulose/ cellulosic wastes/ fermentation/ fertilizers/ industrial wastes/ organic fertilizers/ paper/ paper mill sludge/ pulp and paper industry/ wastes/ paper industry

Abstract: Methods of processing paper and cellulose waste for use as fertilizers are briefly described. They include fermentation with the aid of bird droppings and cattle manure.

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699. Paper mill residuals and compost effects on particulate organic matter and related soil functions in a sandy soil.

Newman, C. M.; Rotenberg, D.; and Cooperband, L. R.

Soil Science 170(10): 788-801. (Oct. 2005)

NAL Call #: 56.8 So3; ISSN: 0038-075X

Descriptors: pulp and paper sludge/ pulp and paper industry/ solid wastes/ composts/ soil amendments/ soil organic matter/ application rate/ carbon/ nitrate nitrogen/ ammonium nitrogen/ sandy soils / soil fertility/ nitrogen/

crop production/ crop rotation/ *Solanum tuberosum*/ potatoes/ *Phaseolus vulgaris*/ *Cucumis sativus*/ cucumbers/ paper mill residuals/ particulate organic matter
This citation is from AGRICOLA.

700. Paper mill residuals and compost effects on soil carbon and physical properties.

Foley, B. J. and Cooperband, L. R.

Journal of Environmental Quality 31(6): 2086-2095. (2002)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: available water/ carbon/ composting/ composts/ crop production/ Entisols/ irrigation/ irrigation requirements/ irrigation water/ paper mill sludge/ plant water relations/ potatoes/ soil amendments/ soil organic matter/ soil physical properties/ soil types/ soil water content/ waste management/ waste utilization/ water holding capacity/ organic matter in soil/ physical properties of soil/ United States of America/ watering

Abstract: Use of organic byproducts as soil amendments in agricultural production exemplifies a strategy for converting wastes to resources. The overall objective of this research was to evaluate the short- and intermediate-term effects of repeatedly amending sandy soil (Typic Udipsamment) with paper mill residuals (PMR) and composted PMR in a vegetable rotation in Wisconsin's Central Sands (Wisconsin, USA). Specifically, we investigated the effects of PMR and composted PMR on total soil C and related these to changes in water-holding capacity and plant-available water (PAW). Amendment effects on irrigation requirements were estimated with a simple soil water balance model. The experimental design was replicated five times as a randomized complete block with four organic amendments: raw PMR, PMR composted alone, PMR composted with bark (PMRB), and peat applied at two rates and a nonamended control. All amended treatments significantly increased total soil C relative to the nonamended control following applications in 1998 and 1999. One year following the second serial amendment, all PMR treatments increased PAW by 5 to 45% relative to the control. There was a significant positive linear relationship between total soil C and PAW. All amended treatments reduced the average amount of irrigation water required for potato production by 4 to 30% and the number of irrigation events by 10 to 90%. There was a clear trend of greater reduction in irrigation requirements with more carbon added. The cumulative effects of repeated additions of PMRB suggest that certain composts might sustain elevated PAW and reduce irrigation requirements beyond one year.

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701. Paper mill sludge as a soil amendment: The performance of field beans on a site restored with Gault Clay.

Sellers, G. and Cook, H. F.

In: Land reclamation: extending the boundaries.

Proceedings of the 7th International Conference of the International Affiliation of Land Reclamationists. Runcorn, UK.; 193 -200; 2003.

Descriptors: arable farming/ clay soils/ crop yield/ growth/ inoculation/ landfills/ nitrogen/ pulp mill effluent/ reclamation/ soil amendments/ soil organic matter/ soil

types/ waste utilization/ Britain/ green bean/ kraft mill effluent/ organic matter in soil/ snap bean/ United Kingdom

Abstract: Results are presented from a field trial investigating the use of Gault Clay and potentially soil forming materials in the restoration of a Landfill site at Small Dole, West Sussex, UK to arable agriculture. Tertiary paper mill sludge was investigated as a substrate amendment, with field beans as the crop. After one year the paper mill sludge had improved the organic content of both substrates however, the sludge seemed to sequester N from the substrates reducing yield substantially on the Gault Clay. Furthermore, it contained no other mineral nutrients, which may have exacerbated the P deficiency in the Gault Clay. Also, Gault Clay proved difficult to cultivate in wet autumn conditions. Crop performance was superior on the soil forming material probably because it did not stay waterlogged for so long and the beans became inoculated with *Rhizobium* bacteria so lack of N wasn't such a factor compared to the Gault Clay.

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702. Paper mill sludge composting and compost utilization.

Evanylo, G. K. and Daniels, W. L.

Compost Science and Utilization 72(2): 30-39. (1999)

NAL Call #: TD796.5.C58 ; ISSN: 1065-657X

Descriptors: chemical properties/ composting/ composts/ dry matter/ growing media/ growth/ nutrients/ organic wastes/ paper mill sludge/ radishes/ sludges/ utilization/ Capparales/ green bean/ potting composts/ rooting media/ snap bean/ United States of America

Abstract: The potential for composting combined primary and secondary dewatered paper mill sludge (PMS) was assessed and the suitability of the finished product as a potting soil substitute was evaluated. Composting treatments were: (1) PMS with no supplemental N (control), (2) PMS + 15 kg N/t PMS (dry weight), and (3) PMS + 30 kg N/t PMS (dry weight). Composting was conducted for 129 days and treatment effects were evaluated by windrow temperature trends. A container plant growth study employing various particle size fractions and proportions of the control PMS compost and a commercial potting medium (Promixtm) was conducted in a greenhouse to assess the capability of the compost to support growth of radish (*Raphanus sativus*), snap bean (*Phaseolus vulgaris*), marigold (*Tagetes erecta*), and green pepper (*Capsicum* sp.). Windrow temperatures were lower with no supplemental N than with the N additions during the initial three weeks and were higher with increasing N rate during the last month of composting, which indicated that the unamended sludge may have been N-limited for maximum biological activity. Reduced temperatures in the high N treatments during the midpoint of the composting process may have been induced by ammonia toxicity. However, cured compost chemical properties and stability were not influenced by treatment and were indicative of good quality compost. The lower amount of plant-available water and greater amounts of plant-available nutrients supplied by the compost than the commercial potting medium resulted in less dry matter produced by all plants except green pepper, whose higher nutrient needs were supplied better by the compost than the commercial potting medium alone.

Therefore, the paper mill sludge compost may best be used as an organic fertilizer, soil amendment, or supplemental nutrient source for potting media, rather than as a potting medium alone.
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703. Paper mill sludge: Heedstock for tomorrow.

Glenn, J.

Progress in Paper Recycling 7(3): 54-59. (1998); ISSN: 10611452 [00297].

Notes: Chapter Number: Appleton, WI, United States.

Descriptors: agriculture/ composting/ land reclamation/ paper and pulp mills/ recycling/ paper mill sludge/ paper mill wastes/ sludge disposal

Abstract: The paper deals with new trends in the disposal and recycling of paper mill sludge. Today the situation with paper mill sludge recycling is changed and ever increasing amount of it is either put back into the production of paper or otherwise being utilized. It is noted that sludges from paper mills which typically have excellent moisture holding properties and also are a significant source of organic matter are well suited for use in both land reclamation and agriculture by means of composting and other operations. © 2009 Elsevier B.V. All rights reserved.

704. Paper mill sludge-soil mixture: Kinetic and thermodynamic tests of cadmium and lead sorption capability.

Battaglia, A.; Calace, N.; Nardi, E.; Petronio, B. M.; and Pietroletti, M.

Microchemical Journal 75(2): 97-102. (2003); ISSN: 0026265X [MICJA].

Notes: doi: 10.1016/S0026-265X(03)00074-2.

Descriptors: cadmium/ lead/ paper mill sludge/ soil sorption/ aluminum silicate/ cadmium/ carbonic acid derivative/ cellulose/ inorganic compound/ lead/ lignin/ organic compound/ tannin/ chemical interaction/ chemical modification/ heavy metal removal/ paper industry/ sludge/ soil/ thermodynamics

Abstract: Paper mill sludge (characterized by 29.0% of organic substances such as cellulose, lignin and tannins and 71.0% of inorganic substances such as kaolinite and carbonates) was studied in a mixture with soil in order to evaluate its effects on soil capability for retaining heavy metals. Attention was focused on cadmium and lead sorption and two parameters were investigated, the contact time of paper mill sludge-soil mixture and the paper mill sludge-soil ratio in the mixture. Results showed that paper mill sludge and soil interact to form 'new' sorbing sites. Taking into account sorption results of lead, the retention of which by soil is substantially increased by sludge addition, can highlight this modification. Also, the amount of sorbed cadmium was increased by sludge addition. © 2003 Elsevier Science B.V. All rights reserved.
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705. Paper mill sludges (biosolids) applications in agriculture: Agronomic and environmental impacts.

N'Dayegamiye, A.; Huard, S.; and Thibault, Y.

In: International Environmental Conference.

Montreal, QC; pp. 651-656; 2002.

Notes: Conference code: 61664

Sponsors: TAPPI; NCASI; PAPTAC; FSDA.

Descriptors: agronomy / bacteria/ biomass/ crops/ effluents/ environmental impact/ enzymes/ fertilizers/ biosolids/ paper and pulp mills/ agronomy/ bacteria/ biomass/ farm crops/ fertilizers/ paper mills/ pollution/ sludge

Abstract: Environmental technologies in paper industry are recognized as important tools in water pollution control and generate high quantities of paper mill sludges (PMS). Large PMS volumes has been used more and more in agriculture for almost five years in the province of Québec, reducing landfilling of these organic materials. In the present study, the agronomic potential and environmental impacts of PMS have been evaluated since 1997 in field experiments in Central Québec on corn, soya and barley crops. Paper mill sludges were applied at rates varying from 20 to 60 t/ha on wet basis, and compared to mineral fertilizer treatments and to a control without any fertilizer and PMS. Results indicated that PMS applied alone significantly increased corn and barley yields, compared to the control treatment. Lower effects were observed on soya bean. Corn and barley highest yields were obtained when PMS were combined with reduced fertilizer rates (50% to 75% NPKMg) leading to higher yields than those obtained with a complete fertilizer application (100% NPKMg). PMS effects on corn and barley yields were mainly due to their high nutrient contents and efficiency and also to their significant effect on soil properties. PMS significantly increased soil microbial biomass, microbial respiration (CO₂), nitrogen mineralization (NO₃) as well as phosphatase and urease activities. PMS applications also increased soil organic matter content and earthworm abundance (data not presented). Results also indicated that three successive PMS applications did not increase soil metal content (Ni, Cr, Co, Cu, Cd and Pb) in the 0-40 cm soil layer, as a result of their low contents in those constituents. Results on *E.coli* and coliforms also showed lower populations in soil treated with PMS, compared to the control and mineral fertilizer treatments. From this point of view, PMS could be considered safe for use in agriculture when they meet environmental standards. Due to their high nutrient and organic matter contents, PMS are recommended as fertilizers and organic amendments for a sustainable agriculture.
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706. Paper mill waste mixed with compost and other ingredients as container nursery substrates.

Chong, C.

Compost Science and Utilization 11(1): 16-26. (2003)

NAL Call #: TD796.5.C58 ; ISSN: 1065-657X

Descriptors: bulk density/ composting/ composts/ growth/ paper mill sludge/ porosity/ Oleales

Abstract: Growth performance of container-grown dogwood (*Cornus alba* L. 'Sibirica'), forsythia (*Forsythia x intermedia* Zab 'Lynwood'), ninebark (*Physocarpus opulifolius* L.), and weigela (*Weigela florida* (Bunge) A. DC. 'Variegata Nana') were evaluated in 20 waste-derived substrates classified into five groups. Each group had 0, 20, 40 or 60% (by volume) of paper mill biosolids in binary mixtures with bark (PB group), tertiary mixtures with topsoil and sand (PTS group), and quaternary mixtures with bark, topsoil and sand (PBTS group). There were also similar binary and quaternary mixtures with compost instead of bark (PC and PCTS groups, respectively). With few exceptions, top dry weights of all four species increased

(linear or curvilinear responses) with increasing rate of biosolids, and were higher in the compost-amended PC and PCTS (forsythia, 72-99 g/plant, range over all rates of biosolids; ninebark, 97-116; dogwood, 45-60; and weigela, 18-25) than in bark-amended PB and PBTS (forsythia, 26-71; ninebark, 32-80; dogwood, 33-56; and weigela, 7.7-18) substrates. Top dry weights in a control nursery mix (80:15:5 by vol bark:peat:topsoil) used by nurseries were: forsythia, 70; ninebark, 110; dogwood, 51; and weigela, 48. While none of the weigela plants attained size comparable to that of the control, top dry weights of other species reached or exceeded their control counterparts in PC and PCTS substrates over most or all rates of biosolids (all species); in PB and PBTS with 40-60% of biosolids (forsythia and dogwood); and in PTS with the highest rate of biosolids (forsythia, 91; and ninebark, 140). Higher retention of nutrients in the substrates and/or more favorable bulk densities and air-filled porosities, primarily due to the biosolids, contributed to increased growth and/or foliar nutrient status of the plants. Reproduced with permission from the CAB Abstracts database.

707. Paper pulp as an amendment to a tropical acid soil: Effects on growth of rye grass.

Nkana, J. C. V.; Tack, F. M. G.; and Verloo, M. G. *Communications in Soil Science and Plant Analysis* 29(9/10): 1329-1340. (1998)
NAL Call #: S590.C63; ISSN: 0010-3624
Descriptors: acid soils/ liming materials/ paper mill sludge/ soil amendments/ soil pH/ ultisols
Abstract: Paper pulp was evaluated, with reference to lime, as a soil amendment to a tropical acid soil (typic Kandiudult). Ryegrass (*Lolium perenne*) was grown under greenhouse conditions. Amendments were applied at rates to attain target pH values of 5.5, 6.0, and 6.5. Paper pulp and lime were equally effective in increasing dry matter production. Similar to lime, paper pulp provided high calcium (Ca) inputs and alleviated aluminum (Al) and manganese (Mn) toxicity. It is concluded that paper pulp can be applied to a tropical acid soil as a lime substitute. Reproduced with permission from the CAB Abstracts database.

708. Paper sludge as a soil amendment for production of corn.

O'Brien, T. A.; Herbert, S. J.; and Barker, A. V. *Communications in Soil Science and Plant Analysis* 34(15-16): 2229-2241. (Sept. 2003)
NAL Call #: S590.C63; ISSN: 0010-3624
Descriptors: Zea mays / corn/ soil amendments/ pulp and paper industry/ industrial wastes/ grain yield/ fertilizer application/ nitrogen fertilizers/ nutrient uptake/ nutrient content/ soil fertility/ plant growth/ dry matter accumulation/ ammonium compound
Abstract: To evaluate paper sludge as a soil amendment for the production of corn (*Zea mays indentata* Bailey 'Pioneer 35N05'), sludge was added to field plots (0 to 448 Mg wet mass ha⁻¹ in 112 Mg units) in May 1998 and was incorporated into the top 15-cm of soil. No sludge was applied in the second year of cropping (1999). In 1998 and 1999, nitrogen (N) was added at 200 or 400 kg ha⁻¹ as ammonium nitrate. Grain or stover yields in 1998 or 1999 were not affected by the addition of paper sludge. Grain yields did not differ between years, but stover production

was greater in 1998 than in 1999. Grain analysis showed an increase in N, phosphorus (P), potassium (K), magnesium (Mg), zinc (Zn), manganese (Mn), and boron (B) concentrations in the year after application of sludge. Also, stover concentrations of copper (Cu) and B were greater in the second growing season than in the first year. Soil analysis showed a decrease in nitrate and calcium (Ca) concentrations with addition paper sludge in 1998. In 1999, nitrate and Ca concentrations did not vary with addition of paper sludge. Soil cation exchange capacity was greater in 1999 than in 1998, with the base saturation being dominated by Ca. Soil pH was 7.0 in 1998 and 7.2 in 1999. Adding paper sludge did not increase soil organic matter, which averaged 2.5%. Results from this study indicated that additions of paper sludge to soil added some nutrients to the crop and did not suppress corn yields. This citation is from AGRICOLA.

709. Paper sludges as soil conditioners.

Norrie, J. and Fierro, A.
Handbook of Soil Conditioners: Substances that Enhance the Physical Properties of Soil: 97-118. (1998)
NAL Call #: S661.7.H35 1998
Descriptors: amendments/ paper mill sludge/ properties/ sludges / soil conditioners
Abstract: The use of paper mill sludges as soil conditioners and amendments for agricultural, horticultural and silvicultural applications is reviewed. Pulping and bleaching processes and sludge production are described. Current sludge production and disposal methods in paper manufacture are outlined. The characteristics of paper mill sludge are described: physical properties, pH, heavy metals and organic compounds, decay patterns, nitrogen availability, availability of other plant nutrients, salinity and sodicity. Plant responses to paper sludge and other lignocellulosic amendments are reviewed. Reproduced with permission from the CAB Abstracts database.

710. Papermill biosolid and hog manure compost affect short-term biological activity and crop yield of a sandy soil.

Lalande, R.; Gagnon, B.; and Simard, R. R. *Canadian Journal of Soil Science* 83(4): 353-362. (2003)
NAL Call #: 56.8 C162; ISSN: 0008-4271
Descriptors: acid phosphatase/ beta galactosidase/ beta glucosidase/ biological activity in soil/ carbon / composts/ crop yield/ enzyme activity/ fertilizers/ fluorescein/ microbial flora/ mineralization/ nutrient uptake/ paper mill sludge/ pig manure/ Podzols/ potatoes/ sandy soils/ soil enzymes/ soil types/ urease/ wheat/ acid phosphomonoesterase/ microbial biomass/ microflora
Abstract: Soils used for intensive vegetable production often become depleted in their organic matter content, and consequently low in their microbial activity. Papermill sludge compost may be an efficient way to improve the biological activity of these soils. An experiment was initiated to determine the effects of a co-composted papermill sludge and hog manure (PHC), applied alone or in combination with mineral fertilizers (MF), on several biochemical properties and crop yield of a Bevin loamy sand (Orthic Humo-Ferric Podzol) located at Saint-Ubalde, province of Quebec, Canada. The PHC was applied in the spring of 1997 at rates of 0, 11.5, 23 and 34.5 Mg dry weight ha⁻¹, with and without MF equivalent to 150 N-200

P₂O₅-200 K₂O kg ha⁻¹. Potatoes (*Solanum tuberosum* L.) were planted the first year and the residual effect of PHC was evaluated on a spring wheat (*Triticum aestivum* L.) crop in 1998. Enzymatic activity of beta -glucosidase, beta -galactosidase, acid phosphatase, urease and fluorescein diacetate hydrolysis, microbial biomass C (MBC) and CO₂-C release in incubation were measured throughout both growing seasons. Application of 11.5 Mg ha⁻¹ of PHC resulted in the highest enzymatic activities and MBC, representing a mean increase of respectively 30 and 55% over the control. Addition of MF to PHC resulted in a greater increase in enzyme activities (12-18%) than PHC alone but had little effect on MBC. Generally, enzyme activities and MBC decreased in the second season. The carbon mineralization potential was low, indicating that the composted material was relatively stable. The addition of 11.5 Mg PHC ha⁻¹ produced the highest marketable potato tuber yield with (34 Mg ha⁻¹) or without (27 Mg ha⁻¹) fertilizer supplement, whereas the highest wheat grain yield was obtained with the 23 Mg PHC ha⁻¹ level in the following season. When PHC was added at 11.5 Mg ha⁻¹, it markedly improved soil biochemical properties and potato crop yield whereas the 34.5 Mg ha⁻¹ level was excessive. Reproduced with permission from the CAB Abstracts database.

711. Papermill biosolids effect on soil physical and chemical properties.

Price, G. W. and Voroney, R. P.

Journal of Environmental Quality 36(6): 1704-1714. (2007)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: aggregates/ agricultural soils/ application rates/ bioavailability/ bulk density/ carbon/ carbon nitrogen ratio/ electrical conductivity/ heavy metals/ hydraulic conductivity/ infiltration/ organic amendments/ paper mill sludge/ soil chemical properties/ soil pH/ soil physical properties/ soil structure/ soil types/ soil water content/ soybeans/ waste utilization/ chemical properties of soil/ physical properties of soil/ soybeans

Abstract: Papermill biosolids (PB) can provide multiple benefits to the soil system. The purpose of this study was to quantify the effects of a high C/N ratio (C/N=100) de-inked PB on soil physical and chemical properties, including soil bulk density, infiltration rates, wet aggregate stability, total soil carbon, and heavy metal concentrations. Four rates of PB (0, 50, 100, and 150 Mg ha⁻¹) were applied annually, for up to 3 yr, on four agricultural soils in Ontario, Canada. Decreases in soil bulk density between 0.27 and 0.35 g cm⁻³, relative to the nonamended treatment, were observed in soils receiving PB treatments over 3 yr. Total soil carbon increased within 1 yr on PB-amended soils planted to soybeans but not on soils planted to corn. Hydraulic conductivities (K_s) were greater in all soils receiving PB amendments relative to the nonamended treatment throughout the study. Other properties measured, such as pH and electrical conductivity, were relatively unchanged after 2 yr of PB applications. While some increases in heavy metal accumulation occurred, there were no clear trends observed at any of the sites related to PB rates. The results of this study provide support to the idea that annual applications of PB can add significantly to the stability of soil structure.

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712. Pelletized chicken litter as a nutrient source for pine establishment in the Georgia coastal plain.

Bush, P B; Merka, W C; and Morris, L A, SRS 20 USDA Forest Service, 1998. 427-432.

Descriptors: costs/ forest plantations/ forest soils/ increment/ paper mill sludge/ phosphorus fertilizers/ poultry manure/ soil amendments/ sulfate pulping/ costings/ kraft process/ kraft pulping/ phosphate fertilizers/ poultry litter/ sulphate pulping/ United States of America

Abstract: The chicken litter was evaluated as a potential phosphorus source for loblolly pine (*Pinus taeda*). Additions of primary sludge from a kraft paper mill stabilized the poultry manure with a high carbon:nitrogen ratio; such mixtures have potential as slow-release nutrient sources. Litter application cost \$9.25/acre vs \$29/acre for diammonium phosphate.

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713. Physical properties of paper sludge-amended media used for evergreen shrub production.

Tripepi, Robert R. and George, Mary W.

In: 98th Annual International Conference of the American Society for Horticultural Science. Sacramento, California, USA.; Vol. 36(3); pp. 499; 2001.

NAL Call #: SB1.H6

Descriptors: horticulture: agriculture/ waste management: sanitation/ coniferopsida: gymnosperms, plants, spermatophytes, vascular plants/ ericaceae: angiosperms, dicots, plants, spermatophytes, vascular plants/ rosaceae: angiosperms, dicots, plants, spermatophytes, vascular plants/ de-inked paper sludge container media: equipment, ornamental culture/ evergreen shrub production/ meeting abstract/ meeting poster

Abstract: De-inked paper sludge from a newsprint mill was evaluated as a substitute for softwood bark in container media. Rooted cuttings of 'Youngstown' juniper (*Juniperus horizontalis*), Fraser photinia (*Photinia x fraseri*), and 'PJM' rhododendron (*Rhododendron*) were planted in 3-L plastic pots that contained potting media amended with 0%, 20%, 40%, 60%, 80%, or 90% paper sludge and 80%, 60%, 40%, 20%, 0%, or 0%, bark, respectively, (by volume). All mixes contained 10% sand and 10% peat moss, except for the 90% mix, which lacked peat moss. Initial bulk density, aeration, water-holding capacity, and total porosity were measured for all media. Final aeration, water-holding capacity, and total porosity were also measured after plants grew in the media for 19 weeks. The heights of the potting mix columns in 16 randomly selected pots for each medium were measured during the second and nineteenth weeks to determine if the volume of the growth medium had changed. The mix made with 90% paper sludge was approx 23% lighter than the control medium that contained 80% bark (control). Initial aeration, water-holding capacity, and total porosity of paper sludge-amended mixes were significantly higher than those of the control, and aeration of the 90% sludge mix was over 2.5-fold higher than that of the control mix. Potting mixes made with 60% or more paper sludge shrunk by 5% or more in volume during the experiment. In fact, the volume of the 90% sludge mix shrunk by almost 13% during the 17-week measurement period. This study demonstrated that paper sludge-amended media were light in weight and well aerated, but their volume also shrunk in proportion to the amount paper used in the mix.

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714. Physicochemical characteristics of lime sludge waste of paper mill and its impact on growth and production of rice.

Medhi, U. J.; Talukdar, A. K.; and Deka, S.
Journal of Industrial Pollution Control 21(1): 51-58. (2005);
ISSN: 09702083 [JIPCE]

Descriptors: growth/ impact/ lime sludge/ paper mill/ rice/ yield / crop production/ physicochemical property/ pulp and paper industry/ rice/ sludge

Abstract: The Nagaon paper mill generates about 448 tones (NEERI, 1990) of lime sludge per day as solid waste. The generated lime sludge has been disposed to a nearby low-lying area of the paper mill. The lime sludge contains huge amount of Calcium Carbonate. Since the agricultural soil of Assam is generally acidic in nature, so liming is necessary to maintain the soil pH. Instead of marketed lime, lime sludge waste of paper mill can also be used in the agricultural soil and soil can profitably be used for crop production. Keeping this view in mind the present investigation was carried out to study the effect of lime sludge on soil quality and production of rice. The physicochemical properties of the lime sludge waste have been analysed. It is shown high in alkalinity (pH 10.35), water holding capacity (70.4%), percentage of calcium carbonate (65.62), sodium (211 ppm), potassium (161 ppm), calcium (7433 ppm). Results of pot experiment on growth and yield reveals that 10 to 30% lime sludge applied in the soil has increased the height of the plants, number of seeds and dry weight of rice. Physicochemical characteristics of sludge mixed soil at the time of plantation and after harvesting have shown significant change in pH, conductivity, Sodium, Potassium, Nitrogen etc. © Enviromedia Printed in India. All rights reserved. © 2009 Elsevier B.V. All rights reserved.

715. Phytotoxicity of organic amendments on activities of select soil enzymes.

Madejon, E.; Burgos, P.; Murillo, J. M.; and Cabrera, F.
Communications in Soil Science and Plant Analysis 32(13-14): 2227-2239. (2001)

NAL Call #: S590.C63; ISSN: 0010-3624

Descriptors: beta glucosidase/ composting/ composts/ cress/ enzyme activity/ heavy metals/ organic amendments/ oxidoreductases/ paper mill sludge/ phytotoxicity/ salinity/ sandy soils/ seed germination/ soil enzymes/ soil organic matter/ soil types/ solid wastes/ urease/ Capparales/ organic matter in soil/ redox enzymes

Abstract: Three organic materials, a municipal solid waste compost (MWC), a paper sludge (PS) and an agroforest compost (AC), were tested to relate their stability to the corresponding soil enzyme activity resulting from their application. PS and AC were stable materials, free of phytotoxic substances, although AC presented direct toxicity due to its high salinity and inhibited seed germination of *Lolium multiflorum* and *Lepidium sativum*. The presence of heavy metal does not seem playing an important role in the phytotoxicity of the tested materials since, the highest values of germination index were obtained with PS material despite its high heavy metals concentration. However, MWC presented a low level of maturity affecting negatively seed germination, and indicating an inaccurate composting process. The application of the three organic materials to a sandy soil (at a rate equivalent to ~50 000 kg ha⁻¹) increased soil enzyme activities (dehydrogenase [oxidoreductase], beta -

glucosidase, urease and benzoylargininamide hydrolyzing (BAA)) with respect to the control (soil without organic matter application) during one month of incubation. The positive effect of the organic materials on enzyme activities was more pronounced in the case of the MWC, a fresh organic residue having low organic matter stability. It suggested that the presence of phytotoxic substances did not affect negatively soil enzyme activities. Probably, molecules or promoters released by decomposing organic compounds which affect negatively seed germination, enhance enzyme activities.

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716. Plant foliar disease suppression mediated by composted forms of paper mill residuals exhibits molecular features of induced resistance.

Vallad, G. E.; Cooperband, L.; and Goodman, R. M.
Physiological and Molecular Plant Pathology 63(2): 65-77. (2003); ISSN: 0885-5765

Descriptors: defence mechanisms/ disease resistance/ elicitors/ genetically engineered organisms/ induced resistance/ industrial wastes/ leaves/ paper mill sludge/ pathogenesis/ plant diseases/ plant pathogenic bacteria/ plant pathogens/ residues/ soil amendments/ tomatoes/ transgenic plants/ waste utilization/ Capparales / defense mechanisms/ genetically engineered plants/ genetically modified plants/ GMOs/ phytopathogens/ resistance to disease

Abstract: *Arabidopsis thaliana* grown in soil from field plots amended with composted forms of paper mill residuals (PMR) exhibited reduced symptoms of bacterial speck caused by *Pseudomonas syringae* pv. tomato (Pst) compared with plants grown in soil from field plots amended with a non-composted PMR or non-amended soils. Similar results were obtained with tomato (*Lycopersicon esculentum* Mill.). No relationship between foliar disease suppression and plant nutrition or stature was observed. In *Arabidopsis*, the reduction of foliar disease symptoms ranged between 34 and 65%, depending on the type of composted PMR amendment, and was associated with reduced Pst titers in planta. An *Arabidopsis* npr1 defence mutant and a NahG transgenic line, both of which exhibit disrupted systemic acquired resistance, were also disrupted in their suppression of Pst disease symptoms in composted PMR treatments. *Arabidopsis* grown in soil amended with composted PMR also displayed an increased expression of pathogenesis-related defence genes prior to pathogen inoculation. We conclude that plants grown in soils with composted PMR-amendments were more resistant to disease caused by Pst due to the induction of plant defenses, similar to systemic acquired resistance. The identity of the PMR elicitor(s) is as yet unknown, but was shown to be heat labile.

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717. Pore occlusion by sugars and lipids as a possible mechanism of aggregate stability in amended soils.

Hafida, Z.; Caron, J.; and Angers, D. A.
Soil Science Society of America Journal 71(6): 1831-1839. (Nov. 2007-Dec. 2007)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Descriptors: soil aggregates/ aggregate stability/ soil pore system/ soil amendments/ pulp and paper sludge/

composts/ lipids/ sugars/ clay loam soils/ carbon/ mineralization/ swelling (materials)/ pressure/ silty clay loam soils / uronic sugars

Abstract: Understanding the underlying mechanisms of structural stability and the contribution of specific organic fractions to such mechanisms is critical in designing new soil and water conservation strategies relying on organic amendments. The objective of this work was to study the role of neutral and uronic sugars and lipids in affecting key mechanisms (swelling rate, pressure evolution) involved in the stabilization of individual aggregates. A 48-wk incubation study was performed on a clay loam and a silty clay loam amended with either deinking-secondary sludges, primary-secondary sludges, or composted deinking sludges at rates ranging from 8 to 24 Mg dry matter ha⁻¹. Different structural stability indices were measured during the incubation, along with CO₂ evolved, neutral and uronic sugar, and lipid contents. Significant increases in all stability indices were measured for both soil types. These improvements were linked to a very intense phase of C mineralization and highly correlated with neutral and uronic sugars as well as lipid contents. Paper sludge amendments also resulted in significant decreases in maximum internal pressure of aggregates and aggregate swelling following immersion in water, two mechanisms affecting structural stability. Overall, the results suggest that reduction in maximum internal pressure induced by organic amendments probably resulted from increases in pore surface roughness and pore occlusion rather than an increase in surface wetting angles. This study also supports the view of a nonspecific action of the lipids and neutral and uronic sugars on aggregate stability to rapid wetting. This citation is from AGRICOLA.

718. Potential for the large-scale production of a biocontrol fungus in raw and composted paper mill waste.

Ramona, Y. and Line, M. A.

Compost Science and Utilization 10(1): 57-62. (2002)

NAL Call #: TD796.5.C58 ; ISSN: 1065-657X

Descriptors: biological control/ composting/ growth/ industrial wastes/ paper mill sludge/ population density/ survival/ Hyphomycetes/ Leotiales/ Sclerotiniaceae

Abstract: The growth and survival of a *Trichoderma* spp. (Td₂₂) antagonistic to *Sclerotinia minor* and *Sclerotium cepivorum* was studied in raw wood fibre waste (WFW) of paper mill origin and in mature compost of this material. In nutrient-amended, sterilized WFW or WFW compost (both supplemented with 20% w/w millet seed), the biocontrol fungus reached densities in the order of 10¹⁰ colony forming units (cfu)/g after 14 days incubation. Lower population densities of Td₂₂ were achieved under non-sterile conditions in the compost:millet mix of between 107-109 cfu/g after 28 days, depending on pretreatment. Viable spore density of Td₂₂ in raw WFW amended with nutrients and 20% w/w millet seed reached approximately 10¹⁰ cells/g after 14 days incubation. This study indicates that cellulosic paper mill waste could provide an abundant low-cost growth medium for the large-scale culture of this or other biocontrol fungi.

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719. Potential mineralization of nitrogen from organic wastes to ryegrass and wheat crops.

Cordovil, C. M. d. S.; Cabral, F.; and Coutinho, J.

Bioresource Technology 98(17): 3265-3268. (Dec. 2007)

NAL Call #: TD930.A32 ; ISSN: 0960-8524.

Notes: In the special issue: Sustainable organic waste management for environmental protection and food safety / edited by M Pilar Bernal, R Moral and Sabine Hourot Paper presented at the "11th International Conference of the FAO ESCORENA Network on Recycling of Agricultural, Municipal and Industrial Residues in Agriculture", October 6-9 2004, Murcia, Spain.

Descriptors: agricultural soils/ soil amendments/ organic wastes/ municipal solid waste/ pulp and paper sludge/ poultry manure/ pig manure/ nitrogen/ mineralization/ Lolium/ Triticum aestivum/ wheat/ nutrient uptake

Abstract: Two-pot experiments with ryegrass and wheat plants were conducted in a Cambic Arenosol to test the reliability of N fate predicted by incubation experiments previously performed, with the same soil, to assess potentially mineralizable nitrogen from six organic wastes (municipal solid waste compost, secondary pulp mill sludge, horn meal, poultry manure, solid phase from pig slurry and composted pig manure). Two treatments, corresponding to 80 and 160 kg N/ha were tested, with or without mineral N fertilization. Experimental data obtained in the pot trials was consistent with nitrogen net mineralization trend observed in the aerobic incubations with all the wastes tested. Values of potentially mineralizable nitrogen (N(0)) from the equations obtained by model fitting, to the incubation data, were well correlated to ryegrass and wheat N uptake. Poultry manure was the most efficient N supplier to crops. This citation is from AGRICOLA.

720. Potentially mineralizable nitrogen from organic materials applied to a sandy soil: Fitting the one-pool exponential model.

Cordovil, C. M. d. S.; Coutinho, J.; Goss, M.; and Cabral, F.

Soil Use and Management 21(1): 65-72. (2005)

NAL Call #: S590.S68; ISSN: 0266-0032

Descriptors: biochemistry and molecular biophysics/ waste management: sanitation/ models and simulations: computational biology/ soil science/ one pool exponential mineralization model: mathematical and computer techniques/ aerobic incubation: laboratory techniques/ sandy soil/ water holding capacity/ poultry manure/ organic waste/ municipal waste/ cambic arenosol soil/ pulp mill sludge/ hornmeal/ pig slurry/ composted pig manure

Abstract: Over the last three decades there has been a great increase in the production of waste from urban, industrial and agricultural activity that could be recycled as a source of plant nutrients, and used to enhance soil quality. The use of these materials could partially offset the need for mineral fertilizers, giving both economic and environmental benefits. An incubation experiment was carried out using different organic waste materials applied to a Cambic Arenosol. Air-dried soil was mixed with increasing amounts of composted solid municipal waste, secondary pulp-mill sludge, hornmeal, poultry manure, solid phase from pig slurry, and composted pig manure, resulting in applications equivalent to 0, 40, 80, 120, 160 and 200 kg ha⁻¹ of Kjeldahl nitrogen. The samples were incubated for 244 days under a controlled environment of 24 degrees C

and 60% water holding capacity of the soil. The increasing amounts of waste applied always led to a greater amount of potentially available nitrogen present in the soil/waste mixture. Based on the proportion of their active N fraction, wastes were ranked: poultry manure > hornmeal > solid phase from pig slurry > composted pig manure > secondary pulp-mill sludge > composted municipal solid waste. The results were well described by a one-pool exponential mineralization model, and mineral N formation was proportional to the quantity of waste applied. Of the wastes tested, those from animal sources showed greater nitrogen mineralisation. Nitrification was rapid, and concentrations of ammonium nitrogen remained relatively small.

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721. Prediction of nitrogen mineralisation from organic residues and supply to ryegrass.

Cordovil, C. M. d. S.; Coutinho, J.; and Cabral, F. In: Controlling Nitrogen Flows and Losses. 12th Nitrogen Workshop. University of Exeter, UK.; pp. 156-157; 2004. *Descriptors:* Arenosols/ crop residues/ hoof and horn meal/ mineralization/ nitrogen/ nitrogen fertilizers/ nutrient uptake/ paper mill sludge/ prediction/ soil fertility/ soil types Reproduced with permission from the CAB Abstracts database.

722. Primary and secondary sludge composting: A feasibility study suggestions are offered on how to reduce the disposal problem.

Arrougé, T.; Moresoli, C.; and Soucy, G. *Pulp and Paper Canada* 100(4): 33-36. (1999); ISSN: 03164004 [PPCAA] *Descriptors:* composting/ costs/ sludge/ sludge disposal/ composting/ cost benefit analysis/ paper and pulp mills/ sewage treatment/ sludge disposal/ composting plants/ paper and pulp industry *Abstract:* The disposal of primary and secondary sludge is becoming a stringent problem for the pulp and paper industry. With the increasing costs of traditional disposal such as landfilling, the industry is seeking new alternatives. In this paper, the key parameters for the treatment of sludge to produce a high quality compost are discussed. In particular, the physical and chemical characteristics of the sludge, the composition of the raw materials mix and the design of the composting plant are addressed. A preliminary cost analysis is also presented. © 2009 Elsevier B.V. All rights reserved.

723. Production and partial characterisation of xylanase from *Streptomyces* sp. strain AMT -3 isolated from Brazilian cerrado soil.

Nascimento, R. P.; Coelho, R. R. R.; Marques, S.; Alves, L.; Girio, F. M.; Bon, E. P. S.; and Amaral Collaco, M. T. *Enzyme and Microbial Technology* 31(4): 549-555. (2002); ISSN: 0141-0229 *Descriptors:* agroindustrial byproducts/ brewers' grains/ cerrado soils/ enzyme activity/ hemicelluloses/ isoenzymes/ maize cobs/ paper mill sludge/ soil bacterial/ temperature/ wheat bran/ wheat germ/ xylan/ endo 1,4 beta xylanase/ isozymes/ wood gum/ wood rosin *Abstract:* *Streptomyces* sp. AMT-3 strain previously isolated from Brazilian cerrado soil has been selected as a promising strain for xylanase production. This bacterial strain was able to produce a medium-high range of extracellular xylanolytic activity levels for liquid cultures

containing commercial xylans (birchwood, larchwood and oat spelts) and agroindustrial byproducts and wastes. Although the best xylanase production (70.0 U ml⁻¹) was obtained in growth medium containing larchwood xylan 1% (w/v), xylanolytic activity was also observed when wheat bran (28.4 U ml⁻¹), wheat germ (20.4 U ml⁻¹), brewer's spent grain (16.0 U ml⁻¹), maize cobs (9.1 U ml⁻¹) and paper recycling mill sludge (7.9 U ml⁻¹) were used as substrates. The *Streptomyces* sp. AMT-3 strain xylanase activity was characterized in terms of temperature and pH profiles and thermostability. Best enzyme activity was observed at the temperature range from 55 to 65 degrees C and at pH 6.0. The enzyme retained 50% of its activity after 20 h at 55 degrees C. As such, this xylanase could be considered as a thermotolerant biocatalyst being interesting for biotechnological applications. Zymogram analysis of the culture supernatant indicated the presence of several bands suggesting the presence of isoenzymes with different molecular weights. When cells were grown on agroindustrial byproducts lower molecular weight bands were more evident. Reproduced with permission from the CAB Abstracts database.

724. Pulp and paper industry's diverse organics stream.

Kunzler, C. *Biocycle* 42(5): 30-33. (2001) *NAL Call #:* 57.8 C734 ; ISSN: 02765055 [BCYCD] *Descriptors:* byproducts/ composting/ feedstocks/ fibers/ organic compounds/ sludge disposal/ wastewater treatment/ woodash/ paper and pulp industry/ kraft papers/ solid wastes *Abstract:* A variety of organic residuals are produced by the paper and pulp industry ranging from paper mill solids and wood ash to postconsumer recovered fiber. The by-products can be industrial sludges that are land applied or composted to postconsumer fibers that are part of the organic composting programs. Soils and crops receive plant nutrients and organic matters by the land application of pulp and paper residuals. The moderate to high level of organic matter with relatively low level of nutrients in the pulp and paper residuals depend on the specific mills. © 2009 Elsevier B.V. All rights reserved.

725. Pulp and paper mill by-products as soil amendments and plant nutrient sources.

Camberato, J. J.; Gagnon, B.; Angers, D. A.; Chantigny, M. H.; and Pan, W. L. *Canadian Journal of Soil Science* 86(4): 641-653. (2006) *NAL Call #:* 56.8 C162 ; ISSN: 00084271 [CJSSA] *Descriptors:* land application/ N and P immobilization/ nutrient efficiency/ paper mill sludge/ soil physical properties/ compost/ crop improvement/ crop production/ nutrient availability/ pulp and paper industry/ sludge/ soil amendment/ soil improvement/ soil organic matter/ soil property/ soil quality/ waste treatment *Abstract:* Pulp and paper mill sludges are produced from primary and secondary treatment of wastes derived from virgin wood fiber sources, recycled paper products, and non-wood fibers. Sludges and sludge composts may be utilized in agriculture to increase soil organic matter, improve soil physical properties, provide nutrients, and increase soil pH. Positive effects of primary, deinking, and low-nutrient combined sludges on soil quality are primarily

due to increased soil organic matter, aggregation, water holding capacity, infiltration rate, and cation exchange capacity. Nitrogen and P immobilization are often induced by primary and deinking sludges, but can be overcome by delayed planting, adding N and P, planting of legumes, or composting. Improved crop production obtained with secondary treatment sludges is most often attributable to enhanced nutrient availability, particularly N, but improved soil physical properties are implicated in some studies. Pulp and paper mill sludges and sludge composts are useful soil amendments and plant nutrient sources.

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726. Pulp sludge as a component in manufactured topsoil.

Carpenter, A. F. and Fernandez, I. J.

Journal of Environmental Quality 29(2): 387-397. (Mar. 2000-Apr. 2000)

NAL Call #: QH540.J6; ISSN: 0047-2425 [JEVQAA]

Descriptors: topsoil/ soil properties/ waste utilization/ soil amendments/ pollution control/ paper mill sludge

Abstract: The primary objective of this study was to evaluate the use of uncomposted, de-watered pulp sludge as the organic matter component in a manufactured topsoil. Seven manufactured topsoils, containing 5.1, 8.8, 9.6, 10.9, or 13.8% pulp sludge and 0, 8.4, or 20.7% flume grit on a dry weight basis, were applied to an abandoned gravel pit. Manufactured topsoils and a control topsoil were evaluated for (i) impacts on soil and soil solution chemistry and (ii) effectiveness as a growing medium for a grass conservation mix and hybrid poplars (*Populus* spp.). Significant N mineralization was evident in all of the manufactured topsoils within the first field season. Soil cation exchange capacity (CEC), pH and P availability were positively correlated to pulp sludge loading rate. In soil solution, the highest concentrations of solutes were detected within 2 mo of topsoil placement and were dominated by NO₃-N and Ca. Cumulative grass yields from the 15 mo following topsoil placement were greater than those in the control topsoil and ranged from 3.9 to 7.3 Mg ha⁻¹ in the manufactured topsoils. Tree height, diameter growth, and foliar nutrient concentrations responded positively to the manufactured topsoils. Results from this study indicate that topsoils manufactured with pulp sludge as the organic matter component can be an environmentally sound alternative to natural topsoil for the reclamation of sites on which existing conditions necessitate importing topsoil for revegetation. This citation is from AGRICOLA.

727. Quality of anaerobic compost from paper mill and municipal solid wastes for soil amendment.

Poggi-Varaldo, H. M.; Trejo-Espino, J.; Fernandez-Villagomez, G.; Esparza-Garcia, F.; Caffarel-Mendez, S.; and Rinderknecht-Seijas, N.

In: IAWQ Symposium on Forest Industry Wastewaters. Tampere (Finland).) Luonsi, A. (eds.); Vol. 40. Pergamon, P.O. Box 800 Kidlington Oxford OX5 1DX UK: Elsevier Science Ltd.; pp. 179-186; 1999. ISBN: 0080437028

Descriptors: anaerobic digestion/ biochemical oxygen demand/ chemical oxygen demand/ compost/ composting/ composts/ experimental data/ germination/ heavy metals/ heavy metals/ land application/ municipal wastes/ municipal solid wastes/ organic acids/ oxygen/ oxygen uptake/ paper

industry wastes/ paper mills/ pulp and paper industry/ soil/ soil amendments/ solid wastes/ Europe/ United States/ organic acids

Abstract: Our previous work has shown the technical and economic feasibility of the solid substrate anaerobic digestion (DASS) of municipal and non-hazardous industrial solid wastes. However, the anaerobic compost (AnC) quality for direct application as a soil amender or other alternative uses are issues that have received scarce attention. This research aimed at reviewing the advances made by our Group in two areas: anaerobic compost quality determination, and its post-treatment by aerobic composting. A factorial experiment 4x2x2 was run. The factors were feedstock type (4 mixtures of food waste, FW, and lignocellulosic fraction, LG: 100%FW, 67%FW-33%LG, 33%FW-67%LG and 100%LG or FS1, FS2, FS3 and FS4 respectively), temperature (35 degree C and 55 degree C), and mass retention time (MRT, 16 and 23 days). The LG fraction consisted of paper mill sludge cake. Anaerobic compost from DASS reactors operated at 23 day/35 degree C) was fed to lab scale semi-continuous aerobic composters (5 day and 10 day MRT, 35 degree C and 55 degree C). The AnC coming from feedstocks with increasing proportion of LG fraction (FS3 and FS4) gave the lowest chemical oxygen demand (COD), biochemical oxygen demand (BOD), volatile organic acids (VOA) and total ammonia nitrogen (TAN) concentrations in the extract and the highest germination indices (GI). The AnC from thermo- digesters showed a lower quality than those from mesophilic reactors (presumably associated to higher contents of VOA and TAN in the extracts), while AnC from digesters at 23 day-MRT had a better quality than those from reactors operated at 16 day-MRT. Overall, AnC generated in reactors fed with FS3 and FS4, at 35 degree C and 23 day-MRT showed the highest quality. Heavy metal concentrations in all the AnC were lower than the maximum levels indicated in USA and European compost quality standards. However, high total oxygen uptake (UAD), moderate-to-high concentrations of VOA and GIs under 60% indicated that the AnC was not suitable for direct use as a soil improver. Regarding the aerobic post-composting, operation at longer MRT (10 day) and 55 degree C gave aerobic composts of better quality than those coming from 5 day-MRT composters. Aerobic post-composting caused considerable reductions of TAN, VOA, UAD, immediate oxygen demand rate, and increased compost GI up to approximately 100%.

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728. Reclaiming mined lands with biosolids, manures, and papermill sludges.

Haering, K. C.; Daniels, W. L.; and Feagley, S. E.

Reclamation of drastically disturbed lands: 615-644. (2000)

Descriptors: animal manures/ coal mined land/ environmental impact/ health/ paper mill sludge/ reclamation/ reviews/ sewage sludge/ soil amendments/ environmental effects/ United States of America

Abstract: The use of municipal biosolids (sewage sludge), animal manures, and paper mill wastes as mined land soil amendments are reviewed. Mine soils and mining wastes are generally lower in fertility and water holding capacity than natural topsoils and so benefit from the addition of

organic matter. The types of biosolids available, their benefits in land reclamation, health and environmental concerns, United States Environmental Protection Agency regulations concerning land application of biosolids, site-specific and regional research projects in Pennsylvania, Chicago and Virginia are discussed. Using animal manures in reclamation is briefly considered. Paper mill sludge characteristics and its use as a soil amendment are also examined.

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729. Reduction of Pb and Zn bioavailable forms in metal polluted soils due to paper mill sludge addition: Effects on Pb and Zn transferability to barley.

Battaglia, A.; Calace, N.; Nardi, E.; Petronio, B. M.; and Pietroletti, M.

Bioresource Technology 98(16): 2993-2999. (Nov. 2007)
NAL Call #: TD930.A32 ; ISSN: 0960-8524

Descriptors: pulp and paper industry/ pulp and paper mills/ industrial wastes/ pulp and paper mill effluents/ pulp and paper sludge/ kaolinite/ polluted soils/ soil amendments/ heavy metals/ lead/ zinc/ reduction/ bioavailability/ soil pollution/ phytoremediation/ barley/ *Hordeum vulgare*/ plant physiology/ photosynthesis/ transpiration/ stomatal conductance/ peroxidase/ root growth

Abstract: In the last few years solidification/stabilisation of acidic soils polluted by heavy metals with low-cost sorbents has been investigated. Paper mill sludges are produced in large amounts and their disposal is a serious environmental problem. The possibility was therefore studied of using paper mill sludge as a stabilizer to reduce the bioavailable metal forms in polluted soils and thus the transferability of metals to plants (barley). We first investigated the sorbing properties of paper mill sludge for Zn(II) and Pb(II) and then their fractionation both in a polluted soil and in the same soil amended with paper mill sludge in order to check the decrease in mobile forms. Finally in both soils we tested the uptake of two metals by common barley in order to assess the performance of soil remediation from an ecological point of view. The addition of paper mill sludge to a soil contaminated by lead and zinc induces a decrease in the mobile forms of both metals, probably due to the presence in sludge of organic matter and kaolinite, which are able to bind the metals very strongly. The decrease in the mobile forms, which are the most readily available for uptake by plants, corresponds to a decrease in plant uptake.

This citation is from AGRICOLA.

730. Reliability of a chemical method to assess nitrogen uptake by winter wheat.

Cordovil, C. M. d. S.; Coutinho, J.; and Cabral, F.
In: Controlling Nitrogen Flows and Losses. 12th Nitrogen Workshop. University of Exeter, UK.; pp. 158-159; 2004.
Descriptors: Arenosols/ biomass production/ hoof and horn meal/ methodology/ mineralization/ nitrogen/ nitrogen fertilizers/ nutrient uptake/ organic amendments/ paper mill sludge/ pig manure / pig slurry/ poultry manure/ refuse/ reliability/ soil types/ wheat/ winter wheat/ methods/ municipal wastes/ poultry litter/ trash

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731. Replacement of peat in growing substrates by paper mill waste materials.

Dubsky, M. and Sramek, F.

Zahradnictvi 25(3): 115-119. (1998)

Descriptors: bark/ cellulosic wastes/ clay/ composts/ culture media/ fibres/ flowering/ growing media/ growth retardation/ lignocellulosic wastes/ mixtures/ ornamental plants/ paper mill sludge/ peat/ physical properties/ pot plants/ quality/ substrates/ waste utilization/ wastes/ anthesis/ fibers/ ornamentals/ potting composts/ rooting media/ Saxifragales

Abstract: Substrates with peat replaced by paper mill waste materials (primary sludge, mixture of primary and secondary sludge, wood waste fibres) were tested in an experiment with pot plants of *Kalanchoe blossfeldiana*. As a control substrate a mixture of peat (40% by volume), composted bark (40%) and clay (20%) was used. In the test substrates, peat was partly or completely replaced by an alternative component. The physical properties of all substrates were good, and the chemical properties were also suitable. Only substrates with primary sludge and with a higher content of the sludges were higher in Ca and pH. *Kalanchoe* plants performed very well in substrates with 20 to 40% volume of wood waste fibres and no significant differences were found between the dimensions of plants cultivated in these substrates and in the control substrate. Plants cultivated in substrates with 30% primary sludge or with 20% of a sludge mixture also grew well. Very slight growth retardation was found in substrates with 30% or 40% of sludge mixture where significant differences in plant width were found at the end of the experiment.

Nevertheless all plant were of good marketable quality and no differences were found in flowering.

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732. Researchers study vermicomposting of municipal and papermill sludges.

Ceccanti, B. and Masciandaro, G.

Biocycle 40(6): 71-72. (1999)

NAL Call #: 57.8 C734 ; ISSN: 0276-5055

Descriptors: paper mill sludge/ sewage sludge/ sludges/ vermicomposting

Abstract: Pilot and field scale tests into vermicomposting, carried out in Pisa, Italy, are described. These trials evaluated the potential of vermicomposting as an economical/environmental alternative for sludge management. The experiments were performed on mixtures of aerobic sewage sludge and anaerobically treated paper mill sludge. The characteristics and agronomic value of the obtained vermicompost are discussed. Following physical and biological conditioning through an accelerated aerobic composting at the end of the vermicomposting process, a high-quality humic product is obtained for use as a soil organic amendment.

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733. Responses of invertebrates to paper sludge application to soil.

Pearce, T. G. and Boone, G. C.

Applied Soil Ecology 9(1/3): 393-397. (1998)

NAL Call #: QH541.5.S6 A67

Descriptors: application to land/ arable soils/ paper mill sludge/ sandy soils/ soil/ soil amendments/ Britain/ land application/ United Kingdom

Abstract: An area of sandy arable soil in the UK which had been treated with paper sludge (200 t ha⁻¹) supported a much greater abundance of lumbricid earthworms (*Aporrectodea caliginosa* and *Octolasion cyaneum*, endogeic species) at the end of an exceptionally dry summer than adjacent untreated soil. In soil selection tests the endogeic *A. rosea* showed no discrimination between arable soil with and without paper sludges produced by two different processes. It did, however, strongly select sandy moorland soil which had been treated with either paper sludge, and had a pH near 7, over unamended moorland soil of pH 3.9. Similar responses were observed for the herbivorous gastropod *Helix aspersa*. The anecic lumbricid *Lumbricus terrestris* drew substantial amounts of both kinds of paper sludge into its burrow, although comparatively slowly compared with decaying leaf material. *Helix aspersa* readily consumed one of the two sludges. Implications of sludge application for faunal abundance and diversity, and likely effects on soil fertility, are outlined. Reproduced with permission from the CAB Abstracts database.

734. Responses of *Salsola kali* and *Panicum virgatum* to mycorrhizal fungi, phosphorus and soil organic matter: Implications for reclamation.

Johnson, N. C.

Journal of Applied Ecology 35(1): 86-94. (1998)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: fertilizers/ guidelines/ halophytes/ industrial wastes/ mine spoil/ paper mill sludge/ phosphorus fertilizers/ plant pathology/ reclamation/ root inoculation/ soil organic matter/ vesicular arbuscular mycorrhizas/ mine wastes/ mining spoil/ mining wastes/ organic matter in soil/ phosphate fertilizers/ phytopathology/ recommendations/ taconite/ United States of America

Abstract: Unreclaimed taconite mine tailings in Arizona, USA, were used as a mycorrhiza-free ecosystem to gain insights about the influence of vesicular-arbuscular mycorrhizas (VAM) and soil organic matter on the growth of *Salsola kali* (an early successional colonist of taconite tailings) and *Panicum virgatum* (a late successional grass planted during reclamation). To assess relative mycorrhizal responsiveness, *P. virgatum* and *S. kali* were grown in taconite tailings along an experimental phosphorus gradient with and without VAM inoculum isolated from reclaimed taconite tailings. At low phosphorus concentrations, VAM inoculation of roots enhanced the growth (height and dry mass) of *P. virgatum*, but it decreased growth at the two highest phosphorus concentrations. At no phosphorus level did VAM inoculum enhance the growth of *S. kali* but it decreased growth at the highest phosphorus concentrations. In field plots, mycorrhizal inoculum and organic soil amendment (composted paper mill sludge) enhanced the growth of *P. virgatum* and decreased the growth of *S. kali*. Large-scale inoculation of reclamation sites, increasing soil organic matter and avoidance of high rates of fertilizers was recommended.

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735. Restoration of ecosystem function in an abandoned sandpit: Plant and soil responses to paper de-inking sludge.

Fierro, A.; Angers, D. A.; and Beauchamp, C. J.

Journal of Applied Ecology 36(2): 244-253. (1999)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: application rates/ biomass/ bulk density/ cation exchange/ fertilizers/ industrial wastes/ mine spoil/ mineral uptake/ nitrogen/ nitrogen fertilizers/ paper mill sludge/ phosphorus/ phosphorus fertilizers/ reclamation/ revegetation/ sand pits/ seasons/ sludges/ soil amendments/ sustainability/ mine wastes/ mining spoil/ mining wastes/ phosphate fertilizers

Abstract: In mine spoil reclamation, the establishment of a sustainable plant cover requires the improvement of limiting conditions and the re-initiation of carbon (C) and nutrient cycling. The approach used in this study for reclaiming an abandoned sandpit in Quebec, Canada, was based on a heavy organic amendment as an attempt to accelerate the reconstruction of a functional ecosystem. The single intervention consisted of incorporating paper de-inking sludge into soil at two rates (0 and 105 dry t/ha), supplemented with nitrogen (N) at three rates (3, 6 and 9 g/kg sludge) and phosphorus (P) at two rates (0.5 and 1.0 g/kg sludge) followed by sowing (mid-summer) of *Agropyron elongatum* [*Elymus elongatus*]. Standing biomass increased in the presence of sludge after both the first and second full growing seasons. High N application rates further increased yield, more importantly in the second season. The high P rate improved grass establishment in all cases. Ground cover increased with time and doubled in the presence of sludge whereas it decreased in the absence of sludge. P and N uptake were improved consistently in the presence of sludge. Sludge application resulted in improved water retention and cation exchange capacities, and an increase in pH and bulk density of sand pit mine spoil, all of which may have accounted for the significant improvement in plant responses. Levels of soil C and N suggest that this reconstructed system approached sustainability. Adequate N and P supplements will accentuate the positive influence of sludge on revegetation.

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736. Reutilization of a paper factory effluent and waste.

Chatterjee, A. K.

Reutilization of Industrial Effluents and Waste: 101-104. (2001)

Descriptors: agricultural wastes/ dyes/ environmental protection/ fly ash/ irrigation/ lignosulfonates/ magnesium/ organic fertilizers/ paper mill sludge/ pollution control/ powders/ pulp and paper industry/ pulp mill effluent/ pulping/ rice husks/ sodium/ waste management/ waste treatment/ waste utilization/ waste water treatment/ water reuse/ dyestuffs/ farm wastes/ kraft mill effluent/ lignin sulfonate/ lignin sulphonate/ lignosulphonates / paper industry/ rice hulls/ watering

Abstract: The Shiva paper mill, located in Jain Nagar, Uttar Pradesh, India, was established in 1980 and processes mainly agricultural residues (bagasse, wheat straw, rice straw and grasses). This integrated mill has adopted environmentally friendly technology for the pulping process,

and has made great efforts to maintain the ecosystem and the environment free from pollution. Treated effluents are being used by the farmers from nearby villages for irrigation purposes. The paper mill also uses rice husks as a fuel which generates wastes in the form of fly ash. This waste can be used as a fertilizer. The commercial production of three types of lignosulfonates (viz., sodium, magnesium and ferro chrome) from black liquor are detailed. The various applications of these lignosulfonate products, in lye and in powder form, are discussed.
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737. Selection of biological agents from composts for control of damping-off of cucumber caused by *Pythium ultimum*.

Carisse, O.; Bernier, J.; and Benhamou, N.
Canadian Journal of Plant Pathology 25(3): 258-267.
(2003); ISSN: 0706-0661

Descriptors: biological control/ biological control agents/ composts/ cucumbers/ fungal diseases/ manures/ paper mill sludge/ plant disease control/ plant diseases/ plant pathogenic fungi/ plant pathogens/ plant residues/ *Bacillus marinus*/ biocontrol agents/ biological control organisms/ gherkins/ *Graphium putredinis*/ *Hyphomycetes*/ *Penicillium thomii*/ *Peronosporomycetes*/ phytopathogens/ *Pythiaceae*/ *Straminipila*/ *Zygorrhinchus moelleri*

Abstract: The microflora of three composts were studied to isolate and test microorganisms for biological control of *Pythium ultimum* on greenhouse-grown cucumber. A more diverse bacterial population was observed in compost from paper mill sludge (170 groups) than in composts from plant waste and from manure (75 and 88 groups, respectively). In compost from paper mill sludge, 12 fungal species were isolated, compared with 22 and 26 in composts from plant waste and from manure, respectively. Selected bacterial and fungal isolates were evaluated in assays on agar plates against *P. ultimum*. A total of 10 bacterial isolates and 4 fungal isolates significantly ($P \leq 0.0001$) reduced *P. ultimum* growth rate. These isolates were evaluated in the greenhouse for control of damping-off of cucumber. Disease incidence and severity and foliage and root masses were measured 3 weeks after soil inoculation with the microbial agents and *P. ultimum*. Under greenhouse conditions, *Zygorrhinchus moelleri* and *Bacillus marinus* were the most effective microorganisms against damping-off, followed by *Penicillium thomii*, *Pseudomonas fluorescens*, *Pseudomonas aeruginosa*, and *Graphium putredinis*. These isolates were tested in a second greenhouse trial and the best control was achieved with *Z. moelleri* and *Penicillium thomii*.
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738. Sequential extraction of metals from artificially contaminated soils in the presence of various composts.

Madrid, L.; Diaz Barrientos, E.; and Cardo, I.
Trace Elements In Soil: Bioavailability, Flux and Transfer: 43-62. (2001)

Descriptors: composts / copper/ extraction/ Inceptisols/ iron/ lead/ manganese/ nickel/ olive oil/ paper mill sludge/ polluted soils/ refuse/ sandy soils/ soil pollution/ soil types/ strawberries/ temperature/ zinc/ Mn/ municipal wastes/ trash

Abstract: This study investigates the effect of adding to the soil of several composted residues on the distribution of metals added to the soil in soluble form. The possible effect of temperature is also tested. A method developed by the European Union's Community Bureau of Reference (BCR) was used as a sequential extraction procedure. A sandy, surface sample of a Typic Endoquept soil from a strawberry-growing area in southwestern Spain was collected. This soil was amended with three composts: composted urban residues (USR), composted wastes from paper industry (WPI), and composted residues from the olive oil industry (OI). The metal forms with environmental significance can be grouped into three fractions, sequentially extracted by 0.11 M CH_3COOH (f1), $\text{NH}_2\text{OH} \cdot \text{HCl}$ at pH 2 (f2), and $\text{CH}_3\text{COONH}_4$ at pH 5 after digestion with H_2O_2 at 85 $\pm$ 5 degrees C (f3). Results showed that f1 for Zn does not undergo any significant variation due to the presence of OI or USR, while the presence of WPI causes a significant increase in f1. For Cu, the most available fraction, f1, undergoes a marked decrease with the doses of OI (more than 50% units) or USR (~30% units), but it is not sensitive to WPI, f2 and f3 markedly increase with the doses of any compost. For the distribution of Ni, the influence of the doses of any compost on f1 seems to be small and not consistent. Only OI seems to cause some depressing effect on this fraction, f2 shows a consistent increase with the doses of the three composts. For Pb, the most soluble fraction f1 is clearly depressed by the three composts, causing decreases of 13-37% from dose 0-3 (23-38% in the 2-week samples). The proportion of Mn in the soil (native+that present in the composts) that can be mobilized in the three fractions is initially clearly smaller than those observed for the other metals, except in the case of the higher dose of WPI. The proportion of extracted Fe is considerably lower than that of any of the other metals, and the distribution among the fractions is quite different: f1 is negligible, and f3 predominates with percentages somewhat greater than those for Zn, Ni, or Mn in this fraction.

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739. Short-term effects of deinking paper sludge on the dynamics of soil carbon, nitrogen, and phenolic compounds.

Machrafi, Y.; Chalifour, F. P.; Wamegni, J.; and Beauchamp, C. J.
Journal of agricultural and food chemistry 56(23): 11399-11406. (Dec. 2008)
NAL Call #: 381 J8223 ; ISSN: 1520-5118.
19007125

Descriptors: Carbon: analysis/ Germination/ Industrial Waste: analysis/ Nitrogen: analysis/ Phenols: analysis/ Plants: growth & development/ Refuse Disposal: methods/ Sewage: analysis/ -Soil: analysis

Abstract: Applications of deinking paper sludge (DPS) decreased the establishment of some crops, indicating that it may have inhibiting effects. The effects of soil-applied DPS on total carbon (C), nitrogen (N), C:N ratio, and nitrate, ammonium, and phenolic compounds were studied for 2 years. The phytotoxicity of simulated phenolic solutions of raw DPS and DPS-amended soil was investigated. Twelve phenolic compounds were quantified in raw DPS. Vanillin and 3-hydroxy-4-methoxycinnamic acids increased with DPS applications in amended soil for

both years. Total soil C and the C:N ratio increased with DPS applications, while nitrate soil content decreased. Germination indices were affected differently by the phenolic compound solution that simulated DPS. This study highlights the lack of availability of nitrate as the main factor involved in the inhibiting effect of DPS. However, other inhibiting effects of phenolic compounds cannot be ruled out since they are known to inhibit nitrification and to trap nitrate into organic N compounds.

This citation is from PubMed.

740. Short-term effects on soil properties and wheat production from secondary paper sludge application on two Mediterranean agricultural soils.

Rato Nunes, J.; Cabral, F.; and Lcdpez Piclairo, A. *Bioresource Technology* 99(11): 4935-4942. (July 2008)
NAL Call #: TD930.A32; ISSN: 0960-8524

Descriptors: soil properties/ wheat production/ secondary paper sludge/ soil amendment/ Mediterranean agricultural soils

Abstract: This study was conducted under greenhouse conditions to evaluate the potential use of SPS as a fertilizer, amendment and/or liming agent for wheat (*Triticum aestivum* L.). Two representative Mediterranean agricultural soils, a Cambic Arenosol (cmAR) and a Cromic Cambisol (crCM) were used. Treatments included four sludge rates ranging from 0 to 40gkg⁻¹ (equivalent of 0, 38, 88 and 120Mgha⁻¹). A significant increment in soil pH, organic carbon, N total, available P and exchangeable K were observed in both soils. Sludge application significantly increased N and decreased Zn, Mn and Cu concentrations in wheat. Wheat grain yields were reduced by 33% and 37% when 120MgSPSha⁻¹ was applied to cmAR and crCM soils, respectively, due apparently to unavailability of Mg. However, straw yields, with much lower Mg requirements, increased significantly with SPS rates. Secondary pulp mill sludge seems to be a potential source of organic matter, N, P, K and a potential soil amendment liming agent for acid soils, when appropriate supplemental fertilizer was provided. For grain crops grown in these soils, addition of Mg is required for proper nutrient balance.

This citation is from AGRICOLA.

741. Soil Aggregation and Biochemical Properties following the Application of Fresh and Composted Organic Amendments.

Bipfubusa, M.; Angers, D. A.; N' Dayegamiye, A.; and Antoun, H.

Soil Science Society of America Journal 72(1): 160-166. (Jan. 2008-Feb. 2008)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Descriptors: silt loam soils/ soil aggregates/ aggregate stability/ pulp and paper sludge/ composts/ humic substances/ amino sugars/ glucosamine/ microorganisms/ soil fungi/ soil organic carbon/ nitrogen fertilizers/ humification/ field experimentation

Abstract: The aim of this study was to evaluate the effects of fresh and composted paper sludge on macroaggregate stability of a silt loam under field conditions, and to assess the possible role of carbohydrate fractions and humic substances. The treatments included fresh paper mill sludge (PMS) and its compost (CPMS) applied at a rate of 40 Mg ha⁻¹ with or without a mineral N fertilizer (120 kg N ha⁻¹), N fertilizer only (recommended rate of 160 kg N ha⁻¹), and an unamended control. Measurements of total and

amino sugars and humic substances were made on slaking-resistant aggregates 2 yr after the last of three successive annual applications of the treatments. Compared with the treatments that received no organic amendment, the PMS and CPMS applications increased macroaggregate stability by an average of 45%. The effects of fresh vs. composted amendments on soil macroaggregates and their organic C contents were similar but differences in C composition were observed. Humic acid content of aggregates >2 mm was significantly higher (50%) with CPMS than PMS, although part of this effect could be attributed to the slightly greater C application rate with CPMS. Conversely, glucosamine content, an indicator of fungi abundance, was significantly greater following PMS than CPMS application. We concluded that microorganisms, in particular fungi, were a more important factor of stable macroaggregation in the soil amended with fresh sludge, while humic substances played a greater role in compost-amended soil. These effects were long lasting in the field since they were still noticeable 2 yr after the last application.

This citation is from AGRICOLA.

742. Soil construction: A step for ecological reclamation of derelict lands.

Sere, G.; Schwartz, C.; Ouvrard, S.; Sauvage, C.; Renat, J. C.; and Morel, J. L.

Journal of Soils and Sediments 8(2): 130-136. (2008);
ISSN: 1439-0108

Descriptors: composts / contaminants/ drainage/ effluents/ industrial wastes/ organic wastes/ paper mill sludge/ polluted soils/ rain/ reclamation/ recycling/ soil conservation/ soil parent materials/ soil pollution/ soil profiles/ soil types/ waste utilization/ water balance/ rainfall

Abstract: Goal, Scope and Background. Efficient and environmentally friendly technologies for soil reclamation require efforts to develop innovative processes. Alternative technologies to drastic techniques (containment, total removal of soil) are receiving increasing interest. They are based either on the use of ameliorants (e.g. lime, fertilizer, organic mulch) and more recently on the spreading of organic wastes (e.g. compost, sewage sludge). This paper presents a new process of soil construction using wastes and industrial by-products which are formulated and stacked in layers to build a new soil profile over in situ degraded substrates. Work was conducted to assess the feasibility of the ecological reclamation, focusing on the major functions of constructed Technosols. Materials and Methods. Two large lysimetric plots (10x10 m) were built on a former coking plant, and two strategies of constructed soil profiles were compared: (i) a control soil using thermally treated industrial soil available in situ, and (ii) a constructed soil with a combination of thermally treated industrial soil mixed with exogenous materials such as green waste compost and paper mill sludge. Rainfall was measured periodically, drainage effluent was collected, and aliquots were sampled per plot. Plants were collected in 8 replicates for each plot. Results. Water balance data showed that about 10% of the rain water percolated through the constructed soil profiles. Drainage effluent contained a low concentration of contaminants, below the French water drinking standards. Plants grew without any deficiency symptoms on both plots. Apart from the sowed plants, indigenous species developed on the constructed Technosols. Discussion. The experimental set-up was

representative of the real conditions for the implementation of such reclamation technologies. In spite of the significant concentrations of trace elements in the parent materials, the fluxes in the drainage effluent were very low because of the high pH. Significantly higher biomass values were recorded on the constructed soil than on the control, as well as a better development of indigenous plants. Conclusions. The constructed soils are examples of Technosols as they are made exclusively of technogenic parent materials. Our results showed that they can behave like natural soils (water cycle, trace elements filtration, biomass production). The process of soil construction is not only an efficient way to reclaim derelict lands, but also a safe alternative for the recycling of wastes and by-products with a minimum use of unpolluted and fertile agricultural soil. Recommendations. The restoration of soil functions, thanks to the soil construction process, must be considered as a primary step for the ecological reclamation of derelict lands. In this way, the pedo-engineering approach should be considered as an essential part of the global ecological engineering for the reclamation of derelict lands. Perspectives. Two major outlooks appear: (i) testing a larger variety of wastes and by-products as parent materials for different constructed soils, (ii) generalize the results on constructed soils to the characterization of Technosols. Reproduced with permission from the CAB Abstracts database.

743. Soil enzymatic response to addition of heavy metals with organic residues.

Madejon, E.; Burgos, P.; Lopez, R.; and Cabrera, F. *Biology and Fertility of Soils* 34(3): 144-150. (2001)
NAL Call #: QH84.8.B46; ISSN: 0178-2762
Descriptors: Alfisols / beta glucosidase/ chemical composition/ enzyme activity/ heavy metals/ Inceptisols/ organic carbon/ organic wastes/ oxidoreductases/ paper mill sludge/ phosphoric monoester hydrolases/ phosphorus/ refuse compost/ soil composition/ soil enzymes/ soil types/ solid wastes/ urease/ phosphatases/ redox enzymes/ town compost

Abstract: Changes in organic C, available P, available heavy metal contents and enzymatic activities induced by addition of two heavy metal rich organic residues (a municipal solid waste compost (MWC) and a non-composted paper sludge (PS)) were determined in two different soils (Typic Endoaquept and Typic Albaqualf) during a 280-day incubation experiment. The addition of the organic materials caused a rapid and significant increase in the organic C and enzymatic activities in both soils, this increase was specially noticeable in soils treated with MWC. In general, enzymatic activities in amended soils tended to decrease with the time. Organic materials also increased heavy metal contents in soil. However, the presence of available soil heavy metals due to the addition of the organic materials at doses of 50 000 kg ha⁻¹ did not negatively affect dehydrogenase [oxidoreductases], beta - glucosidase or urease activities in the soils. There were significant and negative correlations between heavy metals and phosphatase [phosphoric monoester hydrolases] activity in the soils at the beginning of the incubation. This negative correlation was probably due to the decrease in the enzyme activity in soils treated with PS in which high levels of available P were also found. It is difficult, therefore, to attribute an inhibition of the enzyme activity to

the presence of these heavy metals because a high available P concentration in soils also depresses phosphatase activity.

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744. Soil enzyme activities following paper sludge addition in a winter cabbage-sweet corn rotation.

Gagnon, B.; Lalande, R.; Simard, R. R.; and Roy, M. *Canadian Journal of Soil Science* 80(1): 91-97. (2000)
NAL Call #: 56.8 C162 ; ISSN: 0008-4271
Descriptors: acid phosphatase/ alkaline phosphatase/ ammonium nitrate/ application rates/ arylsulfatase/ cabbages/ enzyme activity/ horticultural soils/ horticulture/ maize/ nitrate/ nutrients/ paper mill sludge/ phosphoric monoester hydrolases/ requirements/ rotations/ sludges/ soil/ sweetcorn/ treatment/ winter/ acid phosphomonoesterase/ alkaline phosphomonoesterase/ arylsulphatase/ Capparales/ corn/ crop rotation/ phosphatases/ rotational cropping

Abstract: Combined primary and secondary paper mill sludge (PS) is a good source of C and other nutrients for horticultural soils. A field study was conducted to evaluate the effect of PS, spring-applied alone or in combination with ammonium nitrate (AN), on the enzymatic activity of a Bedford clay (Humic Gleysol) in Quebec, Canada. The experiment was started in 1996 with winter cabbage (*Brassica oleracea* var. capitata) and continued in 1997 and 1998 on the same plots with sweetcorn. The PS was applied at 0 (control), 8, 16, 32 and 65 t ha⁻¹ in 1996 and at 44% of these rates in 1997. No sludge was applied in 1998. Additional treatments consisted of AN applied yearly at 100% of the plant N requirements and a PS and AN combination. Soil arylsulfatase and acid and alkaline phosphatase activities were measured at three different times in each growing season. The PS rate linearly increased the soil acid phosphatase activity in all 3 years. In contrast, the alkaline phosphatase and arylsulfatase activities were enhanced in 1997 by the 8-16 t PS ha⁻¹ treatments, whereas larger amounts of PS showed activity comparable to the control. The second PS application promoted phosphatase activities mostly in the autumn, but did not sustain arylsulfatase activity. The AN gave lower phosphatase activities than PS, and depressed arylsulfatase. Addition of AN to PS increased only acid phosphatase activity as compared with PS alone or the control. This study indicated that addition of PS improved enzyme activity of this horticultural soil but rates in excess to 32 t ha⁻¹ may be detrimental.

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745. Soil properties associated with organic matter-mediated suppression of bean root rot in field soil amended with fresh and composted paper mill residuals.

Rotenberg, D.; Wells, A. J.; Chapman, E. J.; Whitfield, A. E.; Goodman, R. M.; and Cooperband, L. R. *Soil Biology and Biochemistry* 39(11): 2936-2948. (2007)
NAL Call #: S592.7.A1S6; ISSN: 0038-0717
Descriptors: composts / fungal diseases/ microbial activities/ microbial flora/ microbiology/ paper mill sludge/ plant disease control/ plant diseases/ plant pathogenic fungi/ plant pathogens/ rhizosphere/ root rots/ soil

amendments/ soil bacteria/ soil chemical properties/ soil organic matter/ soil physical properties/ chemical properties of soil/ green bean/ microbial communities/ microflora/ organic matter in soil/ physical properties of soil/ phytopathogens/ snap bean

Abstract: The ability of an organic amendment to suppress soil-borne disease is mediated by the complex interactions between biotic and abiotic soil factors. Various microbiological and physicochemical soil properties were measured in field soils with histories of receiving 4 or 5 years of spring additions of paper mill residuals (PMR), PMR composted alone (PMRC), PMR composted with bark (PMRB), or no amendment under a conventionally managed vegetable crop rotation. The objectives of this study were to (i) determine the residual and re-amendment effects of the organic materials on root rot disease severity; (ii) determine the influence of amendment type on the structure of bacterial communities associated with snap bean roots grown in these soils; and (iii) quantify the relative contributions of microbiological and physicochemical properties to root rot suppression in the field and greenhouse. While all amendment types significantly suppressed root rot disease compared to non-amended soils in both environments, only soils amended with PMR or PMRB sustained suppressive conditions 1 year after the most recent amendment event. Disease severity was inversely related to microbial activity (fluorescein diacetate assay) in recently amended soils only. Terminal restriction fragment length polymorphism (T-RFLP) analysis of the 16S rRNA gene was performed to obtain bacterial profiles. Principal component analysis (PCA) of terminal restriction fragments (TRFs) revealed general differences in bacterial community composition (PC1) among amendment types, and specific TRFs contributed to these differences. Correlation and multiple regression analyses of the measured soil variables revealed that the composition of root-associated bacterial communities and the amount of particulate organic matter-carbon in bulk soils imparted independent and relatively equal contributions to the variation in disease severity documented in the field and greenhouse. Together, our findings provide evidence that disease suppression induced by annual PMR inputs was mediated by their differential effects on bacterial communities and the amount and quality of organic matter in these soils.

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746. Sources and pathogenicity of *Escherichia coli* isolated from pulp and paper mill biosolids.

Renner, V. E.; Croteau, M. C.; Ridal, J. J.; Archibald, F. S.; and Lean, D. R. S.

In: Annual Conference on Great Lakes Research. Great Lakes in a Changing Environment. Windsor, ON (Canada).; Vol. 49.

Ann Arbor MI : International Association for Great Lakes Research; pp. [np]; 2006.

<http://www.iaglr.org/conference/>

Descriptors: assay/ DNA/ effluents/ *Escherichia coli*/ freshwater pollution/ hardwood/ industrial wastewater / industrial wastes/ microbial contamination/ nucleotide sequence/ polymerase chain reaction/ pulp and paper industry/ recreational waters/ strain/ toxicants/ toxins/ virulence/ *escherichia coli*/ North America, Great Lakes

Abstract: Pulp and paper mill biosolids have excellent properties as a soil conditioner. However, these biosolids contain high levels of *E.coli*. Since *E.coli* are typically used as an indicator of fecal contamination to assess the safety of drinking and recreational waters, their presence in pulp and paper mill biosolids is of concern. Previous research has shown that these bacteria grow prolifically within pulp and paper mill effluents in the absence of any known fecal source. This research was designed to identify the sources of *E.coli* to the mill. REP (repetitive extragenic palindromic) and ERIC (enterobacterial repetitive intergenic consensus) PCR were used to generate highly discriminatory fingerprints. Biosolids isolates were compared to isolates from potential sources (feed water, mill fibre, stormwater, wood chips, and forest samples). Biosolids isolates were also screened for the presence of *E.coli* virulence factors LT (heat labile toxin), ST (heat stable toxin) and VT (verotoxin) using commercially available oligonucleotide primers in a presence/absence based PCR assay. None of the *E.coli* isolates (n=110), collected over a 3-year period, carried these virulence factors. It seems unlikely that pulp and paper mill biosolids act as a reservoir for pathogenic strains of *E.coli*.

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747. Stability indices for different composts.

EGGEN, T. and VETHE, O.

Compost Science and Utilization 9(1): 19-26. (2001)

NAL Call #: TD796.5.C58 ; ISSN: 1065-657X

Descriptors: composting/ composts/ fish scrap/ humification/ indexes/ organic carbon/ organic nitrogen/ paper mill sludge/ respiration rate/ sewage sludge/ sludges/ sodium hydroxide/ stability/ fish waste

Abstract: Four types of compost (paper mill sludge compost, fish compost, biowaste compost from windrow composting treatment and biowaste compost from reactor treatment) were used to evaluate several chemical parameters, which served as stability indices replacing respiration rate. Compost matter, water extracts and NaOH extracts were analysed. When all composts were statistically treated together, water soluble TOC (total organic carbon) was the only parameter that correlated significantly with respiration rate ($r^2=0.82$, $P<0.0001$). This is suggested as an operational parameter at composting plants. Data in this study supported neither the C:N ratio nor the humification HA:FA ratio as stability indices. When treating only biowaste composts statistically together, TOC (in fulvic acid fraction) and water soluble nitrogen (total and organic) were chemical indices that correlated with respiration rate.

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748. Stability of structural form during infiltration: Laboratory measurements on the effect of de-inking sludge.

Nemati, M. R.; Caron, J.; and Gallichand, J.

Soil Science Society of America Journal 64(2): 543-552.

(Mar. 2000-Apr. 2000)

NAL Call #: 56.9 So3; ISSN: 0361-5995 [SSSJD4]

Descriptors: soil types/ soil structure/ soil physical properties/ application rate/ aggregate stability/ infiltration/ wetting/ stability/ paper mill sludge/ wetting rate

Abstract: An adequate understanding of the mechanisms involved in the structural stabilization of soil by different sources of organic matter is needed to help design management strategies aimed at maintaining a stable soil structure. The objective of this study was to identify mechanisms involved in soil structure stabilization by paper sludge application, either by increasing the soil resistance to external stresses (aggregate stability) or by decreasing the magnitude of the external stresses (diminution of the wetting rate). A laboratory study was conducted on three different soil types with application of paper sludge at three rates (8, 16, and 24 dry t ha⁻¹). The mean weight diameter, bulk density, hydraulic conductivity, and water retention properties were measured before and after a wetting event. The results indicate that most of the changes in physical properties resulting from rapid wetting took place at the soil surface (0-50mm) and the magnitude of these changes gradually decreased down to a depth of 150mm. Paper sludge application significantly improved the stability of 1- to 4-mm aggregates to the destructive action of wetting in all three soil types. Paper sludge application increased porosity at potential > -2 kPa, which resulted in higher hydraulic conductivity values (up to 88%) and a smaller increase in soil bulk density (down to 67%) relative to a control following rapid wetting. The wetting rates observed during the wetting event were similar regardless of the treatment, because the increase in the water potential at the wetting front was compensated for by an increase in hydraulic conductivity with increasing rates of sludge application. This citation is from AGRICOLA.

749. Studies on the influence of paper mill effluents on the yield, availability and uptake of nutrients in rice. Achari, M. S.; Dhakshinamoorthy, M.; and Arunachalam, G. *Journal of the Indian Society of Soil Science* 47(2): 276-280. (1999)

NAL Call #: 56.9 IN2; ISSN: 0019-638X

Descriptors: adverse effects/ availability/ biochemical oxygen demand/ effluents/ grain/ iron/ irrigation/ manganese/ nutrients/ paper mill sludge/ pollution/ pulp and paper industry/ rice/ soil/ soil amendments/ trace elements/ uptake/ yields/ zinc/ adverse reactions/ BOD/ environmental pollution/ microelements/ Mn/ paddy/ paper industry/ watering

Abstract: Paper mill effluent was analysed and applied at differing amounts with irrigation water, NPK fertilizers and soil amendments on a rice test crop. The undiluted effluent was dark brown in colour, had slightly alkaline pH, high biochemical oxygen demand, chemical oxygen demand, and electrical conductivity (EC), with appreciable quantities of Cl⁻, SO₄²⁻ and HCO₃⁻ of Ca, Mg, and Na and varying amounts of micronutrients. Soils irrigated with paper mill effluent had a higher pH and EC. Effluent irrigation, in general, increased the available N and K and decreased available P. DTPA-extractable Fe, Mn, Zn and Cu were also increased due to effluent irrigation. Effluent irrigation did not affect the grain yield. These results suggest the possibility of using paper mill effluent for irrigating rice crop without a major adverse effect on the growth and yield. Reproduced with permission from the CAB Abstracts database.

750. Study on the effects of paper-mill effluents on the growth and chlorophyll content of Pennisetum typhoideum.

Pritima, R. A.

Nature, Environment and Pollution Technology 1(2): 127-130. (2002); ISSN: 0972-6268

Descriptors: agriculture/ chlorophyll/ effluent/ growth/ industrial wastewater/ industrial effluents/ industrial waste waters/ irrigation/ irrigation water/ paper industry wastes/ plant physiology/ plants/ plants (see also aquatic macrophytes)/ pulp and paper industry/ pulp and paper industry waste waters (general)/ vegetation effects/ wastewater disposal/ wastewater irrigation/ water pollution effects

Abstract: Untreated, treated and enriched effluents of a paper-mill were analysed to find out the quantity of suspended solids, pH, chlorides, sulphates and others. These were highly reduced in treated and enriched effluents. Biochemical and chemical oxygen demands decreased considerably. Plants irrigated with treated and enriched effluents showed greater shoot, total length and higher chlorophyll (a, b and total) content, indicating the importance of treatment and enrichment of effluents.

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751. Sugarcane yields and soil analysis following application of paper mill sludge.

Legendre, B. L.; Bischoff, K. P.; Gravois, K. A. ; Hendrick, R. D.; and Arceneaux, A. E.

Journal American Society of Sugar Cane Technologists 24: 60-65. (2004)

Descriptors: ammonium nitrate/ application rates/ crop yield/ fertilizer requirement determination/ nitrogen fertilizers/ paper mill sludge/ soil pH/ sucrose/ sugar content/ sugar yield/ sugarcane/ waste utilization/ saccharose/ United States of America

Abstract: A study was conducted in Louisiana, USA to determine the effect of paper mill primary clarifier sludge in combination with various fertilizer treatments on cane and sugar yields of a sugarcane (*Saccharum officinarum*) plant cane through second ratoon crop cycle. Sludge was applied to fallow fields subsequently planted to sugarcane hybrids. The paper mill sludge was applied at rates of 0, 22.5, and 44.7 Mt per hectare on whole plots. Spring (0-0-0, 90-0-0, and 180-0-0) and starter (0-0-0 and 17-50-50) fertilizer treatments (kg ha⁻¹) were subplots. Soil pH was raised 0.3 units at the 44 Mt per hectare paper mill sludge rate when sampled the following spring after the autumn application. At the end of the experiment, soil pH for the 44 Mt per hectare rate was 0.8 units higher than the control. Spring fertilizer treatments resulted in significantly higher cane and sugar yields in ratoon crops, but not in the plant cane crop. Sludge and starter fertilizer treatments did not affect sugarcane yields. In the first ratoon crop, the highest sludge and the highest spring fertilizer rates produced significantly less sucrose content, but did not affect total sugar yield. Excess nitrogen can delay the accumulation of sucrose (maturity) in sugarcane. Therefore, if sludge is applied to sugarcane in Louisiana, nitrogen fertilizer should be applied at the lower end of the recommended range to the first

ratoon crop. In second-ratoon, sludge and spring fertilizer did not significantly affect sucrose content. The main effect of paper mill sludge appears to be the ability to raise soil pH.
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752. Suitability of sludges from dairy and paper industries for growth and reproduction of *Eisenia andrei*.

Elvira, C.; Sampedro, L.; and Nogales, R.
Pedobiologia 43(6): 766-770. (1999)
NAL Call #: 56.8 P343 ; ISSN: 0031-4056

Descriptors: analysis / cattle manure/ cocoons/ dairy effluent/ manures/ mixtures/ paper mill sludge/ reproduction/ sludges/ substrates/ vermicomposting/ wastes/ *Eisenia andrei*

Abstract: Sludges from a paper-mill and a dairy processing factory were used to grow *Eisenia andrei*. The growth and reproduction of this earthworm species in pure wastes and nine different mixtures of them with cattle manure have been studied weekly over 72 days. Earthworms grew at rates ranging from 6 to 12 mg worm⁻¹ day⁻¹ and cocoons were produced in all the substrates (average rate: 0.06-1.1 cocoon adult worm⁻¹ week⁻¹) with the exception of the pure dairy sludge. Those mixtures with 30% (d.w.) of paper sludge and manure, and those with the three wastes together were the most favourable for vermicomposting according to Principal Components Analysis of the growth and reproduction data.

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753. Suppression of soilborne diseases in field agricultural systems: Organic matter management, cover cropping, and other cultural practices.

Stone, A. G.; Scheuerell, S. J.; and Darby, H. M.
Soil Organic Matter in Sustainable Agriculture: 131-177. (2004)

Descriptors: antibiotics/ application rates/ cattle manure/ composts/ cover crops/ cropping systems/ cultural control/ decomposition/ farming systems/ fungal diseases/ microbial activities/ nutrient content/ nutritional state/ orchards/ organic amendments/ paper mill sludge/ plant breeding/ plant disease control/ plant diseases/ plant nutrition/ plant pathogenic fungi/ plant pathogens/ reviews/ rotations/ soil amendments/ soil organic matter/ soil physical properties/ soil types/ suppression/ suppressive soils/ tillage / agricultural systems/ crop rotation/ Hyphomycetes/ nutritional status/ organic matter in soil/ Peronosporomycetes/ physical properties of soil/ phytopathogens/ Pythiaceae/ rotational cropping/ soil cultivation / Straminipila

Abstract: This paper discusses organic matter (OM) management, cover cropping and other cultural practices to suppress soilborne diseases in field agricultural systems. The concept of suppressive soils and the types of disease suppression are reviewed. The relationships between OM quality and OM-mediated general suppression of diseases (caused by *Pythium* spp. and *Phytophthora* spp.) in container mixes are described. Discussions also include the interpretations of data on OM-mediated general suppression in natural soil systems and field agricultural systems (orchard systems, Chinampa agricultural systems,

field soils amended with paper mill residuals and field soils amended with dairy manure solids). OM-mediated general suppression of plant diseases through the manipulation of soil organic matter (SOM) during early stages of organic matter decomposition and later stages of decomposition is also presented. Soil amendment rates (high-rate organic amendment and low-rate organic amendment), serial amendment (organic soil management or long-term soil-building) and OM-mediated specific suppression of diseases caused by *Fusarium oxysporum* and *Rhizoctonia solani* in soilless container media and field soils are discussed. Also covered are the specific mechanisms such as microbiostasis, microbial colonization of pathogen propagules, destruction of pathogen propagules, antibiosis, competition for substrate colonization, competition for root infection sites and induced systemic resistance involved in biologically and OM-mediated disease suppression. The effects of SOM management on soil and plant nutrient status (macronutrients and micronutrients) and soil physical properties are briefly explained. A toolbox of cultural practices such as SOM management, crop rotation, cover and rotation crops and tillage and inputs like plant genetics, organic amendments, formulated amendments, high N-content amendments and inorganic amendments that could be used by farmers and scientists to generate disease-suppressive soils and cropping systems is also reviewed. Finally, some examples of diseases-suppressive systems are provided.

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754. Symbiotic dinitrogen fixation in forage legumes amended with high rates of de-inking paper sludge.

Allahdadi, I.; Beauchamp, C. J.; and Chalifour, F.
Agronomy Journal 96(4): 956-965. (2004)
NAL Call #: 4 AM34P; ISSN: 0002-1962

Descriptors: *Lotus corniculatus*/ *Medicago sativa*/ *Trifolium pratense*/ *Melilotus officinalis*/ forage legumes/ soil amendments/ pulp and paper sludge/ application rate/ *Sinorhizobium meliloti*/ *Mesorhizobium loti*/ *Rhizobium leguminosarum* bv/ *trifolii*/ nitrogen fixation/ nitrogen content/ dry matter accumulation/ nitrogen/ nutrient uptake/ Quebec

Abstract: The paper de-inking process produces a waste by-product, de-inking paper sludge (DPS), which contains paper fibers, clay particles, and inks and has high C and Ca and low N and P concentrations. Use of high rates of DPS to increase the soil organic matter thus requires provision of high rates of N for adequate plant growth. Using dinitrogen (N₂)-fixing forage legumes is an alternative to the N fertilization under such circumstances. In a 2-yr field study (1995 and 1996), the effect of different rates of DPS (0, 50, or 100 Mg dry matter ha⁻¹), applied once in October 1994, were evaluated on symbiotic N₂ fixation of forage legumes established on two soil types in Eastern Quebec, Canada. Symbiotic N₂ fixation was measured in alfalfa (*Medicago sativa* L.), birdsfoot trefoil (*Lotus corniculatus* L.), red clover (*Trifolium pratense* L.), and sweetclover (*Melilotus officinalis* L.); brome grass (*Bromus inermis* L.) was used as the reference (non N₂-fixing) crop. Dinitrogen fixation was estimated by the 15N natural abundance method. The percentages of N derived from the atmosphere increased significantly with DPS in the year of establishment (1995). In the first production year (1996), the effects of DPS on N₂ fixation were mainly observed at the first cut. Our results

show that DPS used as an organic amendment generally led to similar or greater forage legume productivity and greater N₂ fixation compared with unamended controls in the first production year and is compatible with sustainable agricultural practices.
This citation is from AGRICOLA.

755. Trace metal leachability from papermill ashes and sludge used as soil amendments.

Xiao, Chengqing University of Florida, 1998.

Notes: Thesis (M.S.). Includes bibliographical references (leaves 82-86).

Descriptors: trace metals/ leachability/ papermill ash/ sludge/ soil amendments

This citation is from AGRICOLA.

756. Trace metals and biochemical oxygen demand of pulp and paper mill effluents.

Shrivastava, V. S. and Yeole, P. M.

Nature, Environment and Pollution Technology 1(2): 121-122. (2002); ISSN: 0972-6268

Descriptors: biochemical oxygen demand/ biological oxygen demand/ chemical oxygen demand/ chemical oxygen demand/ effluent/ industrial wastewater/ industrial effluents/ industrial waste waters/ industrial wastes/ paper industry wastes/ pulp and paper industry/ pulp and paper industry waste waters (general)/ pulp wastes/ trace metals/ trace metals / trace-metal/ waste water/ wastewater analysis/ wastewater analysis/ India/ India, gujarat/ India, gujarat, satpura/ India

Abstract: Ukai-Songarh pulp and paper mill was selected for the present investigation. The mill is located in Satpura valley in south Gujarat. For the study, the effluents, amended soils and neighbouring plant samples were analysed for Cu, Zn, Cd, Pb, Ni, As, Hg and Fe. The obtained concentrations were found to be much higher. Effluents affect quality of soils and adjoining plants. The pulp and paper mill effluent samples have also been investigated for their COD and BOD.

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757. Treatment of heavy metal contaminated soils to reduce metal uptake by cultivations.

Calace, N.; Petronio, B. M.; Pietroletti, M.; Deriu, D.; and Pompili, L.

Recent Research Developments in Agronomy and Horticulture 1: 29-46. (2004)

Descriptors: acid soils/ application rates/ barley/ bioavailability/ chemical speciation/ copper/ growth/ heavy metals/ lead/ paper mill sludge/ phytoremediation/ phytotoxicity/ polluted soils/ pollution control/ soil amendments/ soil pH/ soil pollution/ soil types/ soyabeans/ spatial distribution/ uptake/ waste disposal/ waste management/ waste utilization/ zinc/ green bean/ snap bean/ soybeans

Abstract: This study was conducted to determine the effects of paper mill sludge addition on metal (Cu, Pb and Zn) distribution in soil, plant growth and metal uptake by barley (*Hordeum distichum* [H. vulgare]) at different rates of sludge addition to an artificially polluted soil. Moreover, after establishing the best paper mill sludge adding rate, the

same parameters were studied in a naturally polluted soil using barley, bean (*Phaseolus vulgaris*) and soyabean (*Glycine max*) as test plants. The paper mill sludge added to the heavy metal polluted soils induced some changes in the chemical metal forms present in the soil. These changes in some cases mainly concerned the shift from mobile forms to less extractable forms; in other cases the formation of available compounds in which metals were strongly bound prevailed. Consequently, both the metal uptake by plants, depending on the nature of the metal, and some physiological parameters of plants, were modified. The mechanisms studied were dependent on soil characteristics, in particular to soil pH, and were strongly influenced by the composition of the paper mill sludge. In acid soils, the addition of paper mill sludge shifted pH values towards moderately basic values and reduced metal uptake. In basic soils, the addition of paper mill sludge reduced the toxic effects on plants without decreasing or increasing metal uptake, depending on sludge composition. It is concluded that paper mill sludge addition to heavy metal polluted soils might possibly affect phytopurification mechanisms.

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758. Use of bark and combined paper sludge for the revegetation of bark-covered land.

Beauchamp, C. J.; Camire, C.; and Chalifour, F. P.

Journal of Environmental Engineering and Science 5(3): 253-261. (2006); ISSN: 1496-2551

Descriptors: bark/ choice of species/ establishment/ growing media/ nitrogen fertilizers/ paper mill sludge/ phosphorus fertilizers/ plant residues/ potassium fertilizers/ phosphate fertilizers/ potash fertilizers/ potting composts/ rooting media

Abstract: This study investigated the use of bark and combined paper sludge to develop a suitable plant growth substrate and to establish a vegetation cover on bark-covered land. Field experiments conducted in Quebec, Canada, were established to determine the best plant growth medium, plant mixtures, and fertilizer application programme. The best soil cover consisted of 2.5 cm of combined paper sludge on top of 2.5 cm of black bark. On this soil cover, the Savoureux mixture in combination with birdsfoot trefoil (*Lotus corniculatus*), Lab02 in mixture with MR77, and birdsfoot trefoil in mixture with brome grass (*Bromus inermis*) gave good vegetation growth and yields. For birdsfoot trefoil over all soil covers, the phosphorus and potassium fertilizer applications were required at 140 kg P₂O₅/ha and 160 kg K₂O/ha, respectively. These results suggest that combined paper sludge and black bark can be used as topsoil to favour plant establishment on bark-covered land.

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759. Use of de-inked paper sludge in potting mixes for geranium and zinnia production.

Tripepi, Robert R. and Koehn, Charlyn A.

In: 95th Annual International Conference of the American Society for Horticultural Science. Charlotte, North Carolina.; Vol. 33 (3); pp. 464; 1998.

NAL Call #: SB1.H6; ISBN: 0018-5345

Descriptors: horticulture: agriculture/ compositae: angiosperms, dicots, plants, spermatophytes, vascular plants/ geraniaceae: angiosperms, dicots, plants, spermatophytes, vascular plants/ de-inked paper sludge/ potting mix composition/ meeting abstract/ meeting poster/ sanitation/ waste management
© Thomson Reuters

760. Use of fresh and composted de-inking sludge in cabbage production.

Simard, Regis R.; Coulombe, J.; Lalande, R.; Gagnon, B.; and Yelle, S.

In: Beneficial co-utilization of agricultural, municipal and industrial by-products. Beltsville, Maryland, USA.) Norwell, Massachusetts: Kluwer Academic Publishers; pp. 349-361; 1998.

Notes: Meeting Information: Proceedings of the Beltsville Symposium XXII.; ISBN: 0792351894

Descriptors: horticulture: agriculture/ soil science/ waste management: sanitation/ cruciferae: angiosperms, dicots, plants, spermatophytes, vascular plants/ crop yield/ de-inking sludge: composted material, fresh material, paper mill waste/ meeting paper/ typic humaquod
© Thomson Reuters

761. Use of lux-based biosensors for rapid diagnosis of pollutants in arable soils.

Palmer, G.; McFadzean, R.; Killham, K.; Sinclair, A.; and Paton, G. I.

Chemosphere 36(12): 2683-2697. (1998)

NAL Call #: TD172 .C54; ISSN: 0045-6535

Descriptors: application to land/ arable soils/ biosensors/ cadmium / copper/ crops/ diagnosis/ paper mill sludge/ pentachlorophenol/ pollutants/ polluted soils/ soil pollution/ soil types/ toxicity/ Britain/ land application/ United Kingdom

Abstract: A field trial, in Central Scotland, UK, demonstrated that crop yields were reduced with increased application of paper mill sludge to land. A suite of ecotoxicity assays, including luminescence response of lux-marked bacteria, respirometry and enzyme activity was used to assess toxicity of the paper mill sludge to the soil microbial biomass. The results from the use of the lux based biosensors correlated well with more traditional microbial indicators of soil pollution (respiration and enzyme activity). Concentrations of metals and organic contaminants in samples were confirmed using GFAAS and GC-MS, respectively. The main pollutant components of paper mill sludge were Cd, Cu and PCP (pentachlorophenol). The range of environmental bioassays used, with chemical verification, offered a rapid and comprehensive battery test for assessment of the ecotoxicity associated with paper mill sludge application to land.

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762. Use of organic wastes in substrates for pot-in-pot shade tree production.

Chong, Calvin and Lumis, Glen P.

Canadian Journal of Plant Science 80(1): 233. (2000)

NAL Call #: 450 C16; ISSN: 0008-4220.

Notes: 1999 Meeting of the Canadian Society for Horticultural Science.

Descriptors: horticulture: agriculture/ waste management: sanitation/ Aceraceae: angiosperms, dicots, plants,

spermatophytes, vascular plants/ Betulaceae: angiosperms, dicots, plants, spermatophytes, vascular plants/ Oleaceae: angiosperms, dicots, plants, spermatophytes, vascular plants/ pot in pot shade tree production: horticultural method/ paper mill sludge: organic waste/ wood chips: organic waste

© Thomson Reuters

763. Use of paper mill wastes on agricultural soils: Is this a way to reduce nitrate leaching?

Kirchmann, H. and Bergstrom, L.

Acta Agriculturae Scandinavica: Section B, Soil and Plant Science 53(2): 56-63. (2003)

NAL Call #: 11 Ac82 ; ISSN: 0906-4710

Descriptors: agricultural soils/ arable land/ arable soils/ aromatic hydrocarbons/ cadmium/ carbon nitrogen ratio/ cellulose/ chemical composition/ copper/ decomposition/ fibre content/ hemicelluloses/ immobilization/ leaching/ mineralization/ nitrate/ nitrogen/ nitrogen content/ nutrient content/ organic carbon/ paper mill sludge/ polluted water/ pollution control/ polycyclic hydrocarbons/ sludges/ soil amendments/ soil organic matter/ soil types/ waste wood/ water pollution/ water quality/ wood fibres/ wood residues/ fiber content/ inorganic nitrogen/ organic matter in soil/ polycyclic aromatic hydrocarbons/ water composition and quality

Abstract: The term paper-mill waste is used for different products: de-inked fibre sludge, primary fibre sludge, secondary sludge, residual wastes and mixtures. This study was conducted to determine if any of these materials could be safely used on agricultural soils to induce net N immobilization, and thereby decrease nitrate (NO₃) leaching. Chemical characterization showed that secondary sludge derived from biological waste water treatment was a nutrient-rich material low in fibre content, whereas primary and de-inked fibre sludge were high in fibre content and low in nutrient content. Cellulose-C and hemicellulose-C amounted to 46 and 36% of the organic C present, respectively, and C:N ratios were approximately 130 in primary and de-inked fibre sludge. Incubation studies at 8 degrees C over 2 months showed that the decomposability of primary and de-inked fibre sludge in soil was not significantly different. Both showed lower decomposability than secondary sludge. Concentrations of inorganic N in soil declined to very low levels after application of primary and de-inked fibre sludge and their capacity for net N immobilization was 4.8-7.2 kg N t⁻¹ C added at 5 degrees C. However, contents of Cu, Cd and polycyclic aromatic hydrocarbons in de-inked fibre sludge limit its use on arable land. Only primary fibre sludge was found to be suitable as a nitrogen catch fibre material for use on agricultural soils. Reproduced with permission from the CAB Abstracts database.

764. Use of raw and composted paper mill sludges, municipal waste composts, and other waste ingredients in container nursery substrates.

Chong, Calvin and Purvis, Peter.

In: 102nd Annual Meeting of the American Society for Horticultural Science. Las Vegas, NV, USA.; Vol. 40(4); pp. 1048; 2005.

NAL Call #: SB1.H6

Descriptors: waste management: sanitation/ horticulture: agriculture/ Cornaceae: angiosperms, dicots, plants, spermatophytes, vascular plants/ Oleaceae: angiosperms,

dicots, plants, spermatophytes, vascular plants/ Rosaceae: angiosperms, dicots, plants, spermatophytes, vascular plants/ Saxifragaceae: angiosperms, dicots, plants, spermatophytes, vascular plants/ paper mill sludge/ municipal waste compost
© Thomson Reuters

765. Using paper de-inking sludge to maintain soil structural form: Hield measurements.

Nemati, MR; Caron, J; and Gallichand, J
Soil Science Society of America Journal. Jan/Feb 2000; 64(1): 275-285. 64(1): 275-285. (Jan. 2000-Feb. 2000)
NAL Call #: 56.9 So3; ISSN: 0361-5995 [SSSJD4]
Descriptors: soil types/ soil structure/ hydraulic conductivity/ soil water retention/ bulk density/ correlation/ application rate/ Quebec/ stability/ paper mill sludge
Abstract: A high level of organic matter in soils is crucial to maintain structural stability but organic matter sources differ in their effectiveness in stabilizing structural units. Objectives of this study were, first, to determine the optimal rate of sludge and fertilizer application to improve soil physical properties, and second, to investigate a possible correlation between hydraulic conductivity and structural stability measurements. A 4-yr field study (1994-1997) was conducted on three different soil types to evaluate the effect of different amounts of deinking secondary paper sludge on the soil physical properties. The soil physical properties we monitored were structural stability, water desorption characteristics, bulk density, and saturated hydraulic conductivity. Structural stability was increased by 17% in silty clay soil (SCS) and 15% in loamy soil (LS), but decreased by 35% in sandy loam soil (SLS). Results suggest that the effect of sludge application (SA) is short-lived and that an annual application of sludge is necessary to obtain a year-to-year effect on structural stability. Measured bulk density dropped significantly in the SCS (4-10%) and in the LS (1-6%). A significant increase in air capacity and available water values revealed that SA increases both transmission and storage pores in the SCS. Field-saturated hydraulic conductivity (Kfs) was increased in the SCS, but decreased in the SLS and the LS. A good correlation was observed between structural stability and hydraulic conductivity measurements in the SCS and the LS.
This citation is from AGRICOLA.

766. Utilization of paper sludges for developing bed soils and seedling pots: Physico-chemical analysis of paper sludges.

Kim, G. Y.; Kim, C. H.; Sin, T. G.; Jung, H. G.; Lee, Y. M.; Song, D. B.; and Huh, M. R.
Palpu Chongi Gisul/Journal of Korea Technical Association of the Pulp and Paper Industry 39(4): 61-67. (2007); ISSN: 02533200 [PCGID].
Notes: Language of Original Document: Korean.
Descriptors: bed soils/ heavy metals/ paper sludge/ physico-chemical analysis/ plant nutrition/ seedling-pot/ crops/ grain (agricultural product)/ heavy metals/ newsprint/ nitrogen/ nutrients/ pigments/ raw materials/ silicon/ soils/ water absorption/ bed soils/ paper sludges/ seedling pots/ sewage sludge/ grain/ newsprint/ paper/ sludge/ soil
Abstract: Paper sludges collected from three different paper mills were physico-chemically analyzed in order to use them as raw materials for making bed soils and seedling pots. The sludge from a fine paper mill contained

lots of inorganic pigment particles used for coating, as those from a newsprint mill and a tissue mill had not. It was clearly through XRD analysis confirmed that all sludges included calcium carbonate. The paper sludge from the tissue mill contained the greatest amount of particles, which would contribute to water absorption and nutrient storage. The sludge from the fine paper mill had the highest density due to many inorganic elements. While the ash content and the total nitrogen content were the highest in the sludge from the fine paper mill, the C/N ratio was the lowest in the fine paper mill sludge. All sludges seemed to have insufficient contents of potassium. The sludges from the newsprint mill and the tissue mill showed more silicon contents than that from the fine paper mill. It was concluded that the sludge from the fine paper mill would be able to be the most efficient raw materials for making bed soils and seedling pots and the other two sludges would be more efficient for intensive culture for crops such as rice and grain with additional supplement of nitrogen and other nutrients.

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767. Value and potential contamination risk of paper mill sludge land application: A review.

Du, W.; Zheng, G. D.; Chen, T.-B.; Fu, B.-T.; Lei, M.; Gao, D.; Yue, B.; Liu, B.; and Zhang, J.
Shengtai Xuebao/ Acta Ecologica Sinica 28(10): 5095-5103. (2008); ISSN: 10000933 .
Notes: Language of Original Document: Chinese.
Descriptors: composting/ land application/ paper sludge/ resource/ risk assessment
Abstract: The pulp and paper industry generates a considerable amount of sludges from the paper making processes. With the development of paper making industry, the environment concerns about paper sludge have increased. Paper sludge has high water content from 75% to 80% and high organic matter. It is easily to be rotten and has odor, and also isn't inconvenient to transport and land application. Therefore, paper sludge should be stabilized and used non-hazardous treatment. Composting can be an effective strategy to stabilize the sludge and reduce its environmental risk prior to land application. The composting process biologically stabilizes heterogeneous raw paper sludge and reduces mass and volume and thus hauling costs. Paper sludge is rich in organic matter and other nutrients and its land application don't lead to the heavy metal contamination, the organic chemicals and nitrate leaching risk. Many studies involving paper sludge and compost land application highlight the effects on soil chemical and physical properties. Application of paper sludge can increase soil C, water holding properties and aggregation, also can improve soil structure, decrease soil bulk density, and promote the soil enzyme activity. Paper sludge and compost can also improve soil nutrients status, and increase crop production and has residual effect. It is a main avenue to dispose paper sludge that paper sludge after composting process mixes with chemical fertilizer as compound organic fertilizer.

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768. Value of paper mill sludge in agriculture: Crop yield, soil properties, and environmental impacts.

Gagnon, B. and Ziadi, N.
Recent Research Developments in Crop Science 1(1): 1-10. (2004)

Descriptors: agriculture/ carbon nitrogen ratio/ crop yield/ degraded land/ environmental impact/ immobilization/ industrial wastes/ paper mill sludge/ sludges/ soil degradation/ soil properties/ waste water/ waste water treatment/ environmental effects/ soil quality

Abstract: Intensive agriculture practices often result in soil degradation that can limit crop yield. Canadian pulp and paper industries dispose of large amounts of solid residues rich in C that can potentially maintain and restore the productivity of these degraded soils. Most residues produced locally by the pulp and paper industries are a combination of primary/de-inking and secondary sludge (CS). Our research has shown that CS may be applied to crops without any mineral supplement under cool and humid climates. When applied at appropriate rates, CS increases yield without producing any detrimental effects on soil quality. Compared with mineral N fertilizer crop response, the contribution of total N from CS reaches on average 40% in the year of application. Conversely, the sludge from primary waste water treatments or de-inking process (RS) are considered more as a soil conditioner. Their very high C to N ratio causes soil N immobilization. However, RS may be composted with farm manure or supplemented with mineral N to improve their nutrient content before land application. Reproduced with permission from the CAB Abstracts database.

769. The value, use, and environmental impacts of pulp-mill sludge additions to forest and agricultural lands in Europe.

Cabral, F.; Vasconcelos, E.; Goss, M. J.; and Cordovil, C. M. D. S.

Environmental Reviews 6(1): 55-64. (1998); ISSN: 1181-8700

Descriptors: agricultural land/ application to land/ forests/ groundwater/ leaching/ paper mill sludge/ pollution/ properties/ pulp and paper industry/ sludges/ soil amendments/ wastes/ environmental pollution/ farmland/ land application/ paper industry

Abstract: The current state of knowledge on the recycling of pulp sludge in the forest and agricultural lands as an alternative to disposal is reviewed. Effects of land application of pulp sludge on chemical and physical properties of soils, on leaching of chemical constituents to groundwater, and on yields of crops are discussed. Regions in Europe where land application of pulp sludge are potentially most beneficial are identified. Information on pulp production, pulping and bleaching methods, and treatments of the effluents, as well as its environmental implications, are also briefly reviewed. Reproduced with permission from the CAB Abstracts database.

770. Vermicomposting of paper mill sludge using an African earthworm species *Eudrilus eugeniae* (kinberg) with a note on its physico-chemical features.

Umamaheswari, S. and Vijayalakshmi, G. S.

Pollution Research 22(3): 339-341. (2003); ISSN: 02578050 [PORS]

Descriptors: eudrilus eugeniae/ paper mill sludge/ vermicompost/ composting/ decomposition/ earthworm/ organic matter/ physicochemical property/ pulp and paper industry/ sludge/ eudrilus eugeniae/ pheretima sieboldi

Abstract: Paper mill sludge collected from the local paper factory premises was vermicomposted using an African species of earthworm *Eudrilus eugeniae* and physico-chemical features of paper mill sludge before and after composting was analysed which showed that macro and micro nutrients as well as physico-chemical features such as pH, pore space increased after vermicomposting. Electrical conductivity, bulk density was found to be reduced which indicates the better degradation of organic waste.

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771. Vermicomposting of sludges from paper mill and dairy industries with *Eisenia andrei*: A pilot-scale study.

Elvira, C.; Sampedro, L.; Benitez, E.; and Nogales, R.

Bioresource Technology 63(3): 205-211. (1998)

NAL Call #: TD930.A32 ; ISSN: 0960-8524

Descriptors: cattle manure/ composts/ cows/ dairy wastes/ manures/ paper mill sludge/ physical properties/ pulp and paper industry/ sludges/ vermicomposting / paper industry

Abstract: Vermicomposting of paper mill sludges mixed with cattle manure using *E. andrei* was studied in a 6-month pilot-scale experiment. Initially, a small-scale laboratory experiment was carried out to determine the growth and reproduction rates of earthworms in the different substrates tested. In the pilot-scale experiment, the number of earthworms increased between 22- and 36-fold and total biomass increased between 2.2- and 3.9-fold. The vermicomposts were rich in nitrogen and phosphorus and had good structure, low levels of heavy metals, low conductivity, high humic acid contents and good stability and maturity.

Reproduced with permission from the CAB Abstracts database.

772. Waste management from pulp and paper production in the European Union.

Monte, M. C.; Fuente, E.; Blanco, A.; and Negro, C.

Waste Management 29(1): 293-308. (2009); ISSN: 0956053X [WAMAE].

Notes: doi: 10.1016/j.wasman.2008.02.002.

Descriptors: air pollution/ building materials/ construction equipment/ deinking/ energy conversion/ environmental impact/ incineration/ industrial waste treatment/ paper and pulp industry/ paper coating/ production/ pulp/ waste management/ waste treatment/ deinked pulps/ economic factors/ energy recoveries/ European pulps/ European unions/ high moistures/ in compositions/ inorganics/ process conditions/ pulp and paper productions/ pulp and papers/ recycled papers/ waste compositions/ waste recoveries/ waste incineration/ ash/ environmental impact assessment/ european union/ incineration/ moisture content/ optimization/ pulp and paper industry/ recycling/ sludge/ waste management/ air pollution/ coatings/ gasification/ moisture content/ paper industry/ paper products/ production/ pulps/ pyrolysis/ waste management/ waste papers

Abstract: Eleven million tonnes of waste are produced yearly by the European pulp and paper industry, of which 70% originates from the production of deinked recycled paper. Wastes are very diverse in composition and consist of rejects, different types of sludges and ashes in mills having on-site incineration treatment. The production of pulp and paper from virgin pulp generates less waste but

the waste has similar properties to waste from the production of deinked pulp, although with less inorganics. Due to legislation and increased taxes, landfills are quickly being eliminated as a final destination for wastes in Europe, and incineration with energy recovery is becoming the main waste recovery method. Other options such as pyrolysis, gasification, land spreading, composting and reuse as building material are being applied, although research is still needed for optimization of the processes. Due to the large volumes of waste generated, the high moisture content of the waste and the changing waste composition as a result of process conditions, recovery methods are usually expensive and their environmental impact is still uncertain. For this reason, it is necessary to continue research on different applications of wastes, while taking into account the environmental and economic factors of these waste treatments. © 2008 Elsevier Ltd. All rights reserved.

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773. Wheat and field beans grown on Gault Clay or a soil-forming material amended with paper mill sludge.

Sellers, G.; Christin, F.; and Cook, H. F.
Land Contamination and Reclamation 13(1): 61-79. (2005);
ISSN: 0967-0513

Descriptors: crop yield/ growth/ landfills/ organic amendments/ paper mill sludge/ waste utilization/ wheat/ Britain/ green bean/ snap bean/ United Kingdom
Abstract: Re-establishment of vegetation on landfill sites, as required by UK planning consents, frequently means establishing viable arable agriculture rather than grassland. However, there is currently little information on crop suitability or yield, especially where the land has been restored with clay subsoils. Results are presented from two years growing field beans and wheat on a landfill site just outside Brighton, England, which has been restored with Gault Clay. The site was restored in two ways. One area had a 1 m depth of Gault Clay applied to the top of the engineered landfill cap. The other area had 300 mm of Gault Clay overlain by 700 mm of potentially topsoil-forming material, formed mainly of screened building waste materials which looked suitable for use as a soil-forming material. The amendments tested were mineral fertilizer and paper-mill sludge. The results show that nothing grew well on the Gault Clay, even when amended. Furthermore, growth was better on the soil-forming material, but yields were still unsatisfactory even when amended with mineral fertilizer. The paper-mill sludge produced little improvement in growth and actually suppressed growth significantly on the Gault Clay, and the combination must therefore be questioned as a solution to restoration of capped landfill, brownfield or contaminated land situations. Reproduced with permission from the CAB Abstracts database.

774. Windrow composting of paper mill by-products: Scale-up and seasonal effects.

Das, K. C.; Tollner, E. W.; and Tornabene, T. G.
Compost Science and Utilization 10(4): 347-355. (2002)
NAL Call #: TD796.5.C58 ; ISSN: 1065-657X
Descriptors: ammonium nitrate/ carbon nitrogen ratio/ composting/ composts/ landfills/ maturity/ moisture content/ paper mill sludge/ poultry manure/ seasonal variation/ soil amendments/ stability/ temperature/ waste management/ waste utilization/ windrows/ poultry litter/ seasonal changes/ seasonal fluctuations/ swath
Abstract: A significant portion of byproducts generated at pulp and paper mills are biodegradable organics. Presently, over 70% of these byproducts are disposed in landfills. Composting can be an effective process to stabilize and reuse them in value-added applications. Laboratory research has shown that adding nitrogen amendments to a mixture of paper mill byproducts to achieve a C:N ratio of approximately 130 is sufficient to compost these organics. This paper describes evaluating the laboratory-developed mixes and amendments in a full-scale pilot. Two trials, one in fall and one in winter, were conducted to quantify seasonal variations. Each trial consisted of four windrows of approximately 85 tonnes each; two were amended with chicken litter and two with ammonium nitrate. Temperature, moisture, C:N ratio, volatile solids, pH, soluble salt contents, stability and maturity were monitored over the 76-120 days of composting. Data collected were analysed using a general linear model repeated measures design. Results indicate that seasonal variations in process were significant at the 10% level for temperature, moisture content, volatile solids content, soluble salts and stability. Although differences in process performance existed between autumn and winter, the results of this study clearly showed that mill solids composted in this process reached a satisfactory level of stability within 76 days in winter and 120 days in the autumn trial. Final product stability and maturity ranged between stability indices of 0.05 to 0.26 mgO₂/g Solids/h and germination indices of 78.4 to 100%, respectively. Although the compost product from the winter trial was more stable (mgO₂/g Solids/h basis), the germination indices were lower indicating phytotoxicity resulting from a less desirable composting process. Addition of low levels (5 to 6 g ammonium nitrate/kg Composting blend, dry basis) of nitrogen amendment was sufficient to develop an active composting environment, thus, confirming that laboratory-developed mixes perform similarly at full-scale. A key limitation in scale-up was the oxygen availability within windrows, which affected the duration of composting required to achieve stability. Stability levels of 0.10 mgO₂/g Solids/h were achieved only after a minimum of 11 weeks (76 days in winter trial) in full-scale, compared to four weeks during laboratory trials. Reproduced with permission from the CAB Abstracts database.

Steel Industry Byproducts

775. Agronomic Implications of Converter Basic Slag as a Magnesium Source on Acid Soils.

Peregrina, F.; Mariscal, I.; Ordonez, R.; Gonzalez, P.; Terefe, T.; and Espejo, R.

Soil Science Society of America Journal 72(2): 402-411. (Mar. 2008-Apr. 2008)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Descriptors: slags/ magnesium fertilizers/ magnesium/ soil amendments/ acid soils/ industrial byproducts/ industrial wastes/ plant growth/ dry matter accumulation/ phosphogypsum/ gypsum/ limestone/ aluminum/ phytotoxicity/ Xerults/ Triticum aestivum/ Spain

Abstract: The feasibility of using converter basic slag (CBS) as a source of Mg for gypsum-amended acidic soils was studied in a Plinthic Palexerult from western Spain. An experimental farm was established and the Ap horizon of the soil was amended with limestone (L), phosphogypsum (PG), or red gypsum (RG) to alleviate Al toxicity. The PG and RG were supplied at 8.0 and 8.8 Mg ha⁻¹, respectively. In addition, the gypsum-amended plots received either CBS at 0.9 Mg ha⁻¹ or limestone at 1.1 Mg ha⁻¹. We studied the effects of the treatments on the exchange complex, soil solution, and the biomass production of 'Jabato' wheat (*Triticum aestivum* L.) under field and greenhouse conditions. The CBS proved highly effective in replenishing Mg lost from the soil through application of gypsum amendments. In the field experiment, only the RG + CBS treatment resulted in a statistically significant increase of biomass production relative to the control. In the greenhouse experiment, all treatments resulted in significantly increased production relative to the control, the largest (26 times) by RG + CBS. The PG + CBS and RG + CBS treatments resulted in significantly increased production relative to PG + L and RG + L, which testifies to the favorable effect of the Mg supplied by CBS. Also, the treatments including RG resulted in significantly increased production with respect to those including PG; the increased productivity is tentatively ascribed to a potential toxic effect of Al-F ion pairs, which were more abundant in the soil solution of PG-treated soil.

This citation is from AGRICOLA.

776. Application of basic slag iron-chromium in soil in nutritional state and dry matter production of passion fruit seedlings.

Prado, R. de M. and Natale, W.

Revista Brasileira de Fruticultura (Brazil) 26(1): 140-144. (Apr. 2004)

NAL Call #: SB354 .R48; ISSN: 0100-2945.

Notes: Original title: Efeitos da aplicacao da escoria de siderurgia ferrocromo no solo no estado nutricional e na producao de materia seca de mudas de maracujazeiro. 7 illus.; 24 ref. Summaries (En, Pt).

Descriptors: passiflora-edulis/ residues/ liming/ growth/ dry-matter-content/ Sao Paulo/ biological-development/ Brazil/ passiflora/ passifloraceae/ proximate-composition/ soil-management/ South America

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777. Application of basic slag iron chromium in the reaction of a Dark Red Latosol.

Prado, R. de M.; Leal, R M.; Franco, C. F.; and Braghirolli, L. F.

Revista de Agricultura Piracicaba 80(2): 228-241. (2005); ISSN: 0034-7655.

Notes: Original title: Aplicacao da escoria de siderurgia ferro cromo na reacao de um Latossolo Vermelho distrofico.

Descriptors: application rates/ base saturation/ calcium/ chromium/ iron/ magnesium/ red latosols/ slags/ soil acidity/ soil chemical properties/ soil ph/ soil types/ chemical properties of soil

Abstract: A study was conducted to evaluate the application of basic slag iron-chromium at different times of incubation on the chemical properties of a Dark Red Latosol. The treatments include: five basic slag rates (0, 0.375, 0.750, 1.125 and 1.500 g/dm³) and five incubation times (1, 2, 3, 4 and 7 months). The application of slag was efficient in neutralizing soil acidity; pH increased followed by the reduction in potential acidity. Calcium and magnesium contents increased as well as the sum of bases and base saturation in the soil. After three months of incubation, a residual effect on soil chemical properties was observed especially at higher rates.

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778. Application of steel making slag and converter sludge in farm manure enrichment for corn nutrition in greenhouse conditions.

Melali, A. R. and Shariatmadari, H.

Journal of Science and Technology of Agriculture and Natural Resources 11(42(B)): 505-514. (2008); ISSN: 1028-7655

Descriptors: byproducts/ copper/ crop yield/ field capacity/ growth/ industrial wastes/ iron/ maize/ manganese/ organic matter/ plant nutrition/ slags/ sludges/ soil amendments/ uptake/ vermicompost/ waste utilization/ zinc/ corn/ Mn

Abstract: Application of slag and converter sludge, major byproducts of Esfahan Zob Ahan factory, Iran, to enrich two organic amendments for maize (*Zea mays*) nutrition, was investigated. Farm manure and its vermicompost mixed with different rates of slag and sludge were incubated in 3 kg pots at field capacity moisture and home temperature for three months. The applied rates of slag and sludge were 0, 5 and 10 percent (w/w) of pure iron from these compounds to the organic amendments. Iron sulfate with the above ratios was also examined for comparison. Sub-samples of the incubated materials were taken after 0, 10, 25, 45, 65 and 90 days of incubation and examined for DTPA extractable Fe, Mn, Zn and Cu. After the incubation, the enriched amendments were applied to a soil sample to grow maize. Three kg soil samples, taken from Chah Anari experimental farm, Esfahan University of Technology, were mixed with 17 g of the amendments (50 tonnes/ha) placed in 3 kg pots. In each pot, two maize seeds (single cross 704) were planted and after 70 days crop yield and

concentration of Fe, Mn, Zn, Cu in the plant tissues were determined. Results showed that the use of iron sulfate strongly increased DTPA extractable Fe and Mn of the amendments. In enrichment by converter sludge, the best result was obtained in the mixture of 10% pure iron with the vermicompost on 60 days of incubation. Treatment of 5% pure iron from slag mixed with the manure increased DTPA extractable Fe and Mn with the time, but the 10% treatment was not much effective in this regard. The highest rates of iron uptake by the plants occurred in the iron sulfate and 10% converter sludge treatments, respectively. However, the highest rate of the plant Mn uptake was observed in 5% iron from converter sludge mixed with vermicompost. In general, 10% pure iron from converter sludge was the most effective enrichment treatment, increasing the plant uptake of Fe, Mn, Zn and Cu micronutrients.

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779. Assessment of basic slag as soil amelioration and their effects on the uptake of some nutrient elements by radish plants.

Abou Seeda, M.; El Aila, H I; and El Ashry, S.

Bulletin of the National Research Centre Cairo 27(4): 491-506. (2002); ISSN: 1110-0591

Descriptors: calcium/ growth/ iron/ leaves/ magnesium/ nitrogen/ nutrient availability/ nutrient uptake/ organic acids/ organic matter/ phosphorus/ plant nutrition/ potassium/ radishes/ recycling / roots/ slags/ soil amendments/ soil fertility/ soil ph/ waste management/ waste utilization/ zinc/ Capparales

Abstract: In Egypt, tremendous mass of slag has been produced from iron steel industries. To overcome this problem, a series of laboratory and greenhouse experiments were conducted to evaluate the agricultural recycling of Helwan slag. The application of slag increased the pH of the soil. The extractable fraction of Fe by CaCl_2 increased with organic matter addition due to increasing the solubility through complexation of Fe with soluble organic acids. Organic matter addition changed the inorganic precipitates of Fe to organic complexes. The order of the sequential extraction was organically bounded > occluded > adsorbed > exchangeable+soluble. Increasing rates of slag increased the mobile fractions of P, K, Ca and Mg during the incubation period. The addition of organic matter to Helwan slag at any rate increased the availability of nutrients. The application of slag stimulated the growth of radish plants, that was gradually increased with organic matter addition. The application of slag enhanced the nutrient uptake by radish plants. Slag with organic matter added at different rates stimulated the accumulation of nutrients (N, P, K, Fe and Zn) in both leaves and roots of the radish plant, due to the regulation of nutrients release from slag combined with organic matter, which play an important role for ensuring efficient utilization of nutrients. Reproduced with permission from the CAB Abstracts database.

780. Availability of silicon from several sources as determined by chemical and biological methods.

Gascho, G. J. and Korndorfer, G. H.

Proceedings Soil and Crop Science Society of Florida 58: 109-113. (1999); ISSN: 0096-4522

Descriptors: basic slag/ calcium silicate/ cerrado/ deficiency / iron/ rice/ silicon fertilizers/ soil/ sugarcane/ paddy

Abstract: The value of silicon (Si) application for rice (*Oryza sativa*) and sugarcane (*Saccharum* spp.) has been demonstrated when soil soluble Si is low. In south Florida, calcium silicate slag is applied to most muck soils and associated sands that are to be planted to rice and sugarcane. There is a need to investigate the availability of silicon in sources which are potentially available for those crops in the Cerrado of Brazil, where response to Si is also being demonstrated. Total Si and Si extracted by 0.1 M citric acid were measured for five sources. An incubation experiment was conducted with four important soil groups cropped in the Cerrado and a greenhouse experiment with rice was conducted using the soil most likely to show response to added Si, based on its low soluble Si content. Experiments included five sources and several rates of silicon. After 60 days incubation, Si extracted by 0.5 M acetic acid ranged from 2.5 to 22 mg/kg for the four soils. Calcium silicate slag, wollastonite, and thermo-phosphate increased soluble Si significantly. A basic slag and magnesium metasilicate provided little soluble Si. In the greenhouse experiment, increasing the rate of wollastonite increased Si concentration in rice. Calcium silicate slag, wollastonite, and thermo-phosphate application resulted in erect leaves, while rice plants that received no Si or other Si sources had droopy leaves. But, when applied at high rates, sources that supplied Si to rice plants also induced Fe deficiency, resulting in reduced dry weight. In addition to calcium silicate slag, thermo-phosphate - a fertilizer product that provides Si, P, and Mg - appears an excellent source for use in the Cerrado.

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781. Basic slag as a liming material to ameliorate soil acidity in Alfisols of sub-tropical India.

Bhat, J. A.; Mandal, Biswapati; and Hazra, G. C.

American-Eurasian Journal of Agricultural and Environmental Science 2(4): 321-327. (2007); ISSN: 1818-6769

Descriptors: acid soils/ acidity/ alfisols/ analysis/ basic slag/ calcite/ crop production/ exchange acidity/ farmyard manure/ grain/ incorporation/ lime/ liming/ liming materials/ manures / mineral uptake/ nitrogen/ nutrient availability/ nutrients/ organic matter/ poultry/ poultry manure/ soil/ soil acidity/ soil types chemical/ straw/ subtropics/ treatment/ uptake/ wheat/ domesticated birds/ FYM/ poultry litter/ subtropical zones

Abstract: Crop production on acid soils can be improved greatly by adjusting the pH to near neutrality. While soil acidity is commonly corrected by calcite, there is evidence that use of basic slag as an amendment can increase the pH of acid soils. The effect of calcite and basic slag (CaSiO_3) with different doses on soil acidity, nutrient availability and grain yield was determined in the experiments. Fourteen field experiments were conducted during the rabi season of 2003-2004 and 2004-2005 in Alfisols of Midnapur West and Purulia districts of West Bengal, INDIA. Besides liming materials, locally available organic resources e.g. farmyard manure (FYM) and poultry manure (PM) were also used along with basic slag to

increase its efficacy. The treatments used were as follows: No lime, 1/5th LR (basic slag), 1/5th LR (calcite), 1/10th LR (basic slag), 1/10th LR (calcite), 1/5th LR (basic slag + FYM @ 5t/ha) and 1/5th LR (basic slag + PM @ 3t/ha). Results showed that both calcite and basic slag increased the grain yield of wheat. They were effective when applied @ 1/5th LR dose than 1/10th LR. On an average, calcite and basic slag caused an increase in grain yield to the extent of 21.9 and 31.0% over the no lime treatment, respectively. Results also showed that increase in the yield of wheat was more with basic slag 1/5th LR than with calcite. Incorporation of organic sources of nutrients particularly FYM and PM caused a further increase in yield, the magnitude being 56.2 and 60.2% respectively over the no lime treatment. Results of straw yield also showed the similar trend of change. Uptake of N and P by wheat plants showed that liming caused significant increases in their uptake. There was no significant increase in concentration of K with lime application. Organic matter addition enhanced the uptake of the nutrient elements viz., N, P and K. Results of the analysis of residual soil showed that total acidity, exchange acidity and hydrolytic acidity recorded a decrease upon liming. Reproduced with permission from the CAB Abstracts database.

782. Basic slag as a liming material to ameliorate soil acidity in Alfisols of West Bengal.

Bhat, J A and Hazra, G C

Research on Crops 8(3): 575-581. (2007); ISSN: 0972-3226

Descriptors: acid soils/ Alfisols/ application rates/ calcite/ crop yield/ farmyard manure/ nitrogen/ nutrient availability/ nutrient uptake/ phosphorus/ potassium/ poultry manure/ slags/ soil acidity/ soil amendments/ soil types/ straw/ wheat/ wheat straw/ FYM/ poultry litter

Abstract: Crop production on acid soils can be improved greatly by adjusting the pH to near neutral. While soil acidity is commonly corrected by calcite, there is evidence that use of basic slag as an amendment can increase the pH of acid soils. The effect of calcite and basic slag (CaSiO_3) with different doses on soil acidity, nutrient availability and grain yield was determined in the experiments. Fourteen field experiments were conducted during the rabi seasons of 2003-2004 and 2004-2005 in Alfisols of Midnapur West and Purulia districts of West Bengal, India. Besides liming materials, locally available organic resources e. g. farmyard manure (FYM) and poultry manure (PM) were also used along with basic slag to increase its efficacy. The treatments used were as follows: No lime, 1/5th LR (basic slag), 1/5th LR (calcite), 1/10th LR (basic slag), 1/10th LR (calcite), 1/5th LR (basic slag+5 tonnes FYM/ha) and 1/5th LR (basic slag+3 tonnes PM/ha). Results showed that both calcite and basic slag increased the grain yield of wheat. They were effective when applied at 1/5th LR dose than 1/10th LR. On an average, calcite and basic slag caused an increase in grain yield to the extent of 21.9 and 31.0% over the no lime treatment, respectively. Results also showed that increase in the yield of wheat was more with basic slag 1/5th LR than with calcite. Incorporation of organic sources of nutrients particularly FYM and PM caused a further increase in yield, the magnitude being 56.2 and 60.2%, respectively, over the no lime treatment. Results of straw yield also showed the similar trend of change. Uptake of N and P by wheat plants

showed that liming caused significant increases in their uptake. There was no significant increase in concentration of K with lime application. Organic matter addition enhanced the uptake of the nutrient elements viz., N, P and K. Results of the analysis of residual soil showed that total acidity, exchange acidity and hydrolytic acidity recorded a decrease upon liming. Reproduced with permission from the CAB Abstracts database.

783. Beneficial reuse of stainless steel slag and its heavy metals pollution risk.

Zhang XiangYu; Zhang Hua; He PinJing; Shao LiMing; Wang RuYi; and Chen RongHuan

Research of Environmental Sciences 21(4): 33-37. (2008); ISSN: 1001-6929

Descriptors: aluminium/ calcium/ carbon/ chromium/ heavy metals/ iron/ magnesium/ oxygen/ pollutants/ pollution/ risk/ risk assessment/ silicon/ stainless steel/ aluminum/ environmental pollution/ hazardous wastes

Abstract: The feasibility of beneficial reuse of two kinds of stainless steel slag, electric arc furnace (EAF) slag and argon oxygen decarburization furnace (AOD) slag, and their pollution properties of heavy metals were studied. The results indicate that the majority of the slags were sized <5 mm. The main elements (mass content >1%) in the EAF slag were Ca, Si, Mg, Al, Fe, O, and Cr, existing as Ca_2SiO_4 and $\text{Ca}_3\text{Mg}(\text{SiO}_4)_2$, while the AOD slag was mainly composed of Ca, Si, Mg, C, and O, and the main minerals were Ca_2SiO_4 . The slags were suitable for beneficial reuse. The leaching mass concentrations of all heavy metals except Cr by the leaching test were lower than or close to the detection limit. The leaching mass concentration of Cr was <0.2 mg/L, far lower than the limit values of Identification Standards for Hazardous Wastes (GB5085.3-1996). Most of the heavy metals existed as stable speciation. The availability leaching test results show that Cr could be leached out at the "worst scenario", but mainly as the less hazardous Cr (III), which was confirmed by the XRD analysis results. Therefore, the pollution risks of the heavy metals in the stainless steel slags were low. Reproduced with permission from the CAB Abstracts database.

784. Capacity of soil amendments in lowering the phytoavailability of sludge-borne zinc.

Mench, Michel J.; Manceau, Alain; Vangronsveld, Jaco; Clijsters, Herman; and Mocquot, Bernard
Agronomie (Paris) 20(4): 383-397. (2000); ISSN: 0249-5627

Descriptors: soil amendments/ phytoavailability/ sludge/ zinc/ basic slags

Abstract: One way to reduce the phytoavailability of an excess of metals such as zinc in soil is through the addition of amendments. The effectiveness of inorganic materials such as basic slags, magnetite, maghemite, hematite, birnessite, hydrous manganese oxide, steel shots, and beringite, was evaluated in a pot experiment with a coarse sandy soil contaminated by sludge-borne zinc. Zinc extractability and phytoavailability were investigated using single soil extraction by 0.1 M calcium nitrate and vegetation experiments with dwarf bean (*Phaseolus vulgaris* L.) and ryegrass (*Lolium multiflorum*). A phytotoxicity test based on the activities of enzymes involved in the stress metabolism caused by toxic Zn

concentrations in the primary leaves of dwarf beans was also performed. Based on the addition rate, birnessite (10 gcntdotkg-1 soil, dry weight DW) resulted in the maximum decrease in extractable Zn from the contaminated soil. Beringite gave similar results but at 50 gcntdotkg-1 soil DW. Birnessite and beringite treatments were the most effective to reduce Zn assimilation by dwarf bean, and in consequence phytotoxicity. Subsequent harvests of ryegrass confirmed the beringite effect on Zn uptake 5 months following the soil treatment. For birnessite, Zn availability to ryegrass shoots increased however at the third harvest and reached the level of the untreated Zn-contaminated soil.

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785. The characteristic of phosphorous adsorption on different substrates used in constructed wetland.

Cui, L. H.; Zhu, X. Z.; Luo, S. M.; Zhu, Y. C.; and Ma, M. *Journal of Agro-Environment Science* 26(3): 894-898. (2007)

NAL Call #: S589.75 .N86; ISSN: 1672-2043

Descriptors: adsorption/ artificial wetlands/ artificial wetlands/ coal/ gravel/ mathematical models/ nutrients (mineral)/ phosphates/ phosphorus/ phosphorus removal/ phosphorus removal/ sand/ soil/ substrates/ turf grasses/ wetlands/ sandy soils/ turf

Abstract: Nine substrates (three substrates of artificial soil) used as media in the vertical-flow constructed wetland were measured under isothermal adsorption experiment, and the data obtained in this study was fitted to both Freundlich and Langmuir isothermal adsorption equations. To simulate the equilibrium P adsorption data, the Langmuir equation was better than the Freundlich equation. When phosphorous concentration in solution was 100 similar to 500 mg times L super(-1), the maximum phosphate adsorption of substrates predicted by Langmuir equation was in the following order: turf (4 242.48 mg times kg super(-1)soil)> artificial soil of blast furnace slag (BFAS, 2 115.65 mg times kg super(-1)soil)> blast furnace slag (BFS, 1 597.92 mg times kg super(-1)soil)> artificial soil of coal bum slag (CBAS)> top soil> coal burn slag (CBS)> artificial soil of mid-sized sand (MSAS)> gravel (494.42 mg times kg super(-1)soil)> and mid-sized sand (MSS, 403.11 mg times kg super(-1)soil). When phosphorous concentration in solution was 5 mg times L super(-1), the order of phosphorus removal rate by these nine substrates was: turf (92.0%) > CBAS (57.3%) > CBS (55.7%)>top soil (40.7%) > BFAS (24.1%) > BFS (20.6%) > MSS (18.9%) > MSAS (11.8%)>gravel (3.06%).

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786. Consequences of basic slag on soil pH, calcium and magnesium status in acid sulfate soils under various water contents.

Khan, M. H. R.; Bhuiyan, M. M. A.; Kabir, S. M.; Blume, H. P.; Oki, Y.; and Adachi, T. *Journal of Biological Sciences* 7(6): 896-903. (2007); ISSN: 1727-3048

Descriptors: acid sulfate soils/ calcium/ drying wetting cycles/ field capacity/ magnesium/ saturated conditions/ slags/ soil fertility/ soil pH/ soil types/ soil water content/ acid sulphate soils/ soil quality/ thionic soils

Abstract: Consequences of Basic Slag (BS) on soil pH, Ca and Mg status in acid sulfate soils under various water contents were studied for 30 months. The four doses of BS at the rates of 0, 10, 20 and 30 t ha-1 and three levels of water contents such as: (a) moisture at field capacity (50% water), (b) moisture at saturated condition (100% water) and (c) wetting-drying cycle (from saturation versus field capacity) were considered for this incubation study. Basic slag at 30 t ha-1 was found to be the best dose in order of the increment in soil pH, followed by the lower doses of BS₂₀ BS₁₀. The BS₃₀ treatment increased the soil pH values by about 1.0, 1.5 and 1.2 units more compared with the control in the Sarisabari soil and 2.0, 1.7 and 1.5 units more in the Purbapukuria soil under the conditions of field capacity, saturated and wetting-drying cycle, respectively. Apart from the water contents and soil conditions, the values of soil pH were also increased significantly ($p<0.05$) at different periods of incubation compared with the control. Like soil pH, almost similar to and significant ($p<0.05$) increased levels of Ca and Mg were determined in both the soils; regardless of water contents and incubation time. The striking changes were recorded for the rate of increments of Ca and Mg, which were 4 to 5 times higher for Ca and more than 2 times higher for Mg compared with the control after 2 months of incubation. These results suggest that the application of basic slag not only increased the Ca to the higher amount than the increment of Mg in the soils but also improved one of the important criteria of imbalance between Ca and Mg status in the soils.

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787. Converter slag as a liming agent in the amelioration of acidic soils.

Ali, M. T. and Shahram, S. H. *International Journal of Agriculture and Biology* 9(5): 715-720. (2007); ISSN: 1560-8530

Descriptors: acid soils/ electrical conductivity/ iron/ liming/ manganese/ mineral uptake/ nutrient uptake/ phosphorus/ plant nutrition/ potassium/ rice/ shoots/ slags/ soil amendments/ soil pH/ tea/ zinc/ Mn/ paddy

Abstract: Amelioration of acid soils with liming materials is a common practice. Some industrial byproducts are also being used as liming agent. The most important byproduct in amending acid soils is steelmaking basic slag. In this research, the possibility of using converter slag, as a soil amendment was investigated in three acid soils. Slag compound contains 52.8% CaO and 2.2% MgO plus large amounts of other elements such as Fe, P, Si, and Mn. First stage was incubation phase and treatments were 0, 0.5, 1, 2, 4, 8 and 16% (w/w) of converter slag kg-1 soil and soil moisture content was adjusted closer to field capacity. The changes in pH, EC and AB-DTPA-extractable Fe, Mn, Zn, P and K were determined after 1, 10, 30 and 60 days. Second phase was a greenhouse study that treatments with due attention to incubation results were determined on maize. Treatments were 0, 0.5, 1 and 2% w/w and 0, 1, 2 and 4% w/w of slag in rice field and tea orchard soils, respectively. Slag increased soil pH and the rate of increase was proportional to the amount of slag used. The slag decreased Fe availability at pH range of 7.4-8.5 but increased at higher pH, while use of slag proportionately increased the P and Mn availability. In greenhouse studies the application of 1 and 2% (w/w) of slag in tea garden soil

and 0.5, 1 and 2% slag in rice field soil increased plant shoot dry yield and P and Mn uptake. Fe and K uptake increased in rice field, K uptake decreased in tea garden soil and Fe uptake was not changed. In conclusion, the converter slag was a suitable amendment for acid soils. Reproduced with permission from the CAB Abstracts database.

788. Decomposition of *Avicennia marina* on an iron smelting slag substrate.

Dick, T. M. and Streever, W. J.

Austral Ecology 26(2): 127-131. (2001); ISSN: 1442-9985

Descriptors: carbon/ chemical composition/ decomposition/ forest litter/ iron/ mangroves/ mineral content/ nitrogen/ nutrient content/ phosphorus/ plant composition/ sand/ trees/ wetlands/ woody plants/ chemical constituents of plants/ duff

Abstract: The present study, conducted near Newcastle, New South Wales, Australia, used a blocked analysis of variance experimental design to compare initial nutrient concentrations and decomposition rates of *Avicennia marina* (grey mangrove) grown on sand and rock blast furnace slag. There were no significant differences (ANOVA; $P > 0.05$) in mean initial nutrient concentrations of total C, N and P for plants grown on the sand and slag substrates. A litterbag technique was used to estimate decomposition rates. After 360 days of incubation, repeated measures analysis did not identify significant differences between the substrates for the interaction term substrate x time or the term substrate alone for percentage weight loss or for C, N and P remaining. *A. marina* on both substrates had nutrient characteristics and decomposition rates comparable to those found in the literature. Results suggest that initial nutrient concentration and decomposition rates are not dramatically influenced by the presence of slag.

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789. Direct and residual effect of combined application of basic slag with green leaf manure on soil available nutrients and yield of rice.

Mohandas, S. and Appavu, K.

Madras Agricultural Journal 87(1/3): 53-56. (2000)

NAL Call #: 22 M262; ISSN: 0024-9602

Descriptors: alfisols / calcium/ green manures/ magnesium/ nutrient availability/ phosphorus/ residual effects/ rice/ rice straw/ slags/ straw/ Madras/ paddy

Abstract: Field experiments were conducted on sandy clay loam soil (Udic Haplustalf) at Central Farm of Agricultural College and Research Institute, Madurai, Tamil Nadu, India, to study the effect of added levels of basic slag with green leaf manure on ADT 36 rice. Addition of graded levels of basic slag viz., 500, 750 and 1000 kg/ha significantly increased the soil available P, Ca, Mg, Fe, Si and the grain and straw yield of rice. Application of 1000 kg of basic slag with 12.50 or 18.75 t/ha of green leaf manure recorded the highest soil available nutrients as well as grain and straw yield of rice over the rest of the treatments. The residual crop yield was also significantly increased over NPK treated control by conjunctive use of basic slag with green leaf manure at higher level (1000 kg of basic slag with 18.75 t/ha of green leaf manure). The superiority of

basic slag with green leaf manure in increasing the soil available nutrients was proved only at higher doses. Reproduced with permission from the CAB Abstracts database.

790. Dynamics of soil solutions of submerged acid sulfate soils under rice as influenced by various treatments.

Khan, H. R.

International Journal of Tropical Agriculture 16(1/4): 81-95. (1998); ISSN: 0254-8755

Descriptors: acid sulfate soils/ ammonium/ basic slag/ calcium / calcium carbonate/ electrical conductivity/ inceptisols/ iron/ leaching/ lime/ magnesium/ manganese/ nutrients/ phosphorus/ phosphorus fertilizers/ potassium/ rice/ rice soils/ soil/ soil amendments/ soil pH/ soil solution/ submergence/ sulfates/ sulfur/ zinc/ acid sulphate soils/ elemental sulphur/ Mn/ paddy/ phosphate fertilizers/ sulphates/ sulphur/ thionic soils

Abstract: The composition of the soil solutions (leachates) was studied as influenced by P (45, 60 mg kg⁻¹), lime (5, 7.5 g CaCO₃ kg⁻¹), basic slag (7.5, 12.5 g kg⁻¹), MnO₂ (50, 75 mg kg⁻¹) and leaching (1.8 litre kg⁻¹) treatments, of a submerged acid sulfate soil (Sulfic Haplaquept) under rice cultivation in Bangladesh, with an initial low pH (4.2, field), high electrical conductivity (ECe, 1.54 S m⁻¹), and high water soluble SO₄ 2-S (3.33 cmol kg⁻¹). The results showed that the various treatments significantly ($P = 0.05$) raised the pH (3.2 to 7.2) of soil solutions over the control treatment. The submergence alone increased the pH from 3.2 to 4.8. Basic slag at 12.5 g kg⁻¹ increased the pH to 7.2. The leaching treatment decreased the EC values from 1.54 to 0.25 S m⁻¹. With the amendments, the ammonium concentrations in the soil solutions increased during the first 30 days and then decreased steadily with the time of submergence and plant age. The highest ammonium (22 mg kg⁻¹) concentration was observed with the highest dose of lime after 90 days of submergence. The submergence and different amendments increased the concentrations of P in the soil solutions. The sulfur concentrations in the solutions were increased in the earlier periods of submergence and then decreased sharply with time. All the treatments, except for leaching and Mn application, increased the concentrations of K, Ca and Mg and decreased those of Fe, Mn and Zn, leading to favourable nutrient concentrations in the soil solutions.

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791. Effect of application of basic slag and superphosphate on herbage yield and on soil and herbage concentrations of phosphorus in organic grassland.

MacNaedhe, F. S.

Biological agriculture and horticulture: an international journal 19(3): 231-245. (2001)

NAL Call #: S605.5.B5 ; ISSN: 0144-8765 [BIAHDP]

Descriptors: grasslands/ organic production/ superphosphate/ yields/ mineral content/ phosphorus/ slags/ soil fertility/ application rate/ Irish Republic/ dry matter/ biomass production

Abstract: The experiment was carried out at an organic farm in 1996 and 1997. The purpose of the experiment was

to test the effectiveness of basic slag (7% P) as a P fertilizer on an organic perennial ryegrass/white clover sward. Superphosphate (16% P) was used as a standard comparison. There was no difference between fresh weight or dry matter yields of grass or clover or of total herbage yields in plots treated with different rates of basic slag or superphosphate in the first harvest at the end of July 1996. In the second harvest, recorded at the end of August 1996, increasing rates of P gave increased yields. P source had no effect on herbage fresh weight or dry matter yield. P source and rate of P application had no effect on herbage yield in 1997. The percentage dry matter in herbage was unaffected by P source. Increasing rates of basic slag and superphosphate had no effect on the percentage dry matter in the herbage. There was no difference in the soil P concentrations obtained with basic slag or superphosphate when these were applied at equivalent rates. Increasing rates of P, when applied as basic slag or superphosphate at rates of 7, 14 and 28 kg ha⁻¹, gave an increase in soil P concentration at 128 days after application. No increase was recorded at 531 days after application. Superphosphate gave the largest initial increase in herbage concentrations of P but was no more effective at raising the soil and herbage concentrations of this element than equivalent rates of basic slag over a two year period. This citation is from AGRICOLA.

792. Effect of application of iron materials on methane and nitrous oxide emissions from two types of paddy soils.

Furukawa, Y. and Inubushi, K.

Soil Science and Plant Nutrition 50(6): 917-924. (2004)

NAL Call #: 56.8 SO38; ISSN: 00380768 [SSPNA]

Descriptors: global warming/ greenhouse gas/ prevent/ slag/ suppression

Abstract: Iron oxide is the most important electron acceptor in paddy fields. We aimed to suppress the methane emission from paddy fields over the long term by single application of iron materials. A revolving furnace slag (RFS; 245 g Fe kg⁻¹) and a spent disposable portable body warmer (PBW; 550 g Fe kg⁻¹) were used as iron materials. Samples of a soil with a low iron level (18.5 g Fe kg⁻¹), hereafter referred to as "a low-iron soil" and of a soil with a high iron level (28.5 g Fe kg⁻¹), hereafter referred to as "an iron-rich soil," were put into 3 L pots. At the beginning of the experiment, RFS was applied to the pots at the rate of 20 and 40 t ha⁻¹, while PBW was applied at the rate of 10 t ha⁻¹ only, and in the control both were not applied. Methane and nitrous oxide emissions from the potted soils with rice plants were measured by the closed chamber method in 2001 and 2002. When RFS was applied at the rates of 20 and 40 t ha⁻¹ to the low-iron soil, the total methane emission during the cultivation period significantly decreased by 25-50% without a loss of grain yield. Applied iron materials clearly acted as electron acceptors, based on the increase in the amount of ferrous iron in soil. However, the suppressive effect was not evident in the iron-rich soil treated with RFS or PBW. On the other hand, nitrous oxide emission increased by 30-95%. As a whole, when the total methane and nitrous oxide emissions in the low-iron soil were converted to total greenhouse gas emissions expressed as CO₂-C equivalents in lime with the global warming potential, the total greenhouse gas emissions decreased by about 50% due to the application of RFS. © 2009 Elsevier B.V. All rights reserved.

793. Effect of blast furnace slag on root growth and yield of rice.

Carvalho Pupatto, J. G.; Bull, L. T.; Crusciol, C. A. C.; Mauad, M.; and Silva, R. H. da

Pesquisa Agropecuaria Brasileira 38(11): 1323-1328. (2003)

NAL Call #: S15 .P452 ; ISSN: 0100-204X.

Notes: Original title: Efeito de escoria de alto forno no crescimento radicular e na produtividade de arroz.

Descriptors: crop yield/ growth/ industrial wastes/ rice/ roots/ silicon/ slags/ soil chemical properties/ chemical properties of soil/ paddy

Abstract: Agricultural use of industrial residues as fertilizers is due to the need of reducing nutrient accumulation in the centres of production. A study was carried out in Sao Paulo, Brazil, to evaluate the effects of blast furnace slag (at 0, 2550, 5100, 10 200 and 15 300 kg/ha) on the root growth and productivity of highland rice irrigated by sprinkler. The use of the slag improved chemical attributes of the soil, increased root growth and reduced root diameter. It increased the silicon content in the soil and in the plant, resulting in higher yield.

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794. Effect of controlling the clubroot disease of sugukina by the application of converter slag for soil amendments.

Murakami, K. and Goto, I.

Japanese Journal of Soil Science and Plant Nutrition 75(2): 233-235. (2004); ISSN: 0029-0610

Descriptors: application rates/ control/ crop quality/ plant diseases/ slags/ soil acidity/ soil amendments/ Brassica campestris var neosuguki/ Capparales/ clubroot/ fulsulfamides/ sulfamides

Abstract: This experiment was conducted in Kyoto, Japan, in 1992-95, to examine the efficacy of LD steel slag to control clubroot disease on sugukina [Brassica campestris var. neosuguki]. A field that had been damaged badly by clubroot disease was divided in to four plots and treated as follows: (plot 1) LD steel slag 40 t ha⁻¹ + fulsulfamide 200 kg ha⁻¹; (plot 2) LD steel slag only; (plot 3) fulsulfamide only; (plot 4) untreated. The quality of crops were compared. The best quality crops were found in plots 1 and 2. LD steel slag controlled the disease and maintained the acid level in the soil effectively.

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795. Effect of graded fertility levels and silicon sources on crop yield, uptake and nutrient-use efficiency in rice (Oryza sativa).

Sudhakar, P. C.; Singh, J. P.; Singh, Yogeshwar; and Singh, Raghavendra

Indian Journal of Agronomy 51(3): 186-188. (2006)

NAL Call #: 22 IN235; ISSN: 0537-197X

Descriptors: application rates/ crop yield/ nitrogen fertilizers/ phosphorus fertilizers/ potassium fertilizers/ rice/ silicon/ yield components/ zinc fertilizers/ paddy/ phosphate fertilizers / potash fertilizers

Abstract: A field experiment was conducted during the wet seasons of 2001 and 2002 on sandy clay-loam soil (Ustochrept), to assess the influence of graded fertility levels and silicon sources on yield and nutrient uptake by rice. Graded fertility levels up to 160-80-80-32-0.75 kg N-

P₂O₅-K₂O-S-Zn-EDTA/ha significantly increased grain and straw yields of rice. Similarly, all the yield attributing characters were also significantly increased up to same (F₃) fertility level but it remained at par with F₄ fertility (200-100-100-40-1.0 kg/ha) level. On the other hand, the highest nutrient uptake was associated with the highest fertility level of 200-100-100-40-1.00 kg N-P₂O₅-K₂O-S-Zn EDTA/ha. Among silicon sources, basic slag was superior to other sources as well as the control for yield and nutrients uptake.

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796. The effect of limestone and iron and steel-making slag on the availability of phosphorus in dark-red latosol, and in quartzose sand.

Prado, R. de M. and Fernandes, F. M.

Revista de Agricultura Piracicaba 74(2): 235-244. (1999); ISSN: 0034-7655.

Notes: Original title: Efeito do calcário e da escória de siderurgia na disponibilidade de fósforo em latossolo vermelho escuro e em areia quartzosa.

Descriptors: acid soils/ application rates/ availability/ cerrado/ Ferralsols/ incorporation/ latosols/ limestone/ phosphorus/ sand/ sandy soils/ slags/ soil/ soil amendments/ superphosphate/ triple superphosphate/ tropics/ tropical countries/ tropical zones

Abstract: The use of limestone and slag were compared as to their effects on the availability of phosphorus in two acidic soils in the cerrado tropical region of Brazil. A 2 x 2 factorial experiment with 2 levels of application (NA1 and NA2) x 2 corrective agents (calcitic limestone and slag), completely randomized, with 4 replications, was performed in pots with quartzose sand (AQ) and dark-red latosol (LE). All pots received 200 mg P/dmsuperscript 3 as triple superphosphate. After 225 days of incorporation of these products, the soil was analysed to evaluate P content in resin. In the AQ soil, the NA2 level gave a better result than NA1, for both correctives. However, for the LE soil, level NA2 was better than NA1 for limestone, with NA1 being better than NA2 for slag.

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797. Effect of nitrogen and silicon on blast disease and yield of rice.

Padasht Dehka Ee, F.

Iranian Journal of Agricultural Sciences 30(4): 735-742. (1999)

Descriptors: cereals/ crop yield/ diseases/ fertilizers/ nitrogen fertilizers/ plant diseases/ plant pathogenic fungi/ plant pathogens/ plant pathology/ rice/ silicon/ silicon fertilizers/ slags/ paddy/ phytopathogens/ phytopathology

Abstract: Effects of nitrogen and silicon on rice blast disease [Magnaporthe grisea] and yield were studied in rice cv. Hassan-Saraie for two years. Rates of N were 0, 60, 90 and 120 kg/ha, while 0, 300, 600 and 900 kg slag/ha were applied as a source of Si (SiO₂ 34%). Number of leaf blast spots on 100-tillers at the stem elongation stage, percentage of panicle blast at the mature grain stage, number of silicified cells in 20 samples of flag leaves, and grain yield, were determined and statistically analysed. Application of nitrogen increased the blast disease and rice yield, but did not affect silicified cells. Silicon (slag obtained

from steel mill) did not affect blast disease or rice yield, but it increased number of silicified cells when applied at 900 kg/ha in the second year.

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798. Effect of silicon carriers and time of application on rice productivity in a rice-wheat cropping sequence.

Singh, K.; Singh, R.; Singh, K. K.; and Singh, Y.

International Rice Research Notes 32(1): 30-31. (2007) NAL Call #: SB191.R5I6; ISSN: 0117-4185

Descriptors: calcium silicate/ composts/ crop yield/ cropping systems/ fertilizer carriers/ panicles/ rice/ rice straw/ seed weight/ seeds/ silicon/ silicon fertilizers/ straw/ tillers/ wheat/ yield components/ paddy

Abstract: A field experiment was conducted in Varanasi, Uttar Pradesh, India, during the 1999/2000, 2000/01, 2001/02 and 2002/03 wet seasons to determine the effect of recycling Si carriers through rice straw compost at different times of Si application on rice productivity in rice-wheat cropping systems. The treatments comprised: control; 100% calcium silicate; 100% basic slag; 100% rice straw compost; 50% rice straw compost + 50% calcium silicate; 50% rice straw compost + 50% basic slag; 50% basic slag + 50% calcium silicate; and 33% rice straw compost + 33% calcium silicate + 33% basic slag. Rice straw compost at 50% + 50% calcium silicate gave the highest number of effective tillers per hill (10.65), grains per panicle (124.5), panicle weight (2.44 g), panicle length (20.57 cm), 1000-grain weight (18.56 g), grain yield (6.4 t/ha) and straw yield (10.0 t/ha).

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799. Effect of steel metallurgy basic slag on corn (Zea mays L.) cultivated in yellow red dystrophic latosol.

Prado, R. de M and Korndorfer, G. H.

Cientifica Jaboticabal 31(1): 9-17. (2003); ISSN: 0100-0039.

Notes: Original title: Efeitos da escória de siderurgia sobre a cultura do milho (Zea mays L.) cultivado em um latossolo vermelho amarelo distrofico.

Descriptors: application rates/ basic slag/ calcium/ crop yield / cultural control/ fungal diseases/ Latosols/ magnesium/ maize/ phosphorus/ plant disease control/ plant diseases/ plant pathogenic fungi/ plant pathogens/ potassium/ silicon/ soil acidity/ soil chemical properties/ soil types/ chemical properties of soil/ corn/ Hyphomycetes/ Phaeosphaeria/ Phaeosphaeria maydis/ Phaeosphaeriaceae/ phytopathogens

Abstract: An experiment was conducted on a yellow red dystrophic latosol in Uberaba, Minas Gerais, Brazil, in 1996 to evaluate the effects of basic slag (at 0, 500, 1000, 2000 and 4000 kg/ha) on maize production, disease control and chemical properties of soil, and the efficacy of this slag as a silicon source. Basic slag up to 4000 kg/ha did not affect the maize productivity, and did not promote a significant increase of available P, K, Ca and Mg in the soil. The soil acidity tended to decrease with basic slag addition. Basic slag did not show any effect on the incidence of Phaeosphaeria maydis and Helminthosporium sp. in the field.

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800. Effects of selected treatments on the production of rice in acid sulfate soils in a simulation study.

Khan, M. H. R.; Bhuiyan, M. M. A.; Kabir, S. M.; Oki, Y.; and Adachi, T.

Japanese Journal of Tropical Agriculture 50(3): 109-115. (2006); ISSN: 0021-5260

Descriptors: acid sulfate soils/ aggregates/ application rates/ crop production/ crop yield/ groundwater level/ growth/ Inceptisols/ rice/ simulation/ slags/ soil types/ acid sulphate soils/ paddy/ thionic soils

Abstract: The effects of application rate of basic slag (BS₁₀ and BS₂₀: basic slag 10 and 20 t ha⁻¹), aggregate size (A₂₀ and A₃₀: aggregate sizes of soils, less than 20 and 20-30 mm) and groundwater level (Gw₀: no influence of groundwater and Gw₅₀: groundwater beneath 50 cm of the soil surface) treatments on growth and yield of rice (*Oryza sativa* cv. BR-3 Mukta) were evaluated through a simulation study in Bangladesh. The plants were cultivated in two pre-leached (leached for a week through tap water to remove excessive acidity and salinity from the soils before transplanting seedlings) acid sulfate soils of Badarkhali (Salidic Sulfaquept) and Cheringa (Typic Sulfic Halaquept) series. Optimum growth and yield of rice were recorded by the treatment combining A₃₀ Gw₅₀ BS₂₀ in both the Cheringa (grain: 6.70 t ha⁻¹) and Badarkhali (5.78 t ha⁻¹) soils. The application of basic slag (BS₂₀) was found to be the most effective among the individual treatments, followed by the BS₁₀ Gw₅₀ A₃₀ treatments. The application of BS₂₀ increased the grain yield in combination with the Gw₀ treatment by 100% for A₂₀, while by 122% for A₃₀ in the Badarkhali soil. On the other hand, in the case of Gw₅₀, these increments were 138 and 246% for A₂₀ and A₃₀, respectively, in the soils. However, the application of BS at the highest rate (BS₂₀) to the Cheringa soil was not as effective as the A₂₀ and A₃₀ treatments in the Badarkhali soil. On the other hand, the same rate (BS₂₀) of basic slag in combination with the Gw₅₀ treatment increased the grain yield by 152 to 382% in the Cheringa soil compared with 138 to 246% in the Badarkhali soil. Almost similar and significant ($p \leq 0.05$) effects were observed for the other yield components of rice grown in both soil series. The effect of a larger soil aggregate size (20-30 mm) was more significant on the increase of growth and yield of rice during the 4-month growing period of rice, regardless of treatments.

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801. Effects of the addition of Fe-containing slag fertilizers on the changes in Eh in paddy soil.

Nozoe, Takuhito; Nishibata, Yoshimaru; Sekiguchi, Tetsuo; and Inoue, Tsunehisa

Soil Science and Plant Nutrition 45(3): 729-735. (1999) NAL Call #: 56.8 SO38; ISSN: 0038-0768

Descriptors: Fe-containing slag/ fertilizers/ oxidation-reduction potential/ Eh/ rice paddy soils

Abstract: Flooded soil with the addition of Fe-containing slags (1% to soil) was incubated under laboratory conditions. Five commercial slags were used in this study. The slag samples were numbered from I to V in ascending order of acid-soluble Ca content. The pH of the soil solution increased with the increased in the Ca content of the slags. All the Eh (oxidation-reduction potential) in the presence of the slags were lower than that of the control during the initial 8 d period of incubation. The Eh value in the

presence of slag V which contained the largest amount of Ca was the lowest throughout the incubation period. These findings suggest that the major factor of Eh decrease among others including the increase in pH, dissolution of Fe(III), and production of Fe²⁺ was the increase in pH. In the case of slags II, III, and IV, the pH values were below 7.0 during the early stage of incubation. Although the pH values increased with the increase in the Ca content, all the Eh values in the presence of slags II, III, and IV decreased similarly, because the increase in pH enhanced the dissolution of Fe(III) in the pH region of 6 to 7 when slags II, III, and IV were applied under a given condition. This fact was confirmed by the dissolution experiments of slags in the EDTA solution. In this experiment, an EDTA solution was used in place of the soil solution. Slag I consisted of a mixture of slag and crystalline Fe(III) oxide. Although slag I contained a large amount of Fe, the reducible Fe(III) content was small. The pH values changed similarly in the presence of slags I and II, while the Eh value in the presence of slag I was lower than that in presence of slag II, presumably because the amount of reducible Fe(III) of slag I was smaller than that of slag II.

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802. Effects of the application of basic slag iron chromium to soil on the nutritional state and dry matter production of passion fruit seedlings.

Prado, R. de M and Natale, W.

Revista Brasileira de Fruticultura 26(1): 140-144. (2004) NAL Call #: SB354 .R48; ISSN: 0100-2945.

Notes: Original title: Efeitos da aplicacao da escoria de siderurgia ferrocromo no solo, no estado nutricional e na producao de materia seca de mudas de maracujazeiro. **Descriptors:** application rates/ chromium/ dry matter/ dry matter accumulation/ industrial wastes/ iron/ passion fruits/ plant nutrition/ Red Latosols/ seedlings/ slags/ soil pH **Abstract:** The effects of slag, an industrial waste containing iron and chromium, on soil pH and on the performance of passion fruit (*Passiflora edulis*) seedlings under greenhouse conditions were studied. Passion fruit seedlings were transplanted in pots containing red latosols at 30 days after the incorporation of the slag (0.0, 0.375, 0.750, 1.125 or 1.500 mg/dm³ of substrate) into the soil.

The seedlings were grown in pots for 85 days. The application of slag neutralized the acidity of the soil. However, when applied at a low rate (360 kg/ha), the slag had adverse effects on seedling nutrition and dry matter production.

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803. Efficiency of liming in controlling the mobility of lead in shooting range soils as assessed by different experimental approaches.

Levonmaki, M. and Hartikainen, H.

Science of the Total Environment 388(1-3): 1-7. (Dec. 2007)

NAL Call #: RA565.S365

Descriptors: soil pollution/ military lands/ lead/ leaching/ liming/ liming materials/ calcium carbonate/ furnaces/ slags/ polluted soils/ humic substances/ solubility/ dissolved organic carbon/ laboratories/ soil pH/ leachates/ soil transport processes/ soil microorganisms/ microbial activity/ provenance/ Finland

Abstract: Shooting range soils contaminated by lead (Pb) are a great environmental risk. Reducing mobility and leaching of Pb by liming, for example, has produced contradictory results. This laboratory study compares the efficiency of two liming agents differing in their reactivity, CaCO₃ and blast furnace slag (BFS), in diminishing the mobility of Pb. In a batch test, contaminated humic soil samples were incubated in closed vessels without and with liming materials added in quantities to correspond additions of 5 t ha⁻¹. Water soluble Pb (Pbw), dissolved organic carbon (DOC), pH and substrate induced respiration (SIR) in soils were monitored for 21 days. In the experiment carried out with freely drained vessels, contaminated humic soil treated without and with liming agents was leached five times during the experimental period of 141 days. Leachates were analyzed for pH, DOC and Pb. At the end of the experiment, soil samples were analyzed for pH, DOC, Pbw, and SIR. In both systems, CaCO₃ raised pH and DOC more than BFS. The liming agents did not significantly differ in their effect on Pb chemistry. Neither had any effect on SIR: however, liming agents markedly reduced the leaching of Pb in the open system, while in the closed system they increased rather than reduced the extractability of Pb. Incubation in a closed vessel proved not to be a suitable experimental system for Pb mobility estimation, since the ionic strength may be raised to abnormal levels, resulting from accumulated reaction products of liming agents. This citation is from AGRICOLA.

804. Evaluation of blast furnace slag as a means of reducing metal availability in a contaminated sediment for beneficial use purposes.

Barth, Ed; Sass, Bruce; and Chattopadhyay, Sandip
Soil and Sediment Contamination 16(3): 281-300. (2007)
 NAL Call #: TD878 .J68; ISSN: 1532-0383
Descriptors: blast furnace slag/ reduction of metal availability/ contaminated sediments/ beneficial use
Abstract: An attractive option for the management of dredged sediment involves the use of dredged sediment for beneficial use purposes, such as for fill material. Treatment (chemical amendment) of contaminated sediment may be necessary to limit the environmental and human availability (bioaccessibility, leachability, plant uptake) of heavy metals associated with the contaminated sediment before it is placed. A laboratory study was conducted to investigate the effect of admixing a specific chemical amendment (blast furnace slag) with slightly contaminated fresh-water sediment for reducing metal availability. Initial characterization tests of the un-amended sediment showed that some of the metals analyzed were present in relatively available (non-residual) forms. Although sulfide was present in the un-amended sediment, the amount was not sufficient to bind all of the available metals. A series of metal availability testing methods indicated that the amendment of the sediment with blast furnace slag (4% on a dry weight ratio basis) had the potential to slightly reduce the availability of some, but not all of the available metals associated with the sediment. Results of the column and batch leaching tests showed that leachability of certain metals, such as barium, nickel and zinc, was reduced by the amendment, but the leachability of copper increased. The effect of the amendment for decreasing bioaccessibility for lead and arsenic was not demonstrated. The amended

soil had a detrimental effect on most of the plant species that were evaluated. The metal availability results for the plant uptake tests were also mixed, with slightly lower uptake of certain metals by corn grown within the amended sediment.

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805. Evaluation of silicate iron slag amendment on reducing methane emission from flood water rice farming.

Ali, Muhammad Aslam; Oh, Ju Hwan; and Kim, Pil Joo
Agriculture Ecosystems and Environment 128(1-2): 21-26. (Oct. 2008)
 NAL Call #: S601.A34; ISSN: 0167-8809
Descriptors: iron slag/ soil amendment
Abstract: Application of electron acceptors such as ferric iron oxides and hydroxides for controlling methane (CH₄) emission from wetland rice fields deserves special attention due to its dominant role over all other redox species in wetland soils. Silicate iron slag (hereafter, silicate fertilizer), a byproduct of steel industry containing electron acceptors, was applied in paddy field (Agronomy Farm, Gyeongsang National University, South Korea) at the rate of 0, 1, 2 and 4Mghap# to investigate their effects on reducing CH₄ emissions from flood water rice (*Oryza sativa*, cv. Dongjinbyeon) farming during 2006-2007. CH₄ emission rates measured by closed-chamber method decreased significantly ($p < 0.05$) with increasing levels of silicate fertilizer application during rice cultivation. Soil redox potential (Eh) showed a contrasting response to CH₄ emission rates. The concentrations of dissolved iron materials in percolated water, and the active and free iron oxides in soil significantly increased with the applications of silicate fertilizer, which acted as oxidizing agents and electron acceptors, and eventually suppressed CH₄ emissions during the rice growing seasons. Total CH₄ emission was decreased by 16-20% with 4Mghap# silicate fertilizer application and simultaneously rice grain yield was increased by 13-18%. Silicate fertilization significantly stimulated rice plant growth, especially root biomass, root volume and porosity, which might have improved rhizosphere oxygen concentration, and then partially contributed to reduce CH₄ emission through enhancing methane oxidation. Therefore, silicate fertilizer could be a good soil amendment for reducing CH₄ emission as well as increasing rice productivity in wetland paddy field. This citation is from AGRICOLA.

806. Evaluation of slag application to decrease methane emission from paddy soil and fate of iron.

Furukawa, Yuichiro and Inubushi, Kazuyuki
Soil Science and Plant Nutrition 50(7): 1029-1036. (2004)
 NAL Call #: 56.8 SO38; ISSN: 0038-0768
Descriptors: slag application/ methane emission/ paddy soil/ fate/ iron
Abstract: Organic carbon in paddy soil is oxidized to carbon dioxide by reducing electron acceptors for a certain period after submerging. Methane production commences after the reduction of iron oxide which is the most important electron acceptor in the soil. We aimed to study the long-term suppression of the methane emission from the paddy soil by single application of iron slag. A revolving furnace slag (RFS; 248 g Fe kg⁻¹) was applied to the potted soil at the rate of 0 (control) or 20 ton ha⁻¹ in 2000. Rice plants

were successively cultivated on the potted soils for 3 years without further application of the RFS. Methane emissions from the potted soils with rice plants were measured by the closed chamber method during these cultivation periods. Total flux of CH₄ emission from the pot applied with RFS decreased by 5-30% compared with the control. The RFS supplied free iron oxide to the potted soil, and its iron acted as the oxidizing agent as evidenced by the increase in ferrous iron content in the soil. The amount of iron lost from leaching at the bottom of the pots was estimated as 54-59 kg Fe ha⁻¹ year⁻¹ at the percolation rate of 20 mm d⁻¹. Accordingly, half-life of the iron in the applied RFS was calculated as 42-46 years. Therefore, there is a possibility that the suppressing effect of RFS on CH₄ emission is sustained for a half-century. Contents of heavy metals (Cd, Cu, and Zn) in the brown rice harvested from the pot applied with RFS were not significantly different with those from the control pot.

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807. Evaluation of the potential for agricultural use of the industrial slag from the iron and steel industry of Boyaca.

Edith Gonzalez, M. and Castro, H. E.

Suelos Ecuatoriales 30(1): 15-20. (2000); ISSN: 0562-5351.

Notes: Original title: Evaluacion de la potencialidad del uso agricola de escorias industriales procedentes de la siderurgica de Boyaca S A.

Descriptors: application rates/ basic slag/ crops/ lime/ magnesian limestone/ rock phosphate/ slags/ wheat/ yield components/ magnesium limestone/ phosphate rock/ Triticum vulgare

Abstract: The fertilizer qualities and possible agricultural use of an industrial slag in Colombia was studied in an experimental design of complete randomized blocks. Eleven treatments were tested including four repetitions and a comparison test or absolute control. The crop indicator was wheat (*Triticum vulgare*), cultivar ICA Hunza. The treatments were: absolute control, as an indicator of the natural fertility of the experimental soil to which no fertilizers were applied; T1: 'regional test' using a common fertilization solution of NPK; treatments T2, T3, T4 and T5 received doses of 500, 1000, 2000 and 4000 kg industrial slag/ha respectively. Treatments T6, T7, T8, T9 and T10 refer to average doses of 1000 kg/ha of conventional materials as dolomitic lime, 'abono Paz del Rio' (another local basic slag), Calfos [calcium phosphate], North Carolina Rock Phosphate and 'Phosphacid-S-B' [phosphoric acid], respectively. The effects of equal doses of materials of different origin and composition were compared. It was concluded that the experimental slag has the characteristics of a fertilizer material and could be used in agriculture in soils of low fertility with properties of those studied. The chemical composition of soluble elements in the industrial slag and the results of yield components obtained by the indicator crop, gave evidence for further research to test at the farming level the validity of the selected doses and their chemical evaluation with liming material containing magnesium, sulfur and trace elements. Reproduced with permission from the CAB Abstracts database.

808. An experimental assessment of slag as a substrate for mangrove rehabilitation.

Day, S.; Streever, W. J.; and Watts, J. J.

Restoration Ecology 7(2): 139-144. (1999)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: assessment/ carbon/ flowering/ habitats/ mangroves/ nitrogen/ nutrient content/ plant nutrition/ reclamation/ rehabilitation/ sand/ slags / substrates/ survival/ trees/ woody plants/ anthesis

Abstract: This study compared propagule retention, early survival, growth, flowering success, and nutrient concentrations of *Avicennia marina* (grey mangrove) grown on sand, naturally occurring substrate (a mixture of sand and silt), and rock blast furnace slag over two growing seasons (1996-97) at an experimental site near Newcastle, Australia. Nutrient concentrations of experimental plants were also compared with those of naturally occurring plants. Experimental results showed significant differences ($p < 0.05$) in short-term survival, growth over the two growing seasons, and carbon and nitrogen concentrations between plants grown on different substrates. Comparison of plants grown in slag and plants from reference sites suggests, however, that slag does not lead to anomalies in nutrient concentrations of young mangroves. Although the results identified some differences between plants grown on river sand, naturally occurring substrate, and slag substrate, the absence of consistent differences suggests that mangroves planted in slag when rehabilitating habitats are under no greater risk of future failure than mangroves planted in naturally occurring substrate. Reproduced with permission from the CAB Abstracts database.

809. Extractors of available silicon in slags and fertilizers .

Pereira, H. S.; Korndorfer, G. H.; Moura, W. F.; and Correa, G. F.

Revista Brasileira de Ciencia do Solo 27(2): 265-274. (2003)

NAL Call #: S590 .R44 ; ISSN: 0100-0683.

Notes: Original title: Extratores de silicio disponivel em escorias e fertilizantes.

Descriptors: acetic acid/ ammonium nitrate/ cation exchange resins/ citric acid/ extractants/ fertilizer analysis/ hydrochloric acid/ nutrient availability/ nutrient uptake/ plant nutrition/ rice/ silicon/ silicon fertilizers/ slags/ sodium carbonate/ paddy

Abstract: The methods to quantify available silicon (Si) in fertilizers and slags are not yet sufficiently trustworthy. In this study, Si extracted from several sources was analysed. The extractors used were: Na₂CO₃+NH₄NO₃ in varying concentration, time of agitation and of reaction; water; 0.5 mol HCl dm⁻³; 50 g Na₂CO₃ dm⁻³; 50 g citric acid dm⁻³; 0.5 mol acetic acid dm⁻³; acid cation exchange resin (Amberlite IRC-50, pK 6.1); and the leaching column method. A greenhouse experiment, where 125 kg ha⁻¹ of total Si from 12 different sources was applied on irrigated rice, was also conducted. For the determination of Si, shaking duration was not essential, although 3 h of shaking entailed a statistically superior result. The concentrations of 10+16 g dm⁻³ and 30+48 g dm⁻³ of Na₂CO₃+NH₄NO₃ proved to be the most promising for Si extraction. The

smaller concentration (10+16 g dm⁻³) was therefore chosen to evaluate Si sources in relation to settling time. All Si sources increased solubility during the rest time period. The best correlation between Si uptake by the rice plants and Si detected in the various analysed sources was found in the period between day 5 and 9. According to the results, the extractor Na₂CO₃+NH₄NO₃ evaluates Si in fertilizers adequately and can be used as a method to determine the potential Si release in the soil and its availability for plants. The most efficient source for Si solubilization for rice was Rhodia, followed by Wollastonita, while the sources MB-4 and blast furnace slag provided less available Si. The acid extractors were more efficient at extracting Si from blast furnace slags and less efficient with Wollastonita. Water was the extractor that presented the lowest Si recovery rate. The best correlation between Si contents and uptake by the rice crop were achieved by the extractors resin Amberlite and Na₂CO₃ 10 g dm⁻³+NH₄NO₃ 16 g dm⁻³, followed by the column-method. Reproduced with permission from the CAB Abstracts database.

810. Feasible suppression technique of methane emission from paddy soil by iron amendment.

Furukawa, Yuichiro and Inubushi, Kazuyuki
Nutrient Cycling in Agroecosystems 64(1-2): 193-201. (2002)

NAL Call #: S631 .F422; ISSN: 1385-1314

Descriptors: suppression techniques/ methane emissions/ paddy soils/ iron amendment

Abstract: A revolving furnace slag (RFS), which is a by-product of the steel industry, and a spent disposable portable body warmer (PBW), which harnessed the heat of iron oxidation reaction, were used as iron materials. Portions of 4 kg of Coarse and Medium Textured Gley soil were placed into plastic pots (3 L). RFS was added to the pots at the rate of 0 (control), 10, 20, 40, 100 ton ha⁻¹, while PBW was added at 10 ton ha⁻¹ only. Methane flux from the potted soil with rice plants and Eh were measured during cropping seasons in 1999 and 2000. In the 1999 experiment, the RFS treatments showed lower Eh values compared with the control, especially at the early period of cultivation, although the RFS was applied to maintain the soil oxidative. The rapid decrease in Eh under high application of RFS may be due to the high pH of the RFS (pH (RFS:H₂O = 1:2.5) was 12.2). However, total methane emission during the cultivation period significantly decreased, about 10%, when 10-40 ton ha⁻¹ of RFS and 10 ton ha⁻¹ of PBW were applied. The grain yield was significantly increased, about 30%, when 40 or 100 ton ha⁻¹ of RFS was applied. This was also partly due to the release of inorganic nutrients from RFS and also from soil. The latter, due to effect of the alkaline RFS on soil. In the 2000 experiment, the pots with soils from 1999 were used without further application of iron materials. The influence of high application of RFS on soil Eh disappeared, compared with 1999. Total methane emission significantly decreased, about 35%, at 20 ton ha⁻¹ of RFS. However, the increase of grain yield caused by RFS in 1999 was diminished, compared with 1999. Production activity of both methane and carbon dioxide at the RFS treatments were decreased, while methane oxidizing activity was increased. The

decrease in total methane emission may be attributed to not only inhibition of methane production but also enhanced methane oxidation. In conclusion, methane emission from paddy soil could be suppressed, over two cropping seasons by single application of RFS without losing grain yield.
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811. Iron and steel industry slag and lime for soil acidity correction using sugarcane grown in pots.

Prado, R. de M. and Fernandes, F. M.
Scientia Agricola 57(4): 739-744. (2000); ISSN: 0103-9016.

Notes: Original title: Escoria de siderurgia e calcario na correcao da acidez do solo cultivado com cana de acucar em vaso.

Descriptors: acid soils/ application rates/ cerrado soils/ Entisols/ Ferralsols/ lime/ lime requirement/ limestone/ Oxisols/ pot experimentation/ slags/ soil acidity/ soil amendments/ soil pH/ soil types/ sugarcane soils
Abstract: The neutralizing components of slag are linked with high energy, combined with the presence of several metallic elements; these characteristics interfere in the chemical evaluation of their neutralization power. This study evaluated whether the neutralization power of lime would be compatible with slag, as a function of pH, H+Al, and Ca+Mg contents on acid soils in the Cerrado region of Brazil, for sugarcane cultivation. The study was performed in 20 dm³ pots in a greenhouse, with Acrustox and Quartzipsamment soils, in two successive cultivations of sugarcane (first cutting and second cutting), each harvested 210 days after amendments incorporation. Treatments constituted of the two corrective agents, limestone and slag, at two levels of application. At the end of each cultivation, soils were sampled and analysed chemically. The reactivity of the slag depended on the soil type. The efficiency of the slag based on the power of neutralization adopted for limestone was not sufficient to allow evaluation of the required amount of the product for the correction of soil acidity.

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812. New applications for iron and steelmaking slag.

Takahashi, T. and Yabuta, K.
NKK Technical Review(87): 38-44. (2002); ISSN: 09150544 [NTERE]

Descriptors: blast furnaces/ carbon dioxide/ concrete aggregates/ research and development management/ slags/ iron slag/ steelmaking

Abstract: Iron and steelmaking slag is a by-product of the iron and steelmaking process. Slag has traditionally been used as a component of cement and construction aggregate. NKK has led the industry in promoting the effective use of slag. In this paper, fine concrete aggregate, known as Sandy-S, and slag sand-capping material are introduced as new applications of granulated blast furnace slag. Other innovative uses of steelmaking slag are introduced: large carbonated slag blocks, called Marine Blocks, produced by injecting carbon dioxide into slag compact, and potassium silicate fertilizer produced by adding a potassium source to steelmaking slag.

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813. New evidence for rejuvenation of phosphorus retention capacity in EAF steel slag.

Drizo, A.; Cummings, J.; Weber, D.; Twohig, E.; Druschel, G.; and Bourke, B.

Environmental Science and Technology 42(16): 6191-7. (Aug. 2008)

NAL Call #: TD420.A1E5; ISSN: 0013-936X

Descriptors: rejuvenation potential/ phosphorus retention capacity/ electric arc furnace/ steel slag

Abstract: The purpose of this research was to investigate phosphorus (P) retention capacity and rejuvenation potential of electric arc furnace (EAF) steel slag from Quebec and New Zealand (NZ) iron melter slag (IMS). Columns filled with slag materials were fed with dairy effluent and subjected to two feeding and one resting cycle(s). P retention capacities and rejuvenation potentials were determined after each feeding cycle. Elemental composition and mineralogical analysis were performed on IMS samples. Finally, chemical fractionation analysis was conducted on both NZ IMS and Quebec EAF steel slags. The results revealed that initiating a resting period in EAF steel slag filters prior to reaching their P saturation point increased the overall filter P retention capacity by 49.5 and 42.4% compared to 28% in a filter which had its resting period initiated after reaching P saturation. The rejuvenation property could play a significant role in full-scale applications by prolonging life expectancy and increasing cost efficiency. P retention and rejuvenation by NZ slag materials was negligible relative to EAF steel slag material from Quebec. Chemical fractionation analysis revealed differences between materials, indicating that the highest quantities of P were bound to Ca and Fe in EAF steel slag and to Ca and Al fractions in iron melter slag. This study also demonstrates that slag's performance is dependent on the source of the material and the steel making practices. Therefore, testing of the P adsorptive capability and, if relevant, the rejuvenation potential of individual steel mill slags, should be a prerequisite prior to their use in field applications.

This citation is from PubMed.

814. The occurrence and distribution of various forms of silica and zeolites in soils developed from wastes of iron production.

Sauer, D. and Burghardt, W.

Catena 65(3): 247-257. (2006); ISSN: 0341-8162

Descriptors: aluminium/ calcium carbonate/ industrial wastes/ iron/ magnesium/ nonclay minerals/ potassium/ saturation/ silica/ silicic acid/ silicon/ slags/ sodium/ soil formation/ soil pH/ soil profiles/ soil properties/ soil salinity/ zeolites/ aluminum/ soil genesis

Abstract: Young soils developed in blast furnace slag, slag sand and ash are often alkaline. Under these conditions the solubility of silica increases greatly. In four soil profiles investigated (two in France and two in Germany) we found not only that dissolved silicic acid and amorphous silica occurred, but also that zeolites had developed. We identified several soil properties that may influence the formation of amorphous silica and zeolites. In the blast furnace slag, the formation of amorphous silica seemed to be enhanced by decreasing pH and increasing Mg content, while the amount of zeolites grew with increasing contents

of water soluble Na and K and with decreasing content of CaCO_3 . In the slag sand, Mg also appeared to promote the formation of amorphous silica. In addition, there was a weaker correlation between rising CaCO_3 content and an increasing amount of amorphous silica. Furthermore, in the slag sand the $\text{Si}_0\text{:Al}_0$ ratio decreased with increasing salinity, suggesting that the zeolites were Al enriched. Longer periods of water saturation of the soil, it is suggested, enhance the development of zeolites and inhibit the formation of amorphous silica.

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815. Plant growth and nutrients uptake as influenced by application of farmyard manure and some natural minerals to sandy soils.

Wafaa, M. T. E.; Gehan, H. Y.; and Laila, K. M. A.

Arab Universities Journal of Agricultural Sciences 14(1): 213-234. (2006); ISSN: 1110-2675

Descriptors: ammonium sulfate/ crop yield/ dry matter accumulation/ farmyard manure/ fertilizers/ flowering/ growth/ magnetite/ maize/ manganese/ minerals/ nutrient uptake/ potassium sulfate/ roots/ sandy soils/ shoots/ slags/ soil types/ superphosphate/ wheat/ ammonium sulphate/ anthesis/ corn/ FYM/ Mn/ potassium sulphate

Abstract: A field experiment was conducted at the Ismailia Agricultural Research Station, Egypt, during two successive seasons, winter 2001-2002 with wheat (*Triticum aestivum* cv. Giza 168) and summer 2002 with maize (*Zea mays* cv. Giza 10) to study the effect of farmyard manure (FYM) and some natural materials on growth and uptake of nutrients by plants. FYM was applied at 2 and 3% individually or combined with micronutrient sources. Micronutrients were magnetic iron oxide, basic slag and manganese dust, applied alone at 0.07% or in combination with FYM levels of 0.02, 0.05 and 0.07%. The plots received inorganic fertilizers as follows: ammonium sulfate (20% N), superphosphate (15% P_2O_5) and potassium sulfate (48% K_2O) at rates of 100, 30 and 48 kg/fed at N, P_2O_5 and K_2O , respectively. The results showed that the mineral fertilizers treatment positively affected the dry matter of both shoots and roots of wheat along with contents of nitrogen and potassium in both shoots and roots and shoot-root ratio. At flowering stage, the results showed that applied FYM at the rate of 3% significantly affected the dry matter of both shoots and roots as well as their content of N, P and K. A similar trend was observed for micronutrients uptake at the two indicated growth stages of wheat, which recorded high values when FYM, at a rate of 3%, was applied. The results indicated that applied FYM at the rate of 2% with high rate (0.07%) of each of the used natural minerals and FYM at the rate of 3% in combination with the moderate rate (0.05%) of such minerals recorded high values of the tested parameters. The basic slag gave the highest values, over control, of dry matter content and macronutrients uptake during the studied two growth stages of wheat (vegetative and flowering stages). The agronomic yield components of wheat (straw, grains and weight of 1000 grains) were increased when mineral fertilizer was applied; such significant increases were obtained in maize yield as a result of applied FYM individually or combined with natural minerals.

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816. Potential of use of slags and other silicon sources in four materials of the savanna soils.

Pereira, H. S.; Queiroz, A. A.; Martins, M. R.; Camargo, M. S. de; and Korndorfer, G. H.

Bioscience Journal 23(3): 17-31. (2007); ISSN: 1516-3725.

Notes: Original title: Potencial de uso de agregados siderurgicos e outras fontes de silicio em quatro materiais de solo fase cerrado.

Descriptors: application rates/ calcium carbonate/ Entisols/ grasslands/ nonclay minerals/ Oxisols/ savannas/ silicates/ silicon/ silicon fertilizers/ slags/ wollastonite

Abstract: To supply the demand for silicates fertilizers, there is need to investigate and to identify the potential sources of silicon (Si) available. This study evaluated materials (fertilizers/slags) with high concentration in Si, through chemical methods of soil incubation, to predict its agronomic efficiency and reatividade in the soil. Incubation studies (with and without balance with CaCO_3 and MgCO_3) were carried out for 90 days, using 4 soil materials under savanna vegetation (Rhodorthox, Gibbsiorthox, Ferrorthox and Quartzipsamment soil) with 12 materials (wollastonite, blast furnace I and II, steel slag of LD I, II, III and IV, slag of P, steel slag of AOD, electric furnace steel slag, stainless steel slag and silicate clay) and a control. Wollastonite was used with doses of 125, 250 and 500 kg/ha and the other materials in the dose of 125 kg/ha. The Si levels in acetic acid were larger than the extracted with water, overestimating the content of Si in the sources when the calcium and magnesium carbonate was used. The metallurgical aggregate originated of blast furnace, which possesses larger Si levels, are more soluble in acetic acid and less soluble in water compared with the other slags. The electric furnace steel slag presented the level of Si extracted in water, wherein it was more soluble, showing high use potential for agriculture, although studies are necessary with plants.

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817. Problems and prospects of efficient use of fertilisers in acid soils of India.

Panda, N.

Fertiliser News 43(5): 39-50. (1998)

NAL Call #: 57.8 F4123; ISSN: 0015-0266

Descriptors: acid soils/ agroforestry/ amendments/ basic slag/ capacity/ cultivation/ fertilizers/ industrial wastes/ lime/ phosphorus/ rock phosphate/ sludges/ soil/ soil management/ use efficiency/ wastes/ agriforestry/ agro forestry/ phosphate rock

Abstract: Acid soils in India are base unsaturated, infertile, low water retentive, nutritionally imbalanced and problematic from the management standpoint. Amelioration of acid soils with commercial lime is cost-prohibitive, and industrial wastes such as basic slag, blast furnace slag, lime sludge from paper mills, cement kiln wastes etc. have potentiality. Indigenous rock phosphate like Mussoorie and Udaipur and imported rock phosphate like North Carolina and Gafsa could also be used. Cultivation of acid-soil-tolerant crop species and varieties are sustainable though not commercially viable. Agro-horticultural and agroforestry systems with proven technology should be encouraged. Integrated nutrient management is highly desirable with chemical fertiliser as a major component. Since fertilizer

use efficiency in acid soils is low, soil-test-based fertilizer recommendations aiming at balanced fertilisation is remunerative.

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818. Reclamation of a Badarkhali hot spot of acid sulfate soil in relation to rice production by basic slag and aggregate size treatments under modified plain ridge ditch techniques.

Khan, Md. H. R.; Kabir, S. M.; Bhuiyan, Md. M. A.; Blume, H.-P.; Oki, Y.; and Adachi, T.

Soil Science and Plant Nutrition 54(4): 574-586. (2008)

NAL Call #: 56.8 SO38; ISSN: 00380768 [SSPNA].

Notes: doi: 10.1111/j.1747-0765.2008.00263.x.

Descriptors: acid sulfate soil/ aggregate size/ basic slag/ growth performance/ reclamation

Abstract: A field experiment was conducted for the reclamation of a Badarkhali hot spot of acid sulfate soil manipulated by flash leaching followed by basic slag (BS) at 10 t ha^{-1} (BS₁₀) and 20 t ha^{-1} (BS₂₀) and aggregate sizes (A) of soil less than 20 mm (A₂₀) and less than 30 mm (A₃₀) treatments under two different techniques (Tech 1: pyrite layer at top, jarosite layer at middle and topsoil at the bottom of the ridge; Tech 2: topsoil at top, pyrite layer at middle and jarosite layer at the bottom of the ridge). Responses to two cultivars of rice (Pizam [local cultivar] and BR 14 [high yielding cultivar]) with the treatments were evaluated. The initial soil had a very low pH(H₂O) 4.0 and a high electrical conductivity (EC) of 1.4 m S^{-1} , and the pyrite content was 68 g kg^{-1} . The exchangeable Mg content of the soil was approximately twice that of Ca and the Al content was at a highly toxic level. The average soil data of all the treatments, except for the control plots (where no amendment was applied), after harvesting of rice increased by 1.1 units for soil pH and 17-524% for the contents of N, P, Ca and Mg, while the concentrations of Fe, Al, Na, Cl- and SO_4^{2-} decreased by 30-94% compared with the initial soil. The maximum growth and yield of rice grains (4.4 t ha^{-1}) were obtained by the Pizam compared with the BR 14 (4.0 t ha^{-1}) in the A₂₀BS₂₀ treatment in the ridges of Tech 2. The lowest grain yields of 0.02 (BR 14) and 0.07 t ha^{-1} (Pizam) were recorded for the control plots. The other treatments also resulted in significantly ($P \leq 0.05$) improved performance on rice production. The highest N, P, K, Ca and Mg contents in the shoots of BR 14 and Pizam rice were obtained under the A₂₀BS₂₀ treatment followed by the A₂₀BS₁₀ > or equal to A₃₀BS₂₀ treatments. Application of A₂₀BS₂₀ under Tech 2 is the most appropriate reclamation option and the local Pizam is the most suitable rice for this soil. © 2008 Japanese Society of Soil Science and Plant Nutrition.

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819. The reduction of phosphorus effluence from greenhouse canal soil using amendments in Korea.

Yun, S. W.; Baek, S. H.; Park, J. C.; and Yu, C.

In: 2007 Asabe Annual International Meeting, Technical Papers.; Vol. 3.

Minneapolis, MN; 2007.

Notes: Conference code: 70499. Sponsors: American Society of Agricultural and Biological Engineers, ASABE.

Descriptors: greenhouse sector/ industrial by-products/ phosphorus/ runoff reduction/ agricultural runoff / catchments/ cultivation/ eutrophication/ greenhouses/ pH effects/ soils/ greenhouse sectors/ incubation/ rotating cultivation systems/ runoff reduction/ phosphorus

Abstract: Phosphorus(P) export from agricultural catchments can accelerate freshwater eutrophication. For most soils around canals of greenhouse sector in Korea, it has been well known that soil P exceeded the appropriate P level because of the continuous rotating cultivation system and the excessive fertilizing. Therefore the excessive P was concentrated in soils around canals and the effluence of P from these soils during the irrigation or flooding season has become a major cause of the pollution of reservoirs or rivers in Korea. In this presentation, the alternative method was investigated in order to reduce the P effluence, especially water extractable soil P (WEP), from these P-rich canal soils to freshwater system. In the tests, a typical soil at excessive soil P level were incubated for 56 weeks after the treatment with the types of 4 application rates (3%, 6%, 9%, 12%) of various industrial by-products such as blast furnace slag (BFS), steel refining slag (SRS), fly ash (FA), bottom ash (BA) and oyster shell (OS) meal. The efficiency of WEP reduction of samples which were treated with industrial by-products as potential PSSAs in the 3-12% application rates and in 56 days incubation period was appeared in the order of OS > FA > SRS > BFS > BA. But all samples were shown the efficiencies that were higher than about 70% during 21 days incubation and higher than about 80% during 56 days incubation. As a result of statistical analysis, among the various relationships, between WEP content and pH and then between WEP content and total P content were shown the most highest significant level when we referred to the result of Student's t-test. Also WEP contents between 21 day and 56 day were not different significantly for all PSSAs and these results suggest that sorption reactions induced by PSSAs are rapid and remain stable over time. On the other hand, pH value of all samples was in the range of 7.35-8.03 at 56 day. It is also suggesting that solubility of soil P which was treated with PSSAs will be low and sustainable for a long period because pH level had sustained in the range above 7.0 for 56-days. Therefore industrial by-product as potential PSSAs can be considered in selecting a material as a possible. These results were considered appropriate in the view of the management of canals around greenhouse site according to the regulation in Korea. Especially, the effect of oyster-shell and bottom-ash were remarkable.
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820. Remediation of arsenic-contaminated soils by iron oxide application, evaluated in terms of plant productivity, arsenic and phytotoxic metal uptake.

Hartley, W. and Lepp, N. W.

Science of the Total Environment 390(1): 35-44. (2007)

NAL Call #: RA565.S365; ISSN: 0048-9697

Descriptors: arsenic/ bioavailability/ biomass/ coal/ fly ash/ goethite/ growth/ heavy metals/ iron/ iron oxides/ lime/ phytotoxicity/ polluted soils/ soil amendments/ soil pollution/ soil types/ spinach/ sulfates/ tomatoes/ uptake/ limonite/ remediation/ sulphates

Abstract: Four iron-bearing additives, selected for known or potential ability to adsorb anions, were evaluated for their effectiveness in attenuation of arsenic (As) in three soils with different sources of contamination (canal dredgings,

coal fly ash deposits, and low-level alkali waste).

Amendments used were lime, goethite (α -FeOOH) (crystallised iron oxide) and three iron-bearing additives, iron grit and iron (II) and (III) sulphates plus lime, which result in 'de novo' iron oxide formation in soils. Each was applied to the test soils at a rate of 1% w/w. A series of plant growth trials were conducted on the equilibrated, amended soils using spinach (*Spinacia oleracea*) and tomato (*Lycopersicon esculentum*) as test crops. These were grown in the contaminated soils for a period of three months in controlled glasshouse conditions. Evaluation of the potential of the amendments as immobilising agents was determined by plant growth (biomass) and elemental accumulation in plant tissues, indicating the bioavailability of As and other heavy metals following amendment. Goethite produced the most promising results in terms of reduction of plant shoot As content. It was concluded that, whilst Fe-oxides may be used as effective in situ amendments to attenuate As in soils by reducing its bioavailability, their effects on plant growth require careful consideration. In addition, soil-plant transfer of As was not completely halted by any amendment.
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821. Remediation of copper-contaminated topsoils from a wood treatment facility using in situ stabilisation.

Bes, C. and Mench, M.

Environmental Pollution 156(3): 1128-1138. (Dec. 2008)

NAL Call #: QH545.A1E52; ISSN: 1873-6424

Descriptors: adsorption/ carbon/ copper: analysis/ environmental remediation: methods/ fabaceae: chemistry: growth & development/ France/ humic substances/ industrial waste/ iron/ phosphates/ plant shoots: chemistry: growth & development/ sewage/ soil: analysis/ soil pollutants: analysis/ wood

Abstract: Five organic matters, three phosphate compounds, zerovalent iron grit (ZVIG, 2% by soil weight), two alkaline compounds, and two commercial formulations were incorporated, singly and some combined with ZVIG, into a highly Cu-contaminated topsoil (Soil P7, 2600 mg Cu kg⁻¹) from a wood treatment facility. Formulations and two composts were also singly incorporated into a slightly Cu-contaminated topsoil (Soil P10, 118 mg Cu kg⁻¹) from the facility surrounding. This aimed to reduce the labile pool of Cu and its accumulation in beans cultivated on potted soils in a climatic chamber. Lowest Cu concentration in soil solution occurred in P7 soils amended with activated carbon (5%) and ZVIG, singly and combined. Basic slag (3.9%) and compost of sewage sludge (5%) combined with ZVIG promoted shoot production and limited foliar Cu accumulation. For amended P10 soils, no changes occurred in soil solution and foliar Cu concentrations, but one compost increased shoot production.
This citation is from PubMed.

822. The Rengen Grassland Experiment: Soil contamination by trace elements after 65 years of Ca, N, P and K fertiliser application.

Hejcman, M.; Szaková, J.; Schellberg, J.; Šrek, P.; and Tlustoň, P.

Nutrient Cycling in Agroecosystems 83(1): 39-50. (2009)

NAL Call #: S631.F422; ISSN: 13851314 [FRESO].

Notes: doi: 10.1007/s10705-008-9197-8.

Descriptors: arsenic/ basic slag/ chromium/ heavy metals/ long-term fertilisation/ mobility and accumulation/ risk elements/ bioavailability/ element mobility/ experimental study/ fertilizer application/ grassland/ heavy metal/ slag/ soil pollution/ soil profile/ trace element/ Central Europe/ Eifel/ Eurasia/ Europe/ Germany/ Rhenish Schiefergebirge/ Rhineland Palatinate

Abstract: The Rengen Grassland Experiment (RGE) was established in the Eifel Mts. (Germany) on a low productive Nardetum in 1941. Since then, the following fertiliser treatments have been applied along with a two cut system: unfertilised control, Ca, CaN, CaNP, CaNP-KCl and CaNP-K₂SO₄ with basic slag (syn. Thomas phosphate) as the only P fertiliser. The effect of long-term fertilisation on plant-available (extracted with 0.01 mol l⁻¹ CaCl₂), easily-mobilisable (extracted with 0.05 mol l⁻¹ EDTA), potentially-mobilisable (extracted with 2 mol l⁻¹ HNO₃) and total concentrations of trace elements (As, Cd, Cr, Cu, Fe, Mn, Ni, Pb and Zn) in the top 0-10 and 10-20 cm of soil were investigated in 2006. According to redundancy analysis (RDA), the effect of treatment on the concentrations of risk elements was significant and explained 82.3 and 90.6% of the variability in the data in the 0-10 and 10-20 cm soil layers, respectively. Basic slag supplied the soil with considerable amounts of As, Cr, Cu, Fe, Mn and Zn. Following 65 years of fertiliser application the concentrations of risk elements in the soil profile had increased substantially, especially with basic slag. However, threshold limits for total trace element concentration in soil permitted by Czech national legislation were exceeded only in the case of As. The increase in plant-available As concentrations was most critical as it increased the potential uptake of As by plants in plots fertilised with P. Although P treatments received more than 300 g of Cr ha⁻¹ annually, no effect on plant-available Cr soil content was detected. This contrasted with the accumulation of total Cr in the 0-10 and 10-20 cm soil layers. Furthermore, plant availability of Cd, Fe, Mn and Zn was affected by soil pH and generally decreased with the application of quick lime. Plant availability of these elements was not correlated with amounts supplied by fertilisers. © 2008 Springer Science+Business Media B.V. © 2009 Elsevier B.V. All rights reserved.

823. Residual effect of calcium silicate slag as soil acidity corrective in sugar cane ratoon.

Prado, R. M.; Fernandes, F. M.; and Natale, W.
Revista Brasileira de Ciencia do Solo 27(2): 287-296. (2003)

NAL Call #: S590 .R44; ISSN: 0100-0683.

Notes: Original title: Efeito residual da escoria de siderurgia como corretivo de acidez do solo na soqueira de cana de acucar.

Descriptors: application rates/ base saturation/ calcium silicate/ crop yield/ limestone/ liming/ liming materials/ ratooning/ residual effects/ slags/ soil acidity/ soil pH/ sugarcane

Abstract: Calcium silicate slag, as a soil acidity corrective material with long-lasting residual effects, can benefit long-cycle cultures like sugarcane, thus minimizing production drops during the productive cycle. This study, conducted in Brazil, evaluated different base saturation levels, comparing calcitic limestone to basic slag as a soil corrective agent, in relation to alterations of some chemical soil properties, as well as to the response of sugarcane ratoon. Sugarcane of

the SP 80-1842 type, during the third and fourth cut in the agricultural years 2000/01 and 2001/02, was used for the experiment. The treatments, arranged in randomized blocks with four replications, consisted in the application of two corrective agents (calcitic limestone and basic slag) evaluated by the base saturation method, with four correction levels (V %): control (without correction), correction for V % to 50; 75; and 100, applied at planting. After 48 months, both calcitic limestone and basic slag had generated a beneficial residual effect in the correction of soil acidity and the increase of base saturation. The highest limestone rate caused a restrictive effect on the sprouts, the number of industrially usable culms and on the sugarcane yield, while under the use of basic slag, this fact was not observed. The application of basic slag and limestone in pre-planting caused a positive residual effect on the yield of sugarcane ratoon.

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824. Response of guava plants to basic slag application as corrective of soil acidity.

Prado, R. de M.; Correa, M. C. de M.; Cintra, A. C. O.; and Natale, W.

Revista Brasileira de Fruticultura 25(1): 160-163. (2003)
NAL Call #: SB354 .R48; ISSN: 0100-2945.

Notes: Original title: Resposta de mudas de goiabeira a aplicacao de escoria de siderurgia como corretivo de acidez do solo.

Descriptors: calcium/ fertilizers/ guavas/ magnesium/ plant nutrition/ slags

Abstract: Basic slag was evaluated for plant nutrition and production of guava plants in pots in Sao Paulo, Brazil. Basic slag was incubated in soil for 90 days before planting. Application of basic slag positively affected values of pH, sum of bases and base saturation and concentrations of calcium, magnesium, phosphorus, and aluminium in soil. Height, number of leaves and foliar area of plants significantly increased with slag application. Concentration of calcium, magnesium and phosphorus in aerial parts and roots also increased. It is concluded that basic slag is suitable for production of young guava plants for correction of acidity and a source of nutrients.

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825. Response of sugarcane to application of iron and steel slag as a corrective for acidity in soil .

Prado, R. M. and Fernandes, F. M.
Revista Brasileira de Ciencia do Solo 25(1): 199-207. (2001)

NAL Call #: S590 .R44; ISSN: 0100-0683.

Notes: Original title: Resposta da cana de acucar a aplicacao de escoria de siderurgia como corretivo de acidez do solo.

Descriptors: application to land/ base saturation/ calcium/ growth/ limestone/ liming/ magnesium/ plantations/ productivity/ responses/ slags/ soil / soil acidity/ soil chemical properties/ stems/ sugarcane/ chemical properties of soil/ land application

Abstract: High acidity predominates in southeastern and midwestern Brazilian soils, where the largest area of sugarcane plantations is concentrated. Large amounts of slag, a steel industry residue containing nutrients such as calcium and magnesium and acting as acidity corrective

agents, are also present in the region. This study aimed to evaluate different base saturation levels using slag as a soil corrective agent. This material was compared to calcitic limestone to analyse acidity neutralization and certain chemical soil properties, as well as sugarcane response during the first two cuts. Thus, an experiment was carried out using sugarcane variety SP 80-1842 during 1998-99 and 1999-2000. The treatments were arranged in a randomized block design, with four replications, consisting of two sources of corrective agents-calcitic limestone and slag - and four correction levels, estimated by the base saturation method (V%): control without correction and V% correction of 50, 75 and 100. It was concluded that the limestone and slag application had a similar effect on the correction of the soil acidity as well as on the increase of calcium and magnesium concentrations of the soil and base saturation. Limestone and slag applications had a quadratic and linear effect, respectively, on culm production and number of millable stalks.

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826. Results of three long term P-field experiments in Austria: 1st report: Effects of different types and quantities of P-fertiliser on yields and pcal/dl contents in soils.

Spiegel, H.; Lindenthal, T.; Mazorek, M.; Ploner, A.; Freyer, B.; and Köchl, A.

Bodenkultur 52(1): 3-17. (2001); ISSN: 00065471 [BODEA].

Notes: Original Title: Ergebnisse von drei 40 jährigen P-dauerversuchen in Österreich: 1. Mitteilung: Auswirkungen ausgewählter P-düngerformen und mengen auf den ertrag und die pcal/dl gehalte im boden. Language of Original Document: German.

Descriptors: cereals/ long-term field experiment/ P-fertiliser/ root crops/ soil-P

Abstract: The effects of different types (superphosphate, basic slag and rockphosphate) and quantities (0, 44 and 175 kg P ha⁻¹ a-1) of P-fertiliser application on crop yields and PCAL/DL-contents in soils were evaluated in three long-term field experiments lasting 40 years. After 20 to 40 years of application of 44 kg P ha⁻¹ a-1 as superphosphate and basic slag crop yields increased in comparison to zero P-fertilisation. These differences are statistically significant (Tukey test) for spring barley (at three sites), sugar beet and potato (at one site each). The omission of P-fertiliser during the whole 40 year period caused great economic losses in these root crops in a conventional cultivation regime. No statistically significant yield decreases were observed when discontinuing P-fertilisation after 20 years of application compared to continuous fertilisation. After 20 years of application of 44 kg P ha⁻¹ a-1 the soil PCAL/DL-contents were at a medium stage (less at one site with heavily textured soil) and decreased only slowly in 20 years of zero application. In the case of zero fertilisation during 40 years the soil PCAL/DL-Contents remained at almost the same level. The correlations between spring barley, winter wheat and sugar beet yields and PCAL/DL-contents in soils are significant and highly significant, the coefficients of determination show that other factors are also important for crop yields.

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827. Results of three long-term P-field experiments in Austria: 2nd report: Effects of different types and quantities of P-fertiliser on P-uptake and P-balances.

Lindenthal, Th.; Spiegel, H.; Mazorek, M.; Heß, J.; Freyer, B.; and Köchl, A.

Bodenkultur 54(1): 11-21. (2003); ISSN: 00065471 [BODEA].

Notes: Original title: Ergebnisse von drei 40jährigen P-dauerversuchen in Österreich: 2. Mitteilung: Auswirkungen unterschiedlicher P-düngerformen und mengen auf den P-entzug und die P-bilanzen. Language of Original Document: German.

Descriptors: crops/ long-term field experiment/ P-balances/ P-fertiliser/ P-uptake

Abstract: The effects of different types (super-phosphate, basic slag and rock-phosphate) and quantities (0, 44 and 175 kg P ha⁻¹ a-1) of P-fertiliser application on P-uptake by crops and P-balances were evaluated in three long-term field experiments lasting 40 years. The omission of P-fertiliser during the whole 40-year-period resulted in P-uptakes of 649-694 kg P ha⁻¹ and considerable negative balances. The fertilisation of 44 kg P ha⁻¹ a-1 as basic slag and super-phosphate showed higher P-uptake than zero P-fertilisation in 40 years, these differences were statistically significant at all three experimental sites for the last 20 years. When discontinuing P-fertilisation after 20 years of application the annual P-uptakes by crops remained at a high level and differed in the majority of cases not significantly compared to continuous fertilisation. But an annual fertilisation of 44 kg P ha⁻¹ a-1 had already caused an accumulation of 371-562 kg P ha⁻¹ in the soil during the first 20 years. After 40 years a balanced P supply in which crop P uptake nearly equalled the P fertiliser rate was assessed at the variants where the fertilisation of 44 kg P ha⁻¹ a-1 as basic slag and super-phosphate was terminated after 20 years. The different P-fertilisation during 20-40 years affected the P-uptake more strongly than the yields at all three sites. In the majority of cases also the correlations between PCAL/DL-contents in soils and P-uptake were closer compared to the crop yields.

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828. Silicate compost used as resistance inductor against the leafminer on chrysanthemum.

Polanczyk, R. A.; Pratisoli, D.; Paye, H. de S. ; Pereira, V. A.; Barros, F. L. S.; Oliveira, R G. S.; Passos, R. R.; and Martins Filho, S.

Horticultura Brasileira 26(2): 240-243. (2008)

NAL Call #: SB320.43 .B7H67; ISSN: 0102-0536.

Notes: Original title: Inducao de resistencia a mosca minadora em crisantemo usando composto silicatado.

Descriptors: composts / cultivars/ induced resistance/ insect control/ insect pests/ metallurgy/ pest control/ pest resistance/ plant pests/ silicates/ slags/ varietal resistance/ cultivated varieties/ Dendranthema morifolium

Abstract: The silicate compost (basic slag from metallurgy) was evaluated as a resistance inducer against leafminer (*Liriomyza* spp.) on 2 chrysanthemum (*Dendranthema grandiflorum* [Chrysanthemum morifolium]) cultivars (Puritan and Yellow Diamond) in a greenhouse in Espirito Santo, Brazil. Fives doses of basic slag were used, i.e. 0.00, 1.40, 2.80, 4.20 and 5.60 g/pot. Evaluations were performed weekly, for 9 weeks, observing the presence of

leafminer and the number of mines in each leaf. The basic slag from metallurgy showed potential against the leafminer. The 2 cultivars also showed differences in susceptibility to the leafminer attack. Reproduced with permission from the CAB Abstracts database.

829. Silicon sources for rice crop.

Pereira, H. S.; Korndorfer, G. H.; Vidal, A. de A.; and Camargo, M. S. de
Scientia Agricola 61(5): 522-528. (2004); ISSN: 0103-9016
Descriptors: chemical composition/ crop yield/ grain/ nutrient content/ nutrient uptake/ plant composition/ rice/ silicon/ silicon fertilizers/ slags/ soil chemical properties/ wollastonite/ chemical constituents of plants/ chemical properties of soil/ paddy
Abstract: The effect of Si sources on the agronomic efficiency and economic viability in rice crops was investigated in the greenhouse. The treatments (applied at 125 kg Si/ha) comprised: control; wollastonite; blast furnace slag 1, AF1; blast furnace slag 2, AF2; LD furnace steel slag 1, LD1; LD furnace steel slag 2, LD2; LD furnace steel slag 3, LD3; LD furnace steel slag 4, LD4; phosphorus soluble slag; stainless steel slag; electric furnace steel slag; AOD furnace steel slag; silicate clay; Schist; and Schist ash. Dry matter yield, in the aboveground parts, grain yield, and soil and plant part Si contents were evaluated 150 days after sowing. Wollastonite was also applied at 350, 375 and 500 kg Si/ha to obtain the Si absorption curves. Wollastonite showed a linear effect in yield, increasing Si content in the soil and plants with increasing application rates. The highest Si uptake was obtained with phosphate slag, followed by wollastonite and electric furnace slag. The highest grain Si accumulation was obtained with stainless steel, while the lowest was obtained with silicate clay. Reproduced with permission from the CAB Abstracts database.

830. Soil chemical attributes, root growth and rice yield according to slag application.

Carvalho Pupatto, J. G.; Bull, L. T.; and Crusciol, C. A. C.
Pesquisa Agropecuaria Brasileira 39(12): 1213-1218. (2004)
 NAL Call #: S15 .P452; ISSN: 0100-204X.
Notes: Original title: Atributos quimicos do solo, crescimento radicular e produtividade do arroz de acordo com a aplicacao de escorias.
Descriptors: chemical composition/ crop yield/ dry matter/ rice/ roots/ shoots/ silicon/ slags/ soil acidity / soil chemical properties/ sprinkler irrigation/ chemical properties of soil/ paddy/ spray irrigation
Abstract: A study was conducted to evaluate the effect of metallurgy slag on soil chemical properties and grain yield of upland rice under sprinkler irrigation. Treatments include two scums: blast furnace (196g/kg of Si) and steel slag (56 g/kg of Si), and a control without application. The scums can be used to correct soil acidity and silicon source. Alterations on the soil chemical properties were related to the chemical composition of the scums. Treatment with blast furnace slag produced maximum root growth in depth and better distribution in the profile, which resulted to higher shoot dry matter and grain yield. Reproduced with permission from the CAB Abstracts database.

831. Some possibilities for sustainable organic production from clover rich pastures in the hills and uplands.

Anderson, G. D.
 In: Organic farming: Science and practice for profitable livestock and cropping. (Newport, Shropshire, UK.); pp. 96-100; 2004.
Notes: Proceedings of the BGS/AAB/COR Conference.
Descriptors: dry matter accumulation/ grass sward/ moorlands/ nitrogen fertilizers/ organic farming/ pastures/ reviews/ rock phosphate/ slags/ sustainability/ triple superphosphate/ Britain/ eco agriculture/ ecological agriculture/ grazing lands/ moorland/ moors/ organic culture/ phosphate rock/ United Kingdom
Abstract: The paper reviews results of experiments in the 1970s in which white clover was oversown at 4 kg/ha on to moorland swards in Yorkshire, without cultivation or herbicide. Within 3-4 years, mean yields of *Molinia* and *Nardus* swards almost doubled, to 4 t DM/ha/annum, and on Calluna heath increased five-fold to 1.45 t/ha, associated with 51% and 35% clover cover, respectively. This was achieved by one application of 12 t lime/ha with 90 kg P₂O₅/ha as triple superphosphate or basic slag, but after 4 years rock phosphate was catching these up. N fertilizer reduced clover, while clover without N in *Molinia* and *Nardus* swards gave DM yield increases exceeding 1.5 t/ha/annum. These findings were subsequently put into practice on a Scottish farm where application of 7.5 t/ha magnesium lime, followed after grazing by 2.5 kg/ha each of clover, timothy and ryegrass with 90 kg P₂O₅/ha, enabled doubling of the livestock on *Molinia* and *Nardus* swards within 4 years. A further 6.0-7.5 t lime/ha increased clover spread and sward palatability. In rejuvenated in-bye and hill swards, S184 clover has persisted for over 20 years. Reproduced with permission from the CAB Abstracts database.

832. Steel industry furnace residue as a source of micronutrients and contaminants to maize plants.

Aguar Accioly, A. M. de; Furtini Neto, A. E.; Muniz, J. A.; Faquin, V.; and Aquino Guedes, G. A. de
Pesquisa Agropecuaria Brasileira 35(7): 1483-1491. (2000)
 NAL Call #: S15 .P452 ; ISSN: 0100-204X.
Notes: Original title: Po de forno eletrico de siderurgia como fonte de micronutrientes e de contaminantes para plantas de milho.
Descriptors: acidity/ application rates/ biomass/ biomass production/ cadmium/ Cambisols/ contaminants/ contamination/ dry matter/ iron/ lead/ liming/ maize/ plant composition/ shoots/ slags/ soil acidity / soil pollution/ trace elements/ treatment/ zinc/ chemical constituents of plants/ corn/ microelements
Abstract: Steel making residue (slag) was tested as a source of micronutrients and contaminants to maize under greenhouse conditions in Minas Gerais, Brazil. Soil material of an Inceptisol (Alic Cambisol) was used as substrate, which received 0, 2 and 4 ton ha⁻¹ of liming material and the following treatments: blank, micronutrient as p.a. reagent, and 250, 500, and 1000 kg slag ha⁻¹. Liming dose was the main factor accounting for the differences in dry matter production. The residue increased biomass production in relation to check, but results from p.a. reagents were lower; there were no significant differences due to doses of this product. The residue supplied mainly

Zn and Fe to maize. The solubility of this byproduct increased with the soil acidity. Cadmium and Pb were detected in the shoot dry mass of maize. The potential risk of soil and food contamination must be taken into account when using the slag as a source of micronutrients. Reproduced with permission from the CAB Abstracts database.

833. Steel industry slags compared with calcium carbonate in neutralizing acid mine soil.

Munn, David A.

Ohio Journal of Science 105(4): 79-87. (2005); ISSN: 0030-0950

Descriptors: steel/ slags/ calcium carbonate/ acid mine soil/ liming

Abstract: Ohio has substantial lands impacted by surface mining for coal and an active steel industry. Steel industry slags have been used as liming compounds for agriculture and acid mine soil reclamation. This 3-year study evaluates slags from Ohio steel mills in greenhouse trials where these materials are compared to reagent grade CaCO_3 in their ability to improve plant growth on acid mine soil. The objectives of this study were to evaluate the effectiveness of these materials at two rates of application in raising acid mine sod pH and to address concerns about metals in such slags. Three slags and reagent grade CaCO_3 were applied at rates equivalent to 12.5 and 25 g $\text{CaCO}_3 \text{ kg}^{-1}$ soil on acid mine soil (pH = 3.5). Five consecutive crops of oats (*Avena sativa* L.), wheat (*Triticum aestivum* L.), corn (*Zea mays* L.), wheat and soybean (*Glycine max* (L.) Merr.) were grown and harvested at the seedling stage. The slags and CaCO_3 increased yields ($P < 0.01$ level) compared to unlimed control pots. Soil and plant Ca were increased and plant Al and Mn decreased by application of all four materials. The slags increased soil and plant Mg. Particle size of the slags was somewhat coarse which decreased their effectiveness, but overall these slags proved to be satisfactory liming materials. The fineness efficiency developed for carbonate forms of time may not adequately characterize slag effectiveness. Micronutrient metals including iron were not found to be in excess in plant tissue treated with slags despite the steel slags' high Fe content.

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834. Steel slag as an iron fertilizer for corn growth and soil improvement in a pot experiment.

Wang Xian and Cai QingSheng

Pedosphere 16(4): 519-524. (2006)

NAL Call #: S590 .P43 ; ISSN: 1002-0160

Descriptors: application rates/ biomass production/ calcareous soils/ crop yield/ dry matter accumulation / growth/ industrial wastes/ iron/ iron fertilizers/ maize/ nutrient uptake/ pot experimentation/ slags/ soil types/ waste utilization/ corn

Abstract: The feasibility of steel slag used as an iron fertilizer was studied in a pot experiment with maize. Slag alone or acidified slag was added to two Fe-deficient calcareous soils at different rates. Results showed that moderate rates (10 and 20 g kg^{-1}) of slag or acidified slag substantially increased maize dry matter yield and Fe uptake. Application of steel slag increased the residual concentration of ammonium bicarbonate-diethylenetriamine pentaacetic acid (AB-DTPA) extractable Fe in the soils. The increase of extractable Fe was usually proportional to the application rate, and enhanced by the acidification of slag.

Steel slag appeared to be a promising and inexpensive source of Fe to alleviate crop Fe chlorosis in Fe-deficient calcareous soils.

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835. Suppression of methane emission from paddy soil by application of iron materials.

Furukawa, Y; Tsuji, T; and Inubushi, K

Japanese Journal of Soil Science and Plant Nutrition 72(2): 257-264. (2001); ISSN: 0029-0610

Descriptors: basic slag/ emission/ iron/ methane/ paddy soils/ rice/ slags/ soil amendments/ soil types/ suppression/ fluxes/ paddy

Abstract: A study was conducted to investigate the suppression of methane emission from paddy soil by application of iron materials such as revolving furnace slag (RFS), an industrial by-product, and spent disposable portable body warmer (PBW). Rates of RFS added to the pots planted with rice were 0 (control), 10, 20, 40, and 100 tonnes ha^{-1} , and PBW at 10 tonnes ha^{-1} only. Results showed that pots which received RFS exhibited lower Eh values compared with the control plot, although the RFS was applied to keep soil oxidative in the early period of cultivation. A significant decrease in Eh under a high rate of RFS application may be due to high pH of the RFS (pH (H_2O)=12.2). On the other hand, methane flux was suppressed under a high rate of of RFS application, during the early period of cultivation. However, this flux trend was reversed during the mid-growing period. This may be due to disturbances in the soil environment caused by dissolving element from RFS. Total methane flux during the cultivation period was significantly decreased, approximately 10%, when 10-40 and 10 tonnes ha^{-1} of RFS and PBW, respectively, were applied. Methanogenic activity did not change significantly when 0-40 tonnes ha^{-1} of RFS were applied, while that of RFS pots at 100 tonnes ha^{-1} and of PBW pots with 10 tonnes ha^{-1} were decreased. Methane oxidizing activity was increased, maximum of 15%, when 10-40 tonnes ha^{-1} of RFS were applied, while that of RFS pots at 100 tonnes ha^{-1} and of PBW pots at 10 tonnes ha^{-1} were decreased. The decrease in total methane flux may be attributed to enhanced methane oxidizing activity rather than inhibition of methanogenic activity. The grain yield was significantly increased, approximately 30%, when 40 or 100 tonnes ha^{-1} of RFS was applied. It was also partly due to the dissolving inorganic substances from RFS. From this study, it is clear that the use of RFS and PBW in paddy field are desirable because they increase grain yield and decrease methane emission.

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836. Time-dependent phosphorus extractability from soils treated with different fertilizer phosphorus sources.

Indiati, R. and Neri, U.

Communications in Soil Science and Plant Analysis 35(11-12): 1741-1755. (2004)

NAL Call #: S590.C63; ISSN: 0010-3624

Descriptors: Time-dependence/ phosphorus extractability/ treated soils/ fertilizer/ phosphorus sources/ basic slag

Abstract: Effect of application of different fertilizer phosphorus (P) sources (diammonium phosphate-DAP, single super phosphate-SSP, phosphate rock-PR, partially

acidulated phosphate rock-PAPR, basic slag phosphate-BSP, and humo phosphate-HP), and time (up to three years of soil-fertilizer P equilibration) on soil extractable P was studied on two representative Italian soils, principally differing in pH values and the capacity to retain P. Phosphorus extractability was measured by seven chemical and two nonconventional soil P test methods based on the use of anion exchange resin membranes and iron oxide coated paper strips. The increases in the amount of extracted P following soil P fertilization were practically in the same order for both Ravenna and Paliano soils: DAP > SSP > HP > BSP > PAPR > PR; that order reflecting the corresponding scale of P water solubility. More P tended, however, to be dissolved from PR treatment in more acidic soil. On an average, the effectiveness of the different soil P test procedures in extracting P from two soils was in the order: Egner-P > Bray2-P > Olsen-P > Mehlich3-P > resin-P > iron oxide-strip-P > Bray1-P > water-P > CaCl₂-P. The Egner soil P test method appeared to overestimate P bioavailability of all P treatments in the calcareous soil, while both the Egner and Bray2 soil tests overestimated the amount of extractable P of the PR treatment in the other soil. Data of P extracted by the Olsen and Mehlich3 procedures resulted the most closely correlated with the corresponding data obtained with the nonconventional soil P test procedures, currently considered with potential for use in widely ranging soils fertilized with water soluble as well as water insoluble P fertilizers. This citation is from AGRICOLA.

837. Why phosphorus is important.

Monographic Series NSW Agriculture 10/92 : 3 pp. (2002)

Descriptors: animal manures/ diammonium phosphate/ double superphosphate/ growth/ monoammonium phosphate / nutrient uptake/ phosphorus/ phosphorus fertilizers/ plant nutrition/ rock phosphate/ slags/ superphosphate/ ammonium dihydrogen phosphate/ phosphate fertilizers/ phosphate rock

Abstract: This paper discusses the importance of phosphorus in plant growth and nutrition. Phosphorus fertilizers are available in several forms based on rock phosphate, including superphosphate, double superphosphate, monoammonium phosphate and diammonium phosphate. Manure and steel slag are also used as a source of phosphorus. Some possible reasons why plants seem to get little benefit from phosphorus are discussed, as well as the methods on how to improve phosphorus uptake by plants.

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Used Tires

838. Assessment of macro and micro-nutrient accumulation in bermudagrass grown in crumb rubber amended media.

Owings, Allen D. and Bush, Edward W.

HortScience 36(3): 541. (2001)

NAL Call #: SB1.H6; ISSN: 0018-5345

Descriptors: macronutrients/ micronutrients/ bermudagrass/ crumb rubber

Abstract: A study was initiated by the Louisiana State Univ AgCenter to determine the influence of media incorporations of crumb rubber on accumulation of macro and micro-nutrients in leaf tissue of common bermudagrass (*Cynodon dactylon* L.). Vegetative growth influences were also measured. Common bermudagrass was established by seeding in 7.6 L containers filled with either 80% sand : 20% peat moss, 67.5% sand : 20% peat moss : 12.5% crumb rubber, 55% sand : 20% peat moss : 25% crumb rubber, or 42.5% sand : 20% peat moss : 37.5% crumb rubber. Increasing rates of crumb rubber in media significantly increased leaf tissue levels of N, K, Mn, and Zn. Levels of Zn and Mn exceeded optimum levels recommended for bermudagrass. There was no statistical difference in leaf tissue concentrations of P, Ca, Mg, Na, B, Cu, and Fe. Vegetative growth was decreased with increasing rates of crumb rubber in the media. Crumb rubber rates >12.5% (by volume) sharply reduced vegetative growth.

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839. Drained and cushioned feed lot for livestock.

Pederson, Les

Official Gazette of the United States Patent and Trademark Office Patents 1227(3)(1999); ISSN: 0098-1133

Descriptors: feed lot / livestock/ waste tires

Abstract: A base for a feed lot composed of baled rubber material such as waste tires. The bales are placed beneath the surface of the feed lot and covered with earth. Any gaps between bales are filled with sand to provide for good drainage of the lot.

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840. The ease of ignition of 13 landscape mulches.

Steward, L. G.; Sydnor, T. D.; and Bishop, B.

Journal of Arboriculture 29(6): 317-321. (2003); ISSN: 0278-5226

Descriptors: bark/ combustion/ fires/ ignition/ landscape/ mulches/ pine bark/ rubber/ straw/ mulching materials

Abstract: The ease of ignition of 13 commonly used landscape mulches was evaluated. Mulches have different ignition potentials based on several factors, including the length of exposure to heat and to the ignition source. Some materials ignited more frequently when exposed to a lit propane torch for 15 seconds. The most to least commonly ignited materials were ground rubber, pine straw, oat straw, shredded hardwood bark, shredded cypress bark, recycled pallets, 2.5 to 5 cm pine bark nuggets, 1.3 to 2.5 cm pine bark nuggets, shredded pine bark, cocoa shells, composted yard waste, bluegrass sod, and brick chips. Not all organic mulches readily ignited, nor were inorganic mulches uniformly ignition resistant. The results of this research show that there are definite differences in the ease of ignition between commonly used mulches. The results

demonstrate that landscapers do not have to resort to using inorganic materials such as brick chips and gravel for ignition-resistant mulches. Under high-temperature ignition, one inorganic material, ground rubber was ignited consistently and was difficult to extinguish. Conversely, there are organic materials that are unlikely to ignite. These also are maintenance practices that will prevent or reduce ignition of these mulches.

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841. Effect of free stall surface on daily activity patterns in dairy cows with relevance to lameness prevalence.

Cook, N. B.; Bennett, T. B.; and Nordlund, K. V.

Journal of Dairy Science 87(9): 2912-2922. (Sept. 2004)

NAL Call #: 44.8 J822 ; ISSN: 0022-0302

Descriptors: dairy cows/ litter (bedding)/ posture/ lameness

Abstract: Differences in behavior of nonlame cows, slightly lame cows, and moderately lame cows in 6 free stall barns with sand bedding (SAND) vs. 6 free stall barns with rubber-crumb geotextile mattress surfaces (MAT) were documented in Wisconsin dairy herds. All lactating cows in the 12 herds were observed and given a locomotion score based on a 4-point scale: 1 = nonlame, 2 = slightly lame, 3 = moderately lame, and 4 = severely lame. Herd least square means +/- SE for prevalence of clinical lameness (locomotion scores = 3 and 4) were 11.1 vs. 24.0 +/- 1.7% for herds using SAND vs. MAT surfaces, respectively. Subsets of 10 cows per herd with locomotion scores of 1 to 3 were observed via video cameras for 24-h periods. Cows in MAT herds spent more time standing in free stalls per day than cows in SAND herds. Differences in standing times were 0.73 h/d for cows that were not lame, 2.32 h/d for cows that were slightly lame, and 4.31 h/d for cows that were moderately lame in MAT herds compared with equivalent cows in SAND herds. In MAT herds, the increase in time spent standing in the stall in moderately lame cows was associated with a significant reduction in stall use sessions per day, which impacted daily lying time. Although cause and effect are not clear, these findings have implications for housing, comfort, and care of cows in dairy herds with different types of free stall surfaces. This citation is from AGRICOLA.

842. The effects of crumb rubber topdressing on hybrid kentucky bluegrass and bermudagrass athletic fields in the transition zone.

Goddard, M. J. R.; Sorochoan, J. C.; McElroy, J. S.; Karcher, D. E.; and Landreth, J. W.

Crop Science 48(5): 2003-2009. (2008); ISSN: 0011183X [CRPSA].

Notes: doi: 10.2135/cropsci2007.07.0405.

Descriptors: *Cynodon* (angiosperm)/ *Cynodon dactylon*/ *Cynodon transvaalensis*/ *Poa*/ *Poa arachnifera*/ *Poa pratensis*/ Poaceae

Abstract: New turfgrass varieties and management practices have introduced new options for transition zone athletic field managers. Our objectives were to determine the wear tolerance of four turfgrasses in the transition zone with and without crumb rubber under simulated athletic field conditions, and to determine if improved cool and warm-season turfgrass species can be used for transition zone

athletic fields. Field trials evaluated the use of four turfgrass species with and without crumb rubber topdressing in Knoxville, TN, and Fayetteville, AR. Experimental design was a randomized complete block with a split-strip plot treatment arrangement. Plots containing 'Thermal Blue' hybrid Kentucky bluegrass (*Poa pratensis* L. x *P. arachnifera* Torr.) or 'Riviera' [*Cynodon dactylon* (L.) Pers.], 'Quickstand' (*C. dactylon*), or 'Tifway' (*C. dactylon* x *C. transvaalensis* Burtt-Davy) bermudagrass were evaluated. Crumb rubber treatments were topdressed to achieve a 2-cm depth. Traffic was applied to each plot using a Cady Traffic Simulator to simulate athletic field wear. Traffic applications coincided with actual fall athletic seasons ranging from October to December 2005. Hybrid Kentucky bluegrass proved to be acceptable for use in transition zone athletic fields, Riviera and Tifway showed comparable wear tolerance, and Quickstand showed the lowest wear tolerance of the varieties tested. Crumb rubber topdressing resulted in a significant increase in turfgrass wear tolerance, and a decrease in surface hardness, soil bulk density, and shear resistance. © Crop Science Society of America.

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843. An evaluation of crumb rubber and calcined clay for topdressing sports fields.

Miller, G. L.

Acta Horticulturae(783): 381-390. (2008)

NAL Call #: 80 Ac82; ISSN: 0567-7572

Descriptors: hardness / lawns and turf/ rooting capacity/ soil amendments/ soil compaction/ soil conservation/ soil strength/ soil texture/ soil types/ soil water content/ sports turf soils/ top dressings/ traction/ Bermuda grass/ lawns and sports turf/ soil quality

Abstract: Topdressing sports fields is used for to control thatch or to modify the soil surface. The use of coarse-textured materials for topdressing, other than traditional sand, has been suggested as a means of reducing compaction and minimizing wear. The objective of this study was to evaluate the effect of topdressing with coarse crumb rubber or calcined clay on a bermudagrass (*Cynodon dactylon*) turf subjected to intense traffic. Turf plots were topdressed with crumb rubber or calcined clay at 6, 11, or 17 mm depth each year for two years (25, 50, and 75 tonnes ha⁻¹ yr⁻¹) or with sand applied at 6 mm depth each year. The plots were subjected to cart wear and cleat damage during the study. Parameters evaluated included surface temperature, soil moisture, turf quality, traction, wear tolerance, recuperative ability, surface hardness, and rooting vigor. In this study, crumb rubber topdressing increased early season turf quality due to convection heating; whereas, calcined clay topdressing resulted in higher soil moisture but did not improve turf quality. High rates of crumb rubber or calcined clay reduced cleat traction 16 to 31% in 2000 and 23 to 29% in 2001, but resulted in reduced stand density when subjected to cart wear. Surface hardness was reduced in 2001 by crumb rubber topdressing 24% compared to apparent slight increases from sand (+1%) or calcined clay (+2%). Plots topdressed with sand showed the best turf surface toward the end of the season each year. This demonstrated that sand topdressing is generally a good cultural practice to maintain or improve turf quality. In these evaluations, the

crumb rubber and calcined clay provided some benefit, but not without some penalty to other parameters. Reproduced with permission from the CAB Abstracts database.

844. An evaluation of mattresses and mats in two dairy units.

Chaplin, S J; Tierney, G; Stockwell, C; Logue, D N; and Kelly, M

Applied Animal Behaviour Science 66(4): 163-272. (2000); ISSN: 0168-1591

Descriptors: animal behaviour/ animal welfare/ behaviour/ body condition/ body weight/ cattle housing/ cows/ dairy cattle/ dairy cows/ feed intake/ feeding behaviour/ floors/ hygiene/ lameness/ litter/ locomotion/ mats/ milk composition/ milk quality/ milk yield/ somatic cell count/ trauma/ animal behavior/ animal rights/ behavior/ Britain/ cattle sheds/ feeding behavior/ flooring/ mattresses/ milk constituents/ traumas/ United Kingdom

Abstract: In order to investigate the relative merits of mats and mattresses in terms of cow comfort, production and performance, 29 cows were housed on ethylethene vinyl acetate mats and 29 on mattresses of loose rubber crumb with a polypropylene cover, at each of 2 similar dairy units of the Scottish Agricultural College. Both mats and mattresses were newly installed at the start of the trial. The cows were housed in the autumn after calving. Milk yield was recorded daily. Cows were weighed and scored for body condition, locomotion, dirtiness and hock and knee injury at fortnightly intervals. Feed offered was recorded daily and refusals were weighed weekly. Monthly milk records of milk yield, milk composition and somatic cell count data were available for both herds. In addition, 24 h behavioural observations of 15 core cows in each group were made at weeks 0, 2, 4, 6, 8, 16, and 32 post-housing. There was no difference between cows on mats and mattresses in milk yield, composition or quality; in feed intake; in weight loss or body condition score; in severe hock or knee injury, or in the incidence of lameness. Cows on mattresses tended to have slightly higher total dirtiness scores than those on mats (7.06 vs. 6.95, $P=0.074$) and had dirtier udders (mattress, 7.50 vs. mat, 6.52, $P<0.05$). However, over the whole housing period, cows on mattresses spent longer feeding, ruminating and lying and a greater proportion of their lying time was spent ruminating. They spent less time standing doing nothing (idling) than cows on mats and less time idling in cubicles. Cows on mattresses appeared to adapt to housing more quickly than those on mats. Overall, neither mat nor mattress gave advantages in terms of production or performance, cows were slightly cleaner on mats but behavioural indices suggest that cow comfort was greater on mattresses.

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845. Foliar accumulation of zinc in tree species grown in hardwood bark media amended with crumb rubber.

Bush, E.; Owings, A.; and Leader, K.

Journal of Plant Nutrition 26(7): 1413-1425. (2003)

NAL Call #: QK867.J67 ; ISSN: 0190-4167

Descriptors: bark/ container grown plants/ foliar diagnosis/ forest nurseries/ growing media/ leaves/ ornamental plants/ pecans/ planting stock/ tyres/ waste utilization/ zinc/ foliage

diagnosis/ hickory nuts/ nursery plants/ nursery stock/ ornamentals/ planting materials/ potting composts/ rooting media/ tires/ tissue analysis/ United States of America

Abstract: Artificial nursery medium sources of uniformity and quality are becoming more difficult to locate. Alternative components such as recycled crumb rubber (CR) may have potential to be incorporated into bark or other growing media. Recycled CR is a waste product from automobile tyres. Mixtures of CR and hardwood bark were evaluated in production of container-grown trees in Louisiana, USA. Leaf tissue analysis revealed that linear or nonlinear increases in zinc (Zn) levels exceeded normal levels. Stem caliper, height, and quality of river birch (*Betula nigra* L.), pecan [*Carya illinoensis* (Wangenh.) C. Koch], and lacebark elm (*Ulmus parvifolia* Jacq.) decreased with increasing percentages of CR.

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846. Foliar accumulation of zinc in tree species grown in pine bark media amended with crumb rubber.

Bush, E; Leader, K; and Owings, A

Journal of Plant Nutrition 24(3): 503-510. (2001)

NAL Call #: QK867.J67 ; ISSN: 0190-4167 [JPNUDS]

Descriptors: *Betula nigra*/ *Ulmus parvifolia*/ *Carya illinoensis*/ nutrient content/ zinc/ soilless culture/ symptoms/ chlorosis/ application rate/ pine bark/ species differences

Abstract: Incorporated crumb rubber (CR) increased Zn tissue levels up to nine times the normal range in tree species. There was a linear increase in Zn tissue accumulation with increasing percentages of crumb rubber for river birch (*Betula nigra* L.), lacebark elm (*Ulmus parvifolia* Jacq.), and pecan [*Carya illinoensis* (Wangenh.) C. Koch]. Pecan leaves containing high levels of Zn exhibited no visual symptoms, unlike the remaining tree species exhibiting leaf chlorosis. Results suggest that crumb rubber incorporated at rates greater than 25% may cause abnormally high concentrations of Zn to accumulate in plant tissue.

This citation is from AGRICOLA.

847. Hock injuries in cattle kept in straw yards or cubicles with rubber mats or mattresses.

Livesey, C. T.; Marsh, C.; Metcalf, J. A.; and Laven, R. A.

Veterinary Record: Journal of the British Veterinary Association 150(22): 677-679. (2002); ISSN: 0042-4900

Descriptors: heifers/ dairy cows/ animal injuries/ tires/ yards/ lesions/ mats/ cow housing/ hocks/ chopped tires/ straw yards

Abstract: Hock damage is one of the most common traumatic injuries suffered by dairy cows, but most hock injuries can be avoided. This study investigated the effect of housing system on the development of hock damage in first lactation Holstein heifers. After calving, 60 heifers were randomly allocated to either straw yards, cubicles with butyl rubber mats, or cubicles with mattresses filled with chopped tyres. The hocks of these heifers were examined at the first week after calving (week 1) and at weeks 6, 12, and 26 of lactation. Hock damage was scored as either 1 (hair loss only) or 2 (all other damage). Heifers housed in cubicles with mats had significantly worse lesions at week 26 than at week 1, whereas no change was observed in heifers housed in cubicles with mattresses, and heifers housed on straw had significantly lower lesion scores. Heifers with no

lesions at calving were significantly more likely to develop lesions when kept on mats than heifers kept on straw or mattresses. These data suggest that replacing mats with mattresses in cubicles can result in a significant reduction in traumatic hock injury.

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848. Immobilization of mercury(II) in contaminated soil with used tire rubber.

Meng, Xiaoguang; Hua, Zeai; Dermatas, Dimitris; and Wang, Wei Kuo Hsiu Yu

Journal of Hazardous Materials 57(1-3): 231-241. (1998)

NAL Call #: T55.3.H3J6; ISSN: 0304-3894

Descriptors: mercury/ contaminated soil/ used tire rubber

Abstract: The effectiveness of used tire rubber for immobilizing Hg(II) in a contaminated soil was evaluated using batch extraction and field rainwater leaching tests. The contaminated soil was prepared using a clay-loam spiked with mercury oxide or mercury chloride to yield a Hg(II) content of 300 mg/kg. When the contaminated soil was treated with 4% of tire rubber, Hg(II) concentration in an acetic acid leachate was reduced from 3500 ppb down to 34 ppb. Hg(II) concentration in the initial rainwater leachate was reduced from 84 ppb for untreated soil to 1.2 ppb for the rubber-treated soil. After 8 months of rainwater infiltration in the field, Hg(II) concentration decreased to less than 0.2 ppb for the treated soil. The rubber-treatment inhibited the evolution of metallic Hg⁰ from the spiked soil samples possibly by retarding the reduction of Hg(II) to Hg⁰. Batch extraction and adsorption results indicated that the rubber had high adsorption capacity for Hg(II) when pH values were between 2 and 8.

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849. Measures for the protection of forest resources of small farmers: Reclamation and conservation of degraded soils.

Mario Pinto, Q.; Rodrigo Azolas, P.; and Enrique Williams, R.

Documento Tecnico Chile Forestal 160: 1-12. (2004).

Notes: Original title: 160 edicion n degrees 310 documento tecnico medidas para la proteccion de los recursos forestales de pequenos productores/as recuperacion y conservacion de suelos degradados.

Descriptors: afforestation/ choice of species/ crop residues/ cropping systems/ dams/ degraded land/ ditches/ drainage channels/ dykes/ eroded soils / erosion/ erosion control/ fences/ forest soils/ freshwater structures/ ground cover/ infiltration/ mulching/ reclamation/ revegetation/ ridging/ runoff/ scarification/ small farms/ soil conservation/ soil degradation/ subsoiling/ techniques/ terracing/ walls/ dikes/ eroded sites/ reafforestation/ reforestation

Abstract: The widespread occurrence of eroded soils in Chile, where 46.8% of the land (34,490,800 ha) is affected, is discussed and the causes and types of erosion involved outlined. The methods that can be used to recuperate and restore these soils are briefly described under two main categories: vegetative ground cover achieved by using cover crops and harvesting residues, and the use of suitable crops and cropping systems (including tree planting and forestry). Three schemes that offer economic incentives for protecting the soil are discussed: the INDAP (Instituto de Desarrollo Agropecuario), SAG (Servicio Agrícola y Ganadero) and CONAF (Corporacion Nacional

Forestry) programmes for recuperation of degraded soils. The last part of the report discusses specific techniques that can be used to recuperate and improve degraded soils, including the construction of infiltration ditches, diversion canals to collect surface runoff and large volumes of water flow, dykes constructed using posts, gabion check dams, fences, low stone walls, fascines, containment fences made of used tyres, terracing (microterraces) with or without scarification, subsoiling with ridging and complementary biological techniques (planting herbaceous and shrubby species).
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850. Methods for assessing the cushioning performance of free-stall dairy cow synthetic beds.

Tierney, G. and Thomson, R.

Transactions of the ASAE 46(1): 147-153. (2003)

NAL Call #: 290.9 Am32T; ISSN: 0001-2351

Descriptors: compression/ cows/ dairy cows/ dairy farming/ deformation/ equipment performance/ litter/ mats/ methodology/ performance tests/ stability/ static tests/ stresses/ methods

Abstract: Cushioning in dairy cow synthetic bed materials is quantifiable in terms of compression force attenuation and stability, but animal observation trials aimed at finding the best materials are expensive and time-consuming. Finite element analysis (FEA) is a computational technique used for engineering stress and deformation analysis. Accelerometric testing is used in sports engineering to test the cushioning offered by athletics tracks and synthetic sports surfaces. In the current work, these two methods were used to study the cushioning performance of two of the most commonly used types of free-stall or cubicle synthetic bed, rubber-crumb mattresses and ethylene vinyl acetate (EVA) mats, both of which are classified in engineering terms as hyperfoams. That is, materials that can undergo large deformations under load and yet return to their original shape on unloading. FEA was used, in conjunction with quasi-static compression force tests, to assess free-stall bed cushioning during the getting-up movement of a cow (a quasi-static "push") and to predict, in a quick and cost-effective way, variation in performance in time or as a result of an altered bed specification. The force-deflection responses of the materials of the two bed types were closely matched in the ABAQUS FE code, giving confidence in the ability of the model to predict the effect of changes in, for example, bed thickness and density. Accelerometric testing was used for the assessment of two further performance criteria vital to a bed purchase decision: first, the impact absorption performance during the lying down movement of a cow (a dynamic "drop"), and second, variation in cushioning performance over time as a result of the bed being used by a herd for three years. The quasi-static testing and FEA showed that a new rubber-crumb bed was more compliant than a new EVA bed and would therefore be more likely to prevent knee pain during the getting-up movement. The peak acceleration results showed that the new-condition rubber-crumb bed cushioned a cow knee impact force from a lying down movement best. However, the test of the three-year-old rubber crumb bed showed it to be less compliant compared to the new condition ($p < 0.001$). The EVA bed peak acceleration results also showed cushioning performance to be poorer after three years of use

($p = 0.007$), although the data showed a less stark change compared to that for the rubber-crumb beds. The observed use-related reduction in cushioning performance of the rubber-crumb bed was simulated in ABAQUS by reducing the model thickness by 50% and looking at the force-deflection response.

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851. Modification of clayey soils using scrap tire rubber and synthetic fibers.

Akbulut, S.; Arasan, S.; and Kalkan, E.

Applied Clay Science 38(1/2): 23-32. (2007)

NAL Call #: TA455.C55; ISSN: 0169-1317

Descriptors: compression/ fibres/ modification/ polyethylene/ properties/ reinforcement/ research/ shear/ soil / wastes/ fibers/ polythene/ studies

Abstract: A number of studies have been conducted recently to investigate the influence of randomly oriented fibres on the geotechnical behaviour of grained soils. However, very few studies have been carried out on fiber-reinforced clayey soils. Therefore, this experimental work has been performed to investigate the influence of randomly oriented fibre inclusion on the geotechnical behaviour of clayey soils. This research evaluates the use of waste fibre materials such as scrap tire rubber, polyethylene, and polypropylene fibre for the modification of clayey soils. This investigation focuses on the strength and dynamic behaviour of the reinforced soils with randomly included waste fibre materials. The unreinforced and reinforced samples were subjected to unconfined compression, shear box, and resonant frequency tests to determine their strength and dynamic properties. These waste fibres improve the strength properties and dynamic behaviour of clayey soils. The scrap tire rubber, polyethylene, and polypropylene fibres can be successfully used as reinforcement materials for the modification of clayey soils.

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852. Monitoring indices of cow comfort in free stall housed dairy herds.

Cook, N. B.; Bennett, T. B.; and Nordlund, K. V.

Journal of Dairy Science 88(11): 3876-3885. (2005)

NAL Call #: 44.8 J822; ISSN: 00220302

Descriptors: comfort index/ lameness/ stall use/ animal/ animal behavior/ animal housing/ animal lameness/ animal welfare/ body posture/ cattle/ dairying/ female/ lactation/ methodology/ physiology/ regression analysis/ statistical model/ time/ animal welfare/ animals/ behavior, animal/ cattle/ cattle diseases/ dairying/ female/ housing, animal/ lactation/ lameness, animal/ least-squares analysis/ linear models/ posture/ time factors

Abstract: Indices of cow comfort are used widely by consultants in the dairy industry, with a general understanding that they are representative of lying behavior. This study examines the influence of stall base type (sand or a geotextile mattress filled with rubber crumbs) and time of measurement on 4 indices of comfort collected at hourly intervals in 12 herds, aligned by morning and afternoon milking. Stall base type significantly influenced all indices of comfort. For example, the least squares mean (SE) cow comfort index (proportion of cows touching a stall that are lying down) was 0.76 (0.015) in

herds with mattresses compared with 0.86 (0.015) in herds with sand stalls. Significant hourly variation was also identified suggesting that timing of measurement is important. None of the indices of cow comfort derived from the high-yielding group pen was associated with the mean 24-h lying time of 10 sentinel cows whose time budgets were known in each herd. However, the cow comfort index was associated with the herd mean 24-h stall standing time, with the strongest relationships occurring 2 h before the morning and afternoon milking, when stall base type did not significantly influence the association. When measured at these times, we recommend use of the stall standing index (proportion of cows touching a stall that are standing), with values greater than 0.20 being associated with abnormally long herd mean stall standing times greater than 2 h/d. © American Dairy Science Association, 2005.

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853. Physical characteristics of sports turf rootzones amended and top dressed with rubber crumb.

Baker, S. W.; Hannaford, J.; and Fox, H.

Journal of Turfgrass Science 77: 59-70. (2001); ISSN: 1367-8361

Descriptors: application rates/ bulk density/ capillary capacity/ golf courses/ golf green soils/ hydraulic conductivity/ lawns and turf/ porosity/ rhizosphere/ sandy soils/ shear strength/ soil amendments/ soil density/ soil physical properties/ soil strength/ soil types/ top dressings/ waste utilization/ wastes/ lawns and sports turf/ physical properties of soil

Abstract: The physical properties of sand-soil root zones were examined after the incorporation of rubber crumb. Four size grades of rubber crumb were either mixed into the root zone at rates varying from 0-50% by volume or applied on the surface, with depths ranging from 0-20 mm. The hydraulic conductivity of mixes containing rubber crumb tended to increase, especially when incorporation rates exceeded 30% (v/v). Hydraulic conductivity was greatest when medium grades (0.25-1.5 mm) of rubber crumb were used. With coarser grades of rubber crumb, it was thought that significant interpacking took place between the rubber crumb and the root zone mix. Bulk density decreased as the incorporation rate of rubber crumb increased and bulk density values were greater for the coarser grades of rubber crumb (1-3 mm or 2-8 mm material). Total porosity decreased with incorporation rate for the coarser grades of rubber crumb but was hardly affected by fine (0.125-1.0 mm) and medium grade material. Capillary porosity decreased with incorporation rate and finer crumb size, while air-filled porosity was greatest where medium grade material was used. Increasing rates of rubber crumb reduced surface hardness and shear strength. When used as a top dressing material, increasing depth of rubber crumb caused increases in total porosity and air-filled porosity and decreases in bulk density, capillary porosity, hardness and shear strength. The effects of crumb grade were generally not significant, although for hydraulic conductivity values decreased with depth for fine grade material. The use of rubber crumb gave advantages of increased hydraulic conductivity and reduced bulk density and hardness. However, the consequences of large quantities of rubber crumb on water retention and surface stability must be considered. In

general, medium grade rubber crumb (0.5-1.5 mm) appeared to be the most effective for use with sand-dominated root zones.

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854. Recycled rubber topdressing improves wear tolerance in athletic turfgrass.

Gazze, Christopher and Walter, Cynthia

Journal of the Pennsylvania Academy of Science 81(2-3): 47-52. (2008); ISSN: 1044-6753

Descriptors: recycled rubber/ topdressing/ wear tolerance/ athletic turfgrass

Abstract: Late summers in southwestern Pennsylvania are characterized by hot, dry weather, which impedes the ability of athletic turf to tolerate wear, therefore decreasing the safety and performance of the field. Crumb rubber made from discarded tires may play an important role in protecting grass from the harmful effects of wear. A study was performed in summer, 2005 to determine the effect of crumb rubber (CR) topdressing on the wear tolerance of a newly established athletic turf. A field was planted in May in Greensburg, PA, Westmoreland Co., using Kentucky bluegrass (*Poa pratensis*) sod treated with combinations of CR topdressing and wear that simulated football practice in August. In most measures of turf quality, results from three replicate plots/treatment in a randomized block design confirmed the expected pattern of progressively decreasing performance in the following treatment groups: no wear with CR, no wear without CR, wear with CR, wear without CR. The CR and wear factors had statistically significant effects on turf coverage and several aspects of grass biology (two factor ANOVA, p values ≤ 0.01). Our results suggest that CR can increase the wear tolerance of a new athletic field used in late summer, and potentially improve the quality of the playing surface for athletes.

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855. The role of finite element analysis in predicting the injury-reduction potential of dairy cow cubicle synthetic beds.

Tierney, G. and Thomson, R. D.

Journal of Agricultural Engineering Research 80(4): 373-379. (2001)

NAL Call #: 58.8 J82; ISSN: 0021-8634

Descriptors: cows/ cubicles/ dairy cows/ finite element analysis/ injuries/ litter/ mats/ prediction/ stress analysis

Abstract: The optimum degree of cushioning in dairy cow cubicle synthetic bed materials is a compromise between impact force attenuation and stability. Farm trials aimed at finding the best materials are expensive but finite-element analysis, a computational method routinely used for engineering stress analysis, is now able to model the deformation of foam-like cubicle bedding materials under loads induced by a kneeling cow. It thus offers the potential for predicting cushioning performance for less cost. This paper compares finite-element analyses of two types of cubicle bed, recycled rubber-crumb mattresses and ethylene vinyl acetate mats, the properties of which were derived from simple laboratory experiments, with results from a two-farm study of cow injury assessments. The bed samples were subject to quasi-static compression tests and their force-displacement responses were measured. Both

samples were found to be non-linear elastic, with a response that may be characterized as hyperelastic. While both products would provide sufficient cushioning to reduce severe hock and knee injuries, the rubber-crumbs mattress was the more compliant of the two and should result in fewer injuries to the cows. These inferences were substantiated by the two-farm study. This allows a practical 'injury prevention performance rating' to be investigated. Reproduced with permission from the CAB Abstracts database.

856. The role of finite element analysis in predicting the short-term and long-term injury-reduction potential of dairy cow cubicle synthetic beds.

Tierney, G. and Thomson, R.

In: 2000 ASAE Annual International Meeting, Technical Papers: Engineering Solutions for a New Century. Milwaukee, WI.; Vol. 2.; pp. 4067-4074; 2000.

Descriptors: dairy cow cubicle beds/ impact loading/ injury prevention/ innovative use of finite element analysis/ attenuation/ computational methods/ deformation/ elastic moduli/ finite element method/ foams/ loads (forces)/ mathematical models/ rubber/ stress analysis/ hyperfoams/ impact loading/ injury prevention/ recycled rubber crumbs (rrc)/ dairies

Abstract: Cushioning in dairy cow cubicle synthetic bed materials is quantifiable in terms of impact force attenuation and stability but trials aimed at finding the best materials are expensive and time-consuming. Finite Element Analysis (FEA), a computational technique used for engineering stress and deformation analysis, can be used to model the deformation of cubicle bedding under loads induced by a kneeling cow. Synthetic beds made from recycled rubber crumbs (RRC) or from ethylene vinyl acetate (EVA) are classified in engineering terms as hyperfoams, i.e. materials that can undergo large deformations under load and yet return to their original shape on unloading. The mechanical behaviour of hyperfoams is difficult to predict by manual calculation but the Abaqus FE code can model them in terms of engineering properties such as the initial shear modulus, μ and the hyperelastic power-stiffening index, n . Suitable values for these properties were derived by matching FE analyses with compression test results and the role of FEA in determining a practical 'injury prevention performance rating' was investigated.

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857. Rootzone mixes amended with crumb rubber: Field study.

Boniak, R.; Chong, S K; Ok, C H; and Diesburg, K L
International Turfgrass Society Research Journal 9: 487-492. (2001)

Descriptors: Alfisols / clay loam soils/ hardness/ lawns and turf/ porosity/ rhizosphere/ rubber/ seed germination/ soil amendments/ soil compaction/ soil types/ soil water content/ tilth/ top dressings/ tyres/ Festuca elatior/ lawns and sports turf/ tires/ United States of America

Abstract: The objective of this study was to evaluate the quality and performance of turf established on root zone amended with crumb rubber in a fine-textured soil. The field experiment was conducted using a randomized complete block design at the Horticulture Research Centre, Southern Illinois University Carbondale, USA. The soil was classified as a Hosmer silty clay loam (fine-silty, mixed, mesic Typic

Fragiudalfs). Three different grades (average 3.5, 6.5 and 9.5 mm) of crumb rubber shredded from used tyres were added to soil for the purpose of enhancing its tilth. The amounts of crumb rubber (treatment) amended in soil were 0.2, 0.3 and 0.4 g g⁻¹. In addition, a zero amendment (as a control) and a zero amendment with 6.5 mm crumb rubber top dressing were included for comparison. The grass used in the test was a tall fescue (*Festuca arundinacea* 'Pyramid') and bluegrass (*Poa pratensis* 'Raven') (90:10) mix. Parameters measured include germination rate, grass clipping weight, turf quality index, root mass, soil moisture content and surface hardness. Poor germination rates were observed in mixtures with 0.3 and 0.4 g g⁻¹ amendment rates of 3.5 mm crumb rubber. Results indicated that soil mixtures with 6.5 mm crumb rubber at 0.2 g g⁻¹ amendment rate recorded the highest clipping yields, but no statistical difference in turf quality was observed between the control and 0.2 g g⁻¹ of 6.5 mm treatments. Reproduced with permission from the CAB Abstracts database.

858. Rootzone mixes amended with crumb rubber: Laboratory study.

Chong, S. K.; Ok, C. H.; Boniak, R.; and Diesburg, K. L.
International Turfgrass Society Research Journal 9: 493-497. (2001)

Descriptors: Alfisols / clay loam soils/ Entisols/ growth/ hydraulic conductivity/ lawns and turf/ porosity/ rhizosphere/ rubber/ silt loam soils/ soil amendments/ soil physical properties/ soil types / sports turf soils/ tilth/ tyres/ lawns and sports turf/ physical properties of soil/ tires

Abstract: The purpose of this research was intended to enhance the tilth of fine-textured soil for turf growth by incorporation of crumb rubber shredded from used tyres. The specific objectives were to determine the physical properties of soil mixtures amended with different grade and amount of crumb rubber. Two soils and three different grades (3.5, 6.5 and 9.5 mm) of crumb rubber were used in this study. The soils selected were an Arenzville silt loam (coarse-silty, mixed, nonacid, mesic Typic Udipluents) and a Hosmer silty clay loam (fine-silty, mixed, mesic Typic Fragiudalfs). The amount of crumb rubber mixed in soil ranged from 0 to 0.4 g g⁻¹ (using 0.05 g g⁻¹ increments and 0 as control). For each treatment, soil cores were constructed following the recommendation by the United States Golf Association Green Section Record. Results indicated that porosity of the mixtures decreased as the amount of crumb rubber increased. Regardless of the grade of crumb rubber, mixtures with less than 0.15 g g⁻¹ of crumb rubber in fine-textured soil could not enhance their macroporosity and hydraulic conductivity. However, as the amendment increased over 0.15 g g⁻¹, the tilth of the mixtures had significantly improved compared with the zero treatment.

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859. Simulated traffic on turfgrass topdressed with crumb rubber.

Rogers, J. N. III; Vanini, J. T.; and Crum, J. R.
Agronomy Journal 90(2): 215-221. (1998)

NAL Call #: 4 AM34P; ISSN: 0002-1962

Descriptors: lawns and turf/ ornamental plants/ particle size/ rubber/ shear strength/ soil mechanics/ sports

grounds/ sports turf soils/ top dressings/ traffic/ engineering properties of soil/ lawns and sports turf/ mechanical properties of soil/ ornamentals/ playing fields/ United States of America

Abstract: Sand is commonly used for top dressing turfgrass subject to traffic; under suboptimal growing conditions, however, methods to maintain wear tolerance are limited. A top dressing study was initiated in July 1993 to determine the effect of crumb rubber from recycled tires on turfgrass systems subjected to simulated athletic field traffic. A factorial randomized complete block design with three replications was implemented with two crumb rubber particle sizes (large, 6.0-2.0 mm; small, 2.0-0.05 mm) and five top dressing rates (0.0, 17.1, 34.2, 44.1, and 88.2 t/ha) on a 1-year-old Kentucky bluegrass-perennial ryegrass (*Poa pratensis*-*Lolium perenne*) stand in Michigan, USA. In 1993 and 1994, 96 passes were made with a Brinkman traffic simulator. Surface hardness characteristics measured were peak deceleration, time to peak deceleration, and impact duration. The small crumb rubber size was more effective in increasing impact time periods than the large crumb rubber, but had no effect on peak deceleration values. Shear resistance values decreased by as much as 40% as crumb rubber volumes increased in 1993, but were increased by 20% in 1994 after rubber particles had settled to the soil surface. There was generally an increase in turf cover under traffic as crumb rubber rates increased above 34.1 t/ha, and the small crumb rubber was more effective in 1993. It is suggested that crumb rubber can alter surface characteristics and increase wear tolerance of turfgrass exposed to traffic. Reproduced with permission from the CAB Abstracts database.

860. State of the art free stall designs: Do they allow lame cows to maintain normal patterns of stall use?

Marin, S. M. J.; Schaefer, M. J.; Mentink, R. L.; Banks, R. J.; Calderon, B. D.; and Cook, N. B.

In: American Society of Agricultural and Biological Engineers. 6th International Dairy Housing Conference 2007. Minneapolis, MN.; pp. 6-11; 2007. ISBN: 9781605600529

Descriptors: cow comfort/ lameness/ mattress/ sand/ agriculture/ housing/ American society/ biological engineers/ cow comfort/ dairy herds/ lameness/ mattress/ rubber crumb/ sand/ state of the arts/ time budgeting/ video analysis/ food products plants

Abstract: Time budgets for 59 mature Holstein cows were obtained using video analysis over a single 48 h period in 4 two-row free stall housed dairy herds, milked twice a day. Stall design differed only in stall base type with 2 herds with Pasture Mat® rubber crumb filled mattress stalls and 2 herds with Pack Mat™ stalls - consisting of 2 inches of sand over a mattress. Both stall base and locomotion score significantly influenced stall standing behavior. Lame cows on Pasture Mats lay for less than 12 h/d and stood in the stall in excess of 4 h/d. In contrast, while lame cows on Pack Mats maintained lying times at 13.1 h/d and stood in the stall for less than 2 h/d. The Pack Mat design appears to be very beneficial for lame cows, while Pasture Mat failed to allow lame cows to maintain normal patterns of stall usage. However, the addition of foam to improve surface cushion of the Pasture Mat appeared to improve stall use by both lame and nonlame cows in one herd.

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861. Treatment of screened dairy manure by upflow anaerobic fixed bed reactors packed with waste tyre rubber and a combination of waste tyre rubber and zeolite: Effect of the hydraulic retention time.

Umaña, Oscar; Nikolaeva, Svetlana; Sánchez, Enrique; Borja, Rafael; and Raposo, Francisco
Bioresource Technology 99(15): 7412-7417. (Oct. 2008)
NAL Call #: TD930.A32; ISSN: 0960-8524

Descriptors: dairy manure/ anaerobic fixed bed reactors/ waste tires/ zeolite/ hydraulic retention time

Abstract: Two laboratory-scale anaerobic fixed bed reactors were evaluated while treating dairy manure at upflow mode and semicontinuous feeding. One reactor was packed with a combination of waste tyre rubber and zeolite (R1) while the other had only waste tyre rubber as a microorganism immobilization support (R2). Effluent quality improved when the hydraulic retention time (HRT) increased from 1.0 to 5.5 days. Higher COD, BOD, total and volatile solids removal efficiencies were always achieved in the reactor R1. No clogging was observed during the operation period. Methane yield was also a function of the HRT and of the type of support used, and was 12.5% and 40% higher in reactor R1 than in R2 for HRTs of 5.5 and 1.0 days, respectively. The results obtained demonstrated that this type of reactor is capable of operating with dairy manure at a HRT 5 times lower than that used in a conventional reactor.

This citation is from AGRICOLA.

862. Turf root zone medium amended with waste crumb rubber and ecological responses of turfgrass.

Wang, LiLi; Zhao, ShuLan; Liu, Yuan; Lian, Fei; Teng, Meng; and Duo, LiAn

Bulletin of Botanical Research 27(2): 233-237. (2007);
ISSN: 1673-5102

Descriptors: clay soils/ growth/ lawns and turf/ loam soils/ plant ecology/ roots/ rubber/ sand/ size/ soil amendments/ soil types/ lawns and sports turf

Abstract: Turf media were respectively compounded by loam, clay soil, sand and waste crumb rubber with four different sizes as soil amendment, and ecological responses of turfgrass were investigated. Analysis on the synthetic effect of all ecological indices showed that in the soil compounded media, compounded medium with 0.5- to 1.0-mm and 4.0- to 6.0-mm crumb rubber was better than those with 1.0-2.0 mm and 2.0-4.0 mm. However, compounded medium with 1.0- to 2.0-mm crumb rubber achieved better results in clay soil compounded media. Moreover, in sand compounded media, 1.0- to 2.0-mm and 2.0- to 4.0-mm crumb rubber was better than 0.5-1.0 mm and 4.0-6.0 mm. By comparison, from the angle of turfgrass growth, compounded medium with sand and waste crumb rubber as soil amendment had better prospects. Reproduced with permission from the CAB Abstracts database.

863. The use of crumb rubber as a container component for Lantana production.

Leader, Kris M.; Owings, Allen D.; and Bush, Edward W.
HortScience 33(4): 593. (1998)

NAL Call #: SB1.H6; ISSN: 0018-5345

Descriptors: crumb rubber/ used tires/ soil media/ Lantana/ flowering plant production

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864. Utilisation of crumb rubber as a soil amendment for sports turf.

Groenevelt, P H and Grunthal, P E

Soil and Tillage Research 47(1/2): 169-172. (1998)

NAL Call #: S590.S48; ISSN: 0167-1987

Descriptors: aeration / amendments/ analysis/ compaction/ effects/ field tests/ lawns and turf/ metals/ physical properties/ porosity/ properties/ rubber/ soil/ sports turf soils/ statistics/ wastes/ lawns and sports turf

Abstract: A rubber crumb-based soil amendment can enhance the physical properties of soils susceptible to the negative effects of compaction. Highly compacted sports fields require constant aeration to maintain a healthy and safe playing surface. Rubber crumb adds resiliency to sports turf. Standard US Golf Association tests showed that admixtures containing 20% or less crumb rubber maintained recommended total porosity values. Field tests showed that 10-20% crumb rubber significantly reduced surface hardness. Analysis of metals, volatile organic compounds and base/neutral/acid extractable compounds from admixture leachate showed no deleterious effects to the environment due to inclusion of rubber crumb in turfgrass root zones.

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865. Utilization of waste tire chips as a cymbidium potting medium.

Kim JungEn; Choi SeongJin; and Kim HongYul

Journal of the Korean Society for Horticultural Science 41(4): 406-408. (2000)

NAL Call #: SB13.H28; ISSN: 0253-6498

Descriptors: growing media/ growth/ iron/ plant development/ tyres/ utilization/ zinc/ potting composts/ rooting media/ tires

Abstract: The physical and chemical characteristics of waste tyre chips, composed mainly of rubber and fibre, were analysed. Cymbidium plants were cultivated in media composed of various sizes of tyre chips. Water and nutrient holding capacity of tyre chips was lower than that of bark, but the growth of Cymbidium in tyre chips was equivalent to that in bark. Although Fe and Zn were present in leached water from tyre chips, heavy metals such as Cd and Pb were not detected and no serious injury symptoms were observed during cultivation of Cymbidium for 6 months in tyre chip potting media.

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866. Waste tire problem becomes opportunity for erosion control.

Anon.

Land Water 42(2): 36-39. (Mar. 1998-Apr. 1998); ISSN: 0192-9453

Descriptors: erosion control/ recycling/ solid wastes/ waste management/ used tires

Abstract: Numerous partners in Oklahoma have been turning the problem of waste tires into an opportunity. Many benefits have resulted by focusing on an alternative way to utilize the bulky waste, as opposed to how to dispose of it. The alternative: utilizing waste tires to control streambank erosion. In addition to saving valuable public and private land or property threatened by erosion, this option has other benefits. It provides a use for problem tires, has financial benefits, gives meaningful work to corrections inmates, and increases public awareness in the area of natural resource conservation and solid waste management.

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Wood Byproducts

867. Absorption of calcium and magnesium by the fruiting body of the cultivated mushroom *Hypsizygus marmoreus* (Peck) bigelow from sawdust culture media.

Tabata, T. and Ogura, T.
Journal of Food Science 68(1): 76-79. (2003); ISSN: 0022-1147

Descriptors: absorption/ calcium/ calcium carbonate/ calcium phosphates/ culture media/ growth/ magnesium/ magnesium carbonate/ magnesium chloride/ magnesium sulfate/ mycelium/ sawdust/ Basidiomycetes/ Basidiomycota/ calcium phosphate/ *Hypsizygus*/ *Hypsizygus marmoreus*/ magnesium sulphate/ Tricholomataceae

Abstract: *H. marmoreus* was cultivated in potato-sucrose-agar (PSA) and in sawdust media supplemented with Ca or Mg salts. The radial growth of mycelia was determined. The mushroom spawn did not grow on PSA supplemented with Ca carbonate, Mg carbonate, or Mg hydroxide. However, the mycelia grew well on sawdust media supplemented with Ca phosphate, Ca carbonate, or Mg sulfate. Ca of the fruiting body was increased 4.0 to 5.6 times by 1 to 5% of Ca phosphate or Ca carbonate. Mg was increased 1.4 times by 0.5% of Mg sulfate or Mg chloride. Reproduced with permission from the CAB Abstracts database.

868. Accelerated cultivation of Siberian Iris (*Iris sibirica* L.) in an unheated plastic tunnel.

Pogroszewska, E.
Folia Universitatis Agriculturae Stetinensis, Agricultura 70: 95-104. (1998).

Notes: Original title: Przyspieszona uprawa kosacka syberyjskiego (*Iris sibirica* L.) w nie ogrzewanym tunelu foliowym.

Descriptors: cut flowers/ flowering/ mulching/ ornamental bulbs/ ornamental plants/ pine bark/ plastic tunnels/ protected cultivation/ sawdust/ anthesis/ cultivation under glass or plastic/ ornamentals

Abstract: One-year-old plants were planted in autumn and mulched with composted pine bark and sawdust. Results indicated that *I. sibirica* was suitable for accelerated cultivation in an unheated plastic tunnel. Cut flowers were ready to market 1-3 weeks earlier and yields and quality were higher than from plants grown outdoors. Mulching plants grown outdoors with bark and sawdust also increased cut flower yields. Reproduced with permission from the CAB Abstracts database.

869. Agricultural use of wood ash in California.

Meyer, Roland D.
Oakland, CA: University of California, Agriculture and Natural Resources; 12 pp. (1999).

Notes: Includes bibliographical references (p. 12)

NAL Call #: S654 .A38 1999

Descriptors: wood ash / agriculture/ California

This citation is from AGRICOLA.

870. Alteration of soil temperature and moisture through mulching on the morpho-physiological differentiation in maize.

Awal, M. A. and Khan, M. A. H.
Pakistan Journal of Biological Sciences (Pakistan) 2(4): 1164-1167. (Oct. 1999)

NAL Call #: QH301 .P355; ISSN: 1028-8880.

Descriptors: mulching / soil/ wood waste/ maize

Abstract: Mulching effects of sawdust, ash, rice straw and water hyacinth on the morpho-physiological differentiation of maize (*Zea mays* L.) and to relate these with soil environment were described. Water hyacinth and rice straw mulches had significant promotive effects on shoot elongation, root penetration, LAI and DM accumulation. All mulches conserved soil moisture but water hyacinth and rice straw retained comparatively greater amount. Water hyacinth and rice straw mulches reduced soil temperature fluctuations in all soil depths (5 to 15 cm) and retained higher soil temperatures at the early hours of the day (02 to 06 hrs) which were considered to be the decisive factor for the rapid development of maize plants. Sawdust mulch due to the lower soil temperature had retardive effects on all morpho- physiological attributes. Ash mulch ranked intermediate between the rice straw or water hyacinth and the control.

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871. Alterations in the physical and physico-chemical properties of a substrate based on composted sawdust and perlite with polycyclic tomato crops.

Favaro, J. C. and Marano, R. P.
Spanish Journal of Agricultural Research 1(3): 105-109. (2003); ISSN: 1695-971X

Descriptors: bulk density/ cations/ composts/ electrical conductivity/ growing media/ perlite/ pH/ protected cultivation/ sawdust/ soilless culture/ substrates/ tomatoes/ cultivation under glass or plastic/ hydrogen ion concentration/ potential of hydrogen/ potting composts/ rooting media

Abstract: Vegetable crops grown continuously in greenhouse are vulnerable to phytosanitary problems or changes in the physical and chemical conditions of the soil such as salinization. One alternative to minimize these problems is to grow crops without soil using different substrates. A mixture of perlite and composted willow sawdust has been used successfully with tomatoes (*Lycopersicon esculentum*) but the behaviour of this substrate when reused is unknown. Factorial trials with tomato pot crops cv. Topacio were developed, and in each experiment, water content at 10, 50 and 100 cm, bulk density, pH, electrical conductivity and exchangeable cations were determined. From a physical perspective, reuse of the substrate did not substantially modify the total available water and aeration was higher than that considered as ideal. Reuse caused a light acidification and increased the C/N ratio with a loss of exchangeable cation capacity for Ca²⁺ and Na⁺. This modification of the substrate did not affect the yield.

This citation is from AGRICOLA.

872. Alternatives to chemical nematicides for the control of *Meloidogyne incognita* infesting beans [*Phaseolus vulgaris* L. Brazil].

Santiago, D. C.; Homechin, M.; Montalvan, R.; Krzyzanowski, A. A.; and Favoretto, L.
Nematologia Mediterranea (Italy) 30(2): 175-180. (Dec. 2002)

NAL Call #: QL391.N4N42; ISSN: 0391-9749.

Notes: Original title: Alternative ai nematocidi chimici per la lotta a *Meloidogyne incognita* infestante il fagiolo [*Phaseolus vulgaris* L. Brazil]. 4 tables; 26 ref. Summary (En). Citation notes: IT (Italy).

Descriptors: *Phaseolus vulgaris*/ Brazil/ field experimentation/ nematode control/ *Meloidogyne incognita*/ sugarcane/ sawdust/ *Pennisetum purpureum*/ industrial wastes/ organic amendments/ cultivation yields/ physicochemical properties/ soil biology / infestation
Abstract: Studies were carried out to assess the effect of crystallized and brown sugars, elephant grass cv Cameroon, filter cake, sugarcane juice and *Pinus elliottii* sawdust for the control of *Meloidogyne incognita* infesting the bean (*Phaseolus vulgaris*) cv Carioquinha. Observations were made on their effect on nematode natural enemies, such as yeasts, actinomycetes, sporulating bacteria and cellulolytic and phosphate solubilizing fungi. Filter cake (30,000 kg/ha) and *P. elliottii* (10,000 kg/ha) were the best treatments for the control of *M. incognita* population. The sawdust soil cover resulted in greater yield weight averages and in healthier root systems. The soil amendments influenced soil microflora and soil chemical properties in the field.
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873. Alternatives to polyethylene mulch film: A field assessment of transported materials in capsicum (*Capsicum annuum* L.).

Olsen, J. K. and Gounder, R. K.
Australian Journal of Experimental Agriculture. 2001; 41(1): 93-103 41(1): 93-103. (2001)

NAL Call #: 23 Au792; ISSN: 0816-1089

Descriptors: crop weed competition/ crop yield/ Ferralsols/ fruits/ growth/ mulches/ mulching/ Oxisols/ paper/ polyethylene film/ sawdust/ soil types/ sugarcane trash/ toxicity/ weight/ mulching materials/ Ustox
Abstract: Materials used as mulches may be either transported to the farm then laid on the soil surface or grown in situ. To assess biodegradable alternatives to non-degradable polyethylene film, the response of capsicum (*Capsicum annuum* cv. Target) grown in soil beds covered with hessian (burlap), hardwood sawdust, sugarcane (*Saccharum* spp.) trash, paper film, black biodegradable polymer film, white polyethylene film, or left uncovered was investigated in a field trial during the autumn-winter growing season in Queensland, Australia during 1999. Use of a split-plot design (mulch whole plots with weeded or unweeded subplots) permitted both weed growth and the effect of weed competition on fruit yield to be measured. The presence of substances within the materials that were possibly detrimental to plant growth was assessed in a separate experiment. The weight of marketable fruit was highest for capsicum plants grown in the weeded subplots of biodegradable polymer and polyethylene, although the yields from these subplots were not different from those for plants grown in the weeded subplots of the paper and sawdust or the unweeded subplots of the biodegradable

polymer and paper. The reduction in weight of marketable capsicum fruit from weed competition was ranked for the various mulch treatments as follows: paper < biodegradable polymer < cane trash < polyethylene < hessian < sawdust < bare soil. More hours at optimum soil temperature for root growth (18.9-30 degrees C) before canopy closure probably accounted for the variation in marketable yield of the capsicum crop. Results from the mulch toxicity experiment indicated that the mulch materials were unlikely to contain phytotoxic substances. Provided the practical difficulties of laying paper film can be overcome and the high cost of biodegradable polymer is reduced, these materials appear to be the best of the biodegradable alternatives tested to polyethylene film.
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874. Amendment of crude oil contaminated soil with sawdust and chromoleana leaves for optimum plant protection.

Offor, U. S. and Akonye, L. A.
African Journal of Biotechnology 5(9): 770-774. (2006)
NAL Call #: TP248.13 .A37; ISSN: 1684-5615
Descriptors: bioremediation/ cowpeas/ crop residues/ diesel oil/ growth/ growth rate/ leaf area/ leaves/ maize/ net assimilation rate/ plant protection/ polluted soils/ sawdust/ soil amendments/ soil pollution/ soil types/ waste utilization/ black eyed peas/ corn/ crop protection/ NAR/ southern peas
Abstract: A study on the effectiveness of sawdust and chromoleana leaves as soil restorative measures to optimize plant growth at two intensities of crude oil contamination showed that both restore parity on the growth parameters (leaf area, leaf ratio, relative leaf growth rate, relative growth rate, and net assimilation rate) of crops tested compared to control. However, chromoleana leaves was found to be more effective than sawdust. The test crops *Zea mays* and *Vigna unguiculata* differed with respect to their response to amendments applied. *V. unguiculata* showed better response than *Z. mays* in most of the parameters tested.
This citation is from AGRICOLA.

875. Ammonia emissions from composting hog manure amended with sawdust under continuous and intermittent aeration.

Elwell, D. L.; Hong, J. H.; Keener, H. M.; and Michel, F. C.
In: Air Pollution from Agricultural Operations. Proceedings of the Second International Conference. Des Moines, Iowa, USA.; pp. 157-162; 2000.
Descriptors: aeration / air flow/ amendments/ ammonia/ composting/ odour abatement/ odour emission/ pig manure/ sawdust/ odor abatement/ odor emission
Abstract: Ammonia emissions during composting of hog manure mixed with sawdust were studied in four runs comprising a total of 22 pilot-scale reactor vessels. These four runs extended previous work and both verified and extended the previous conclusions. The pilot-scale vessels were 205 L, insulated, stainless steel drums that were aerated either continuously (high/low thermostatically controlled fans) or intermittently (5 min high fan, 55 min off). Temperatures, ammonia emissions, air flow rates, carbon dioxide production and oxygen utilization, moisture and dry matter reduction, and initial and final chemical compositions were measured. Ammonia emissions from the intermittently

aerated vessels were only about 50% as great as those from the continuously aerated ones, but this was found to be a result more related to total air flow than to aeration technique. All of the data for total ammonia emissions versus total air flow were fitted with a linear regression line, $y=0.1309x+29.835$ where y is ammonia expressed as g of N and x is air flow in kg, with $R^2=0.6808$. This general trend indicates that about 50% reduction in ammonia emissions can be achieved with 75% reduction in air flow. For the aeration techniques used, the minimum oxygen level in the exhaust gas from the vessels was 5%, and this is probably a reasonable lower limit constraining air flow reduction. However, within this constraint, lower air flow now appears to be a technique that can reduce odorous ammonia emissions.

This citation is from AGRICOLA.

876. Ammonia, nitrous oxide, methane, carbon dioxide and water vapour emissions when weaned pigs are kept either on a sawdust or on a straw deep litter.

Nicks, B.; Laitat, M.; Desiron, A.; Vandenheede, M.; and Canart, B.

In: 34emes Journees de la Recherche Porcine, sous l'egide de l'Association Francaise de Zootechnie.Paris, France.); pp. 149-154; 2002.

Notes: Original title: Emissions d'ammoniac, de protoxyde d'azote, de methane, de gaz carbonique et de vapeur d'eau lors d'elevage de porcelets sevrés sur litière accumulée de paille et de sciure.

Descriptors: air pollution/ ammonia/ carbon dioxide/ litter/ methane/ nitrogen balance/ nitrous oxide/ piglets/ sawdust/ straw/ ventilation/ water vapour/ atmospheric pollution/ hogs/ swine/ water vapor

Abstract: Five batches of 40 weaned pigs were reared successively on a sawdust or on a straw deep litter. The same amount of litter dry matter, i.e. 5 kg/pig, was used in the 2 cases. The gases concentrations were measured 6 times, at about 1 month interval during 6 consecutive days with one measurement every 30 minutes. The ventilation rates were continuously recorded. Rearing pigs on the sawdust deep litter produced 4 times less ammonia than rearing pigs on straw deep litter (0.33 vs 1.29 g/pig per day), 2 times less methane (0.87 vs 1.79 g/pig per day) and 3.5 times more nitrous oxide (1.70 vs 0.47 g/pig per day). Carbon dioxide emissions (458 vs 465 g/pig per day) and water vapour emissions (1088 vs 913 g/pig per day) were not significantly different. According to the N balance, 66% of the N in pigs' manure were lost by gas emissions. N_2 contributed for 79% of the total gas N emissions. This citation is from AGRICOLA.

877. Application of wood ash compared with fertigation for improving the nutritional status and fruit production of kiwi vines.

Merino, A.; Otero, V.; Omil, B.; Lastra, B.; Piñeiro, V.; and Gallego, P. P.

Journal of Plant Nutrition and Soil Science 169(1): 127-133. (2006)

NAL Call #: 384 Z343A; ISSN: 14368730 [JNSSF].

Notes: doi: 10.1002/jpln.200520518.

Descriptors: acid soils/ fertigation/ heavy metals/ kiwifruit/ wood ash/ actinidia chinensis/ actinidia deliciosa

Abstract: Application of wood ash can potentially improve

the fertility of acid soils and the nutritional status of crops. However, there is limited information about the effectiveness of this practice with fruit trees. The application of wood ash as a fertilizer in a kiwifruit plantation - both with and without fertigation/irrigation - was compared with that of a conventional fertigation program in a completely randomized field experiment on an acid soil in northwest (NW) Spain. The effects on plant nutritional status and on fruit yield, as well as environmental effects, were evaluated over a period of 2 y. The application of wood ash led to modest increases in soil pH and extractable nutrients (phosphorus, P; calcium, Ca; magnesium, Mg; potassium, K; boron, B). However, no consistent effects in foliar nutrient concentrations were found. Ash application led to an increase of up to 45% in the number of fruits produced, which was mainly attributed to the inputs of Ca and Mg. Although moderate increases in soil available manganese (Mn) and nickel (Ni) after ash application were recorded, there were no changes in heavy-metal concentrations in leaves or fruits. From the results of the study it can be concluded that wood ash can be used to improve the growth conditions of kiwi vines on acidic soils. Wood ash should be applied at rates adapted to the liming needs of the soil, while also taking into account the chemical composition of the ash. © 2006 Wiley-VCH Verlag GmbH & Co. KGaA. © 2009 Elsevier B.V. All rights reserved.

878. Application of wood ash to acidic boralf soils and its effect on oilseed quality of canola.

Patterson, S. J.; Acharya, S. N.; Thomas, J. E.; and Bertschi, A. B.

Agronomy Journal 96(5): 1344-1348. (Sept. 2004-Oct. 2004)

NAL Call #: 4 AM34P; ISSN: 0002-1962

Descriptors: Brassica rapa/ canola/ crop yield/ wood ash/ soil amendments/ acid soils/ application rate/ crop quality/ canola oil/ chlorophyll/ protein content/ glucosinolates/ soil fertility/ boron/ zinc/ nutrient uptake/ mineral content/ Alberta

Abstract: Acidic Typic Cryoboralf soils amended with wood ash can raise soil pH and can supplement plant growth by adding minerals and micronutrients. However, presence of other elements in soils such as Cd, S, and Zn can affect plant growth and seed quality. In an earlier paper, we have shown that wood ash applications on Typic Cryoboralf and Typic Cryocrypt soils in Alberta, Canada, increased canola (*Brassica rapa* L.) yield by 72%. In this study, the effect of a single application of 0, 6, 12.5, and 25 t ha⁻¹ (dry weight) wood ash on oilseed quality, based on oil, protein, chlorophyll, and glucosinolate content, was examined over three growing seasons from 1998 to 2000. Seed oil and protein content of ash-treated plots either increased or remained the same as controls. In contrast, significant increases ($p < 0.05$) in tissue concentrations of S and seed oil glucosinolates were observed in ash-amended plots. While these changes remained within acceptable limits for canola, seed oil and tissue quality were lower than the average level found in Canada no. 1 grade canola. During the 3-yr period, average Zn content of the oilseed was not different from control plots ($P > 0.05$). Levels of B in ash-treated soils were different from each other but not from the controls ($P < 0.05$). Cadmium levels were below detection

limits for the instrumentation used (0.08 mg kg⁻¹). These results indicate that use of wood ash on acidic soils has the potential to increase seed oil content but may adversely affect quality of the oilseed produced.
This citation is from AGRICOLA.

879. Are your stalls comfortable? The surface of the stall: Part 4.

Ferrouillet, C. and Carrier, J.

Producteur de Lait Quebecois 24(6): 47-49. (2003); ISSN: 0228-1686.

Notes: Original title: Vos stalles sont elles confortables? La surface de la stalle: 4^e partie.

Descriptors: cow housing/ cows/ dairy cows/ floors/ litter/ sand/ sawdust/ straw/ cowsheds/ flooring

Abstract: The ideal stall surface in the cow shed should be non-slip, soft enough to cushion shocks and reduce pressure, and non-abrasive; it should also limit fluid accumulation and bacterial growth. The importance of organic litter (straw or sawdust) or sand in this respect is discussed. The animals should have sufficient space to lie and get up comfortably. Farmers are advised to conduct the 'knee test' by kneeling on the floors of their cow sheds to assess the comfort factor for themselves.

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880. Artificial production technology of *Auricularia delicata* in Manipur.

Devi, M. B. and Singh, N. I.

Journal of Mycopathological Research 43(2): 283-284. (2005)

NAL Call #: QK600.J68 ; ISSN: 0971-3719

Descriptors: calcium carbonate/ cultivation/ edible fungi/ rice/ rice bran/ rice straw/ sawdust/ spawn/ straw/ substrates/ sucrose/ *Auricularia delicata*/ *Auriculariaceae*/ paddy/ saccharose

Abstract: *Auricularia delicata*, an edible fungus collected locally, was tested for artificial production at the Aerobiology, Microbiology and Plant Pathology Laboratory, Department of Life Sciences, Manipur University (India) in an attempt to generate additional income for the socially weaker people of Manipur. Paddy straw soaked overnight in water supplemented with 4% rice bran and partially decomposed sawdust (prepared by mixing and watering ingredients such as sawdust (78%); rice bran (20%); CaCO₃ (1%); and sucrose (1%)) were used as the substrates for the production of this jelly fungus. Prior to cultivation, both substrates were autoclaved and spawned at the rate of 2% on a wet weight basis. Results showed that the partially decomposed sawdust substrate produced better yield (433 g/2 kg wet weight) than the commonly used substrate paddy straw (280 g/2 kg wet weight). It is concluded that large-scale artificial production of *A. delicata* is possible in Manipur.

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881. Assessment of sawdust-based substrates of *Salicaceae* (*Salix* sp.): Composted for plant production.

Favaro, J. C.; Buyatti, M. A.; and Acosta, M. R.

Investigacion Agraria Produccion y Proteccion Vegetales 17(3): 367-373. (2002); ISSN: 0213-5000.

Notes: Original title: Evaluacion de sustratos a base de

serrin de *Salicaceae* (*Salix* sp.) compostados para la produccion de plantones.

Descriptors: sawdust/ willow/ seedlings/ germination/ growth

Abstract: The cost of seedlings grown in trays with large cells is highly correlated to the price of the substrate, and in particular to peat, its main component. Sawdust of willow has been used successfully to replace peat in soil-less cultivation. The aim of this work was to evaluate the use of composted sawdust to produce seedlings. Sawdust of willow mixed in different proportions with perlite (25, 50, 75% v/v), or peat and perlite (33% of each one) was compared to commercial substrates. Polystyrene trays were sown with seeds of tomato cv. BHN 81. Germination, height, and number of leaves of the plant, weight, and dry matter partition were evaluated. The percent germination was the same in all treatments. However, plants in commercial substrate had greater size. The treatments containing sawdust had a higher dry matter percentage and more partition to the root system, probably because they had problems to retain water in the substrate. When the perlite content exceeded 50% in the mix, there were problems to extract the plants and surrounding substrate preserving the tray cell shape. The use of composted sawdust could have possibilities for seedling production, replacing partially or totally the commercial substrate. The initial contents of macro and micronutrients should be adjusted, and to avoid water stress and get better growth, irrigation must be done carefully.

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882. Assessment of three substrata for maize seed testing.

Ajayi, S. A.; Fakorede, M. A. B.; and Owolabi, B. A.

African Crop Science Journal 8(4): 441-445. (2000); ISSN: 1021-9730

Descriptors: emergence/ germination/ maize/ rooting/ sand/ sawdust/ seed testing/ seeds/ soil/ sterilizing/ substrates/ corn

Abstract: Three substrata: topsoil, sand and sawdust, each with sterilized and unsterilized treatments were assessed as potential media for maize seed testing. Seeds of Oba Supa 1, a tropical white maize hybrid, were used. One hundred seeds were planted in plastic containers per replicate, each substratum was replicated three times and data were collected on fifty seedlings per replication per substratum. Traits assessed were germination percentage, emergence index, number of primary roots, and root and shoot lengths. The experiment was repeated four times. Substratum had highly significant effect on number of primary roots and root and shoot lengths but not on germination percentage and emergence index. Sterilization significantly favoured shoot length but not other traits. Sand, sterilized or unsterilized, gave more uniform and reproducible test results than sawdust and topsoil. These results support the conclusion that any of the substrata may be used for the purpose of assessing the germinability of a seedlot. Seed testing involving seedling evaluation or measurements of seedling root and shoot lengths should, however, be done with sterilized sand.

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883. Availability of nutrients in wood ash amended tropical acid soils.

Nkana, J. C. V.; Demeyer, A.; and Verloo, M. G.

Environmental Technology 19(12): 1213-1221. (1998)

NAL Call #: TD1.E59; ISSN: 0959-3330

Descriptors: acid soils/ acidity/ amendments/ availability/ dry matter/ indicator plants/ lime/ manganese/ models/ neutralization/ nutrient availability/ nutrient uptake/ nutrients/ phosphorus/ rye/ soil/ soil acidity/ soil amendments/ soil pH/ trace elements/ treatment/ tropics/ ultisols/ uptake/ wood ash/ zinc/ microelements/ Mn/ plant indicators/ tropical countries/ tropical zones

Abstract: A greenhouse study was conducted to assess nutrient availability in wood ash when applied to surface soil samples of three tropical acid soils (Kandiudult) from Cameroon. Amendments were applied at rates to attain target pH values of 5.5, 6.0 and 6.5. Lime treatments were included as a control. Ryegrass (*Lolium perenne*) was grown as an indicator plant for three successive cycles of 40 days each. Data on total harvested dry matter, nutrient uptake, nutrient additions and extractable soil nutrients from treated soils have been used for availability investigations. Application of wood ash resulted in neutralisation of soil acidity, increased exchangeable nutrient bases and decreased extractable micronutrients. Wood ash was in general more effective than lime in increasing dry matter production, mainly because of higher P and K uptake. Phosphorus, Ca, Mg, K, Mn, Zn and Cu from wood ash were used by plants. Wood ash application increased the availability of P, Ca, Mg and K and decreased that of Mn and Zn for plant uptake. Both nutrient additions and nutrient extractions from treated soils provided a reliable measure for plant available nutrients. Soil pH and effective cation exchange capacity affected the availability of P, Ca, Mg and K positively and that of Mn and Zn negatively. This citation is from AGRICOLA.

884. *Bacillus cereus* in free-stall bedding.

Magnusson, M.; Svensson, B.; Kolstrup, C.; and Christiansson, A.

Journal of Dairy Science 90(12): 5473-82. (Dec. 2007)

NAL Call #: 44.8 J822 ; ISSN: 1525-3198

Descriptors: animal welfare/ animals/ *Bacillus cereus*: growth & development: isolation & purification/ bedding and linens: microbiology: standards: veterinary/ cattle/ colony count, microbial veterinary/ dust/ enterobacteriaceae: growth & development: isolation & purification/ environmental microbiology/ feces: microbiology/ female/ floors and floorcoverings: standards/ housing, animal/ hydrogen ion concentration/ risk factors/ soil/ spores, bacterial/ urine: microbiology/ wood

Abstract: To increase the understanding of how different factors affect the bacterial growth in deep sawdust beds for dairy cattle, the microbiological status of *Bacillus cereus* and coliforms in deep sawdust-bedded free stalls was investigated over two 14-d periods on one farm. High counts of *B. cereus* and coliforms were found in the entire beds. On average, 4.1 log(10) *B. cereus* spores, 5.5 log(10) *B. cereus*, and 6.7 log(10) coliforms per gram of bedding could be found in the upper layers of the sawdust likely to be in contact with the cows' udders. The highest counts of *B. cereus* spores, *B. cereus*, and coliforms were found in the bedding before fresh bedding was added, and the lowest immediately afterwards. Different factors of

importance for the growth of *B. cereus* in the bedding material were explored in laboratory tests. These were found to be the type of bedding, pH, and the type and availability of nutrients. Alternative bedding material such as peat and mixtures of peat and sawdust inhibited the bacterial growth of *B. cereus*. The extent of growth of *B. cereus* in the sawdust was increased in a dose-dependent manner by the availability of feces. Urine added to different bedding material raised the pH and also led to bacterial growth of *B. cereus* in the peat. In sawdust, a dry matter content greater than 70% was needed to lower the water activity to 0.95, which is needed to inhibit the growth of *B. cereus*. In an attempt to reduce the bacterial growth of *B. cereus* and coliforms in deep sawdust beds on the farm, the effect of giving bedding daily or a full replacement of the beds was studied. The spore count of *B. cereus* in the back part of the free stalls before fresh bedding was added was 0.9 log units lower in stalls given daily bedding than in stalls given bedding twice weekly. No effect on coliform counts was found. Replacement of the entire sawdust bedding had an effect for a short period, but by 1 to 2 mo after replacement, the counts of *B. cereus* spores in the beds had increased about 2 log units and were as high as they were before bed replacement. Therefore, free-stall management could, to a limited extent, reduce the content of *B. cereus* spores in the beds by daily bedding and entire bed replacement. This citation is from PubMed.

885. Bacterial counts associated with sawdust and recycled manure bedding treated with commercial conditioners.

Hogan, J. S.; Bogacz, V. L.; Thompson, L. M.; Romig, S.; Schoenberger, P. S.; Weiss, W. P.; and Smith, K. L.

Journal of Dairy Science 82(8): 1690-1695. (Aug. 1999)

NAL Call #: 44.8 J822 ; ISSN: 0022-0302 [JDSCAE]

Descriptors: dairy cows/ sawdust/ alkali treatment/ acid treatment/ plate count/ Gram negative bacteria/ *Klebsiella*/ *Streptococcus*/ pH/ teats/ antibacterial properties/ duration/ litter (bedding)/ cattle manure/ slaked lime/ coliform count/ conditioning

Abstract: Bacteria counts associated with untreated organic bedding materials were compared with those of bedding treated with either an alkaline commercial bedding conditioner, acidic commercial bedding conditioner, or hydrated lime. Bedding materials were recycled manure and kiln-dried sawdust. The effects of bedding treatments on bacteria counts differed between bedding types. Each of the bedding treatments significantly reduced bacteria in recycled manure prior to use. The alkaline conditioner and hydrated lime effectively inhibited bacteria in recycled manure for 1 d. Bedding counts and teat swabs of cows housed on recycled manure treated with the alkaline conditioner were reduced on d 2. The use of the acid conditioner in recycled manure had little effect on bacteria in bedding. Sawdust differed from recycled manure in that bacteria in untreated sawdust prior to use were minimal, and populations increased rapidly during the first 2 d after use as bedding. The acid conditioner had a bacteriostatic effect in sawdust, evident by the reduction of bacteria on d 2. The alkaline conditioner and hydrated lime did not alter bacteria counts in sawdust compared with untreated sawdust. Antibacterial activity of each conditioner deteriorated between d 2 and d 6 in both beddings. The

antibacterial activities of conditioners were related to the pH of bedding materials. The use of commercial bedding conditioners initially reduced bacterial counts; however, the antibacterial effects had diminished between d 2 and 6 after use in bedding.
This citation is from AGRICOLA.

886. Bacterial counts in bedding and on teat ends of cows housed on sand and sawdust.

Zdanowicz, M.; Shelford, J. A.; Tucker, C. B.; and Weary, D. M.

Journal of Dairy Science 85(Supplement 1): 376. (2002)

NAL Call #: 44.8 J822; ISSN: 0022-0302

Descriptors: bedding/ sawdust/ dairy/ bacteria

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887. Bacterial counts in sawdust bedding.

Hogan, J. S. and Smith, K. L.

Special Circular Ohio Agricultural Research and Development Center 163: 32-36. (1998); ISSN: 0736-8003

Descriptors: bacterial diseases/ bovine mastitis/ calcium carbonate/ cattle housing/ disease control/ lime/ litter/ microbial flora/ pH/ sawdust / teats/ bacterial infections/ bacterioses/ cattle sheds/ hydrogen ion concentration/ microflora/ potential of hydrogen/ United States of America

Abstract: Bacterial counts in untreated sawdust bedding were compared with those in sawdust bedding after the addition of lime and after daily replacement of bedding in the back one-third of cow stalls. Addition of 1 kg of lime to 10 kg of sawdust before use as bedding reduced Gram-negative bacteria, coliforms, *Klebsiella* spp., and streptococci. Sawdust treated with lime also showed decreases in bacterial counts when compared with sawdust that was replaced daily and control bedding after one day in the stall. The decrease in bacterial populations was related to an increase in bedding pH. Mean pH in sawdust that contained lime was greater before use and was greater after day one in the stall compared with other treatments. After 2 and 6 days in stalls, bacterial counts and pH were similar among treatments. Dry matter content of bedding did not differ among bedding treatments. Bacterial counts in bedding were positively correlated with those of teat skin swabs. Gram-negative bacterial and *Klebsiella* spp. counts on teat swabs were lower for cows housed on bedding treated with lime on day 2 than for cows housed on control bedding and bedding that was replaced daily. Addition of lime to sawdust in the back one-third of the stalls caused a decrease in exposure of teats to environmental mastitis pathogens in bedding for one day.

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888. Bacterial populations on teat ends of dairy cows housed in free stalls and bedded with either sand or sawdust.

Zdanowicz, M.; Shelford, J. A.; Tucker, C. B.; Weary, D. M.; and Von Keyserlingk, M. A. G.

Journal of Dairy Science 87(6): 1694-1701. (June 2004)

NAL Call #: 44.8 J822 ; ISSN: 0022-0302

Descriptors: dairy cows/ teats/ bacterial colonization/ plate count/ litter (bedding)/ sawdust/ sand/ free stalls/ cattle housing/ coliform bacteria/ *Klebsiella*/ *Streptococcus*/

bovine mastitis/ animal pathogenic bacteria/ udders/ udder cleanliness/ stall cleanliness

Abstract: The main objectives of the experiment were: 1) to compare bacterial populations of mastitis-causing organisms on the teats of lactating dairy cattle housed on sand and sawdust bedding and, 2) to examine the relationship between bacterial counts present in the 2 bedding types with those on teat ends. Sixteen lactating Holstein cows were housed on either sand or sawdust-bedded free stalls using a crossover design with 3 wk per bedding type. Bedding samples were collected on d 0 (prior to animals lying on the bedding), 1, 2, and 6. Teat ends were sampled prior to the morning milking on d 1, 2, and 6. All samples were analyzed to determine coliform, *Klebsiella* spp., and *Streptococcus* spp. populations. There were 2 times more coliforms and 6 times more *Klebsiella* bacteria on teat ends of cows housed on sawdust compared with those housed on sand. In contrast, there were 10 times more *Streptococcus* spp. bacteria on teat ends of cows when housed on sand compared with sawdust. In both sawdust and sand bedding, coliforms, *Klebsiella* and *Streptococcus* counts increased over each experimental week, although patterns varied with bedding and bacteria type. Bacterial counts on teat ends were correlated with bacterial counts in sawdust ($r = 0.47$, 0.69 , and 0.60 for coliforms, *Klebsiella* spp., and streptococci, respectively) and in sand ($r = 0.35$ for coliforms and $r = 0.40$ for *Klebsiella* spp.). In conclusion, coliforms and *Klebsiella* spp. on teat ends were more numerous when cows were housed on sawdust bedding, but *Streptococcus* spp. were more numerous on teat ends of cows housed on sand.

This citation is from AGRICOLA.

889. Bagasse as a possible substrate for *Pleurotus ostreatus* (Fr.) Kummer cultivation for the local mushroom farms in the northeast of Thailand.

Vetayasuporn, S.; Chutichudet, P.; and Cho Ruk, K.

Pakistan Journal of Biological Sciences 9(13): 2512-2515. (2006)

NAL Call #: QH301 .P355; ISSN: 1028-8880

Descriptors: bagasse/ crop yield/ cultivation/ edible fungi/ lactic acid bacteria/ mycelium/ sawdust/ substrates/ yeasts/ Lentinaceae/ Poriales

Abstract: Substrate combinations of sawdust and bagasse were used for *P. ostreatus* cultivation in the farmer's mushroom house in the northeast of Thailand, and 6-9 flushes were obtained from these substrates. The substrate combination of 50% bagasse+50% sawdust accelerated the mushroom-growing processes. The mycelial completed colonization, primordium initiation and fruiting body formation were found within 22, 27 and 32 days, respectively. The 100% sawdust+15% effective microorganisms (bacteria that produce lactic acid, yeasts, photosynthetic bacteria, actinomycetes and fungi) solution gave the maximum mushroom yield (536.85 g/1000 g substrate) but this yield was insignificantly different from those found from 100% sawdust substrate+tap water (control; 508.98 g), 75% bagasse+25% sawdust (524.28 g) and 50% bagasse+50% sawdust (494.05 g) at a confidence level of 95%. However, 107.61 and 106.89% of the biological efficiency values were revealed in 75% bagasse+25% sawdust and 50% bagasse+50% sawdust, respectively. The substrate combination of sawdust and

bagasse has shown great potential for use as a raw material since this mixed substrate provides an economically acceptable production alternative for *P. ostreatus* cultivation.
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890. Barley biomass and grain yield and canola seed yield response to land application of wood ash.

Patterson, S. J.; Acharya, S. N.; Thomas, J. E.; Bertschi, A. B.; and Rothwell, R. L.

Agronomy Journal 96(4): 971-977. (July 2004-Aug. 2004)

NAL Call #: 4 AM34P; ISSN: 0002-1962

Descriptors: *Hordeum vulgare*/ barley/ dry matter accumulation/ grain yield/ *Brassica rapa*/ canola/ crop yield/ wood ash/ soil amendments/ application rate/ acid soils/ nitrogen fertilizers/ fertilizer application/ Alberta

Abstract: Wood ash is considered a waste product that accumulates from the burning of wood waste for energy production. Field studies were conducted on acidic Boralf and Eutrochrept soils and in the greenhouse using material from the surface of these soils in randomized complete block designs to evaluate the effectiveness of wood ash as a liming material for improving crop production. For the greenhouse study, soil was treated with the equivalent of 0 to 200 t ha⁻¹ (w/w) wood ash. Barley (*Hordeum vulgare* L.) yielded up to 50% more dry matter in this study. Based on these findings, a 3-yr field study was done to determine the effect of single applications of 6, 12.5, and 25 t ha⁻¹ wood ash to Boralf soils in central Alberta. Significant increases in barley dry matter and grain yield and oil seed yields of canola (*Brassica rapa* L.) were observed when soil was supplemented with 12.5 or 25 t ha⁻¹ along with N fertilizer. Increases of 72 and 50% in barley dry matter and grain yield were observed while canola oilseed yield increased 124% due to wood ash application. Applications up to 25 t ha⁻¹ did not have a deleterious effect on biomass or seed production in barley or canola crops. Results show that land application of wood ash increased pH and nutrient content of acid soils while having a beneficial effect on crop production. Land application of wood ash can provide timber companies with a viable alternative to landfill disposal.

This citation is from AGRICOLA.

891. Barley dry matter yield, crop uptake, and soil nutrients under fresh and composted manure containing straw or wood-chip bedding.

Miller, J. J.; Beasley, B. W.; Larney, F. J.; and Olson, B. M.

Canadian Journal of Plant Science 84(4): 987-999. (2004)

NAL Call #: 450 C16; ISSN: 00084220 [CPSLA]

Descriptors: barley yield/ bedding/ compost/ fresh manure/ nutrient uptake/ soil nutrients/ barley/ compost/ fertilizer application/ manure/ nutrient uptake/ yield/ alberta/ canada/ great plains/ North America/ western hemisphere/ world/ *bos taurus*/ *hordeum*/ *hordeum vulgare*/ *hordeum vulgare* subsp. *vulgare*

Abstract: Limited information exists on the effect of fresh versus composted beef cattle manure containing straw or wood chips on barley (*Hordeum vulgare*) yield, nutrient uptake, and soil nutrient status in the Great Plains region of North America. Barley was grown on an irrigated clay loam soil in southern Alberta from 1999 to 2001. The treatments

were three rates (13, 39, 77 Mg dry material per hectare) of fresh manure (FM) or composted manure (CM) containing either straw (ST) or wood-chip (WD) bedding, one inorganic (IN) fertilizer treatment (100 kg N ha⁻¹, 17 kg P ha⁻¹), and a control treatment; applied in the fall of 1998, 1999, and 2000. Dry matter yield was not significantly ($P > 0.05$) influenced by manure type or bedding material. Crop protein was 7% higher under FM (12.7 g kg⁻¹) than CM (11.9 g kg⁻¹) in 2001, and crop N uptake was 11 to 13% higher for CM-ST (171.3 kg ha⁻¹) and FM-WD (174.9 kg ha⁻¹) than CM-WD (154.7 kg ha⁻¹) over the 3 yr. Soil available N was 20 to 261% higher for FM than CM at the 39 and 77 Mg ha⁻¹ rates, and it was 62 to 199% higher for FM than CM in 2000 and 2001. Soil available N was 48 to 57% higher for ST than WD at the two higher application rates, and it was 26 to 65% higher for ST than WD in all 3 yr. Overall, manure type and bedding influenced certain crop and soil parameters, and higher available soil N under FM and ST indicated a potential for greater mineralization under these treatments.

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892. Bedding and within-pen location effects on feedlot pen runoff quality using a rainfall simulator.

Miller, J. J.; Olson, E. C.; Chanasyk, D. S.; Beasley, B. W.; Yanke, L. J.; Larney, F. J.; McAllister, T. A.; Olson, B. M.; and Selinger, L. B.

Journal of Environmental Quality 35(2): 505-15. (Mar. 2006-Apr. 2006)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: Alberta/ animal husbandry/ animals/ cattle/ chlorides: analysis/ colony count, microbial/ enterobacteriaceae: isolation & purification/ *escherichia coli*: isolation & purification/ hydrogen-ion concentration/ nitrogen: analysis/ oxygen: analysis/ phosphorus: analysis/ potassium: analysis/ quaternary ammonium compounds: analysis/ rain/ sodium: analysis/ sulfates: analysis/ water microbiology/ water movements/ water pollutants: analysis

Abstract: Soluble salts, nutrients, and pathogenic bacteria in feedlot-pen runoff have the potential to cause pollution of the environment. A 2-yr study (1998-1999) was conducted at a beef cattle (*Bos taurus*) feedlot in southern Alberta, Canada, to determine the effect of bedding material [barley (*Hordeum vulgare* L.) straw versus wood chips] and within-pen location on the chemical and bacterial properties of pen-floor runoff. Runoff was generated with a portable rainfall simulator and analyzed for chemical content (nitrogen [N], phosphorus [P], soluble salts, electrical conductivity [EC], sodium adsorption ratio [SAR], dissolved oxygen [DO], and pH) and populations of three groups of bacteria (*Escherichia coli*, total coliforms, total aerobic heterotrophs at 27 degrees C) in 1998 and 1999. Bedding had a significant ($P < \text{or} = 0.05$) effect on NH₄-N concentration and load in 1999, SO₄ load in 1998, SO₄ concentration and load in 1999, and total coliforms in both years; where these three variables were higher in wood than straw pens. Location had a significant effect on EC and concentrations of total Kjeldahl nitrogen (TKN), Na, K, SO₄, and Cl in 1998, and total coliforms in both years. These seven variables were higher at the bedding pack than pen floor location, indicating that bedding packs were major reservoirs of TKN, soluble salts, and total coliforms. Significantly higher dissolved reactive phosphorus (DRP),

total P, and NH₄-N concentrations and loads at the bedding pack location in wood pens in 1998, and a similar trend for TKN concentration in 1999, indicated that this bedding-location treatment was a greater source of nutrients to runoff than the other three bedding-location treatments. Bedding, location, and their interaction may therefore be a potential tool to manage nutrients, soluble salts, and bacteria in feedlot runoff.
This citation is from PubMed.

893. Bedding on geotextile mattresses: How much is needed to improve cow comfort?

Tucker, C. B. and Weary, D. M.
Journal of Dairy Science 87(9): 2889-95. (Sept. 2004)
NAL Call #: 44.8 J822; ISSN: 0022-0302
Descriptors: animals/ bedding and linens: veterinary/ behavior, animal/ cattle: physiology/ female/ housing, animal/ posture/ textiles/ wood
Abstract: The objective of our study was to evaluate how the amount of sawdust bedding on mattresses affects dairy cattle behavior and preferences. Eleven nonlactating, multiparous cows were housed individually in pens with access to 3 free stalls. Each stall was fitted with a geotextile mattress covered with either 0, 1, or 7.5 kg of kiln-dried sawdust. The experiment began with 7 d of acclimatization to all 3 stalls. Cows were then allowed access to only 1 of the 3 stalls at a time, each for 3 d (restriction phase). At the end of this restriction phase, cows were allowed free access to all 3 stalls for 3 d (free-choice phase). Time spent lying and the number of lying bouts increased significantly with the amount of bedding, from 12.3 +/- 0.53 h lying and 8.5 +/- 0.62 bouts per 24 h on bare mattresses to 13.8 +/- 0.53 h lying and 10.0 +/- 0.62 bouts per 24 h on mattresses with 7.5 kg of sawdust. In addition, the animals spent less time standing with only the front hooves in the stalls when more sawdust was present. When allowed free access to all 3 options, all 11 animals spent a majority of their time lying and standing in the 7.5-kg option. In conclusion, cows preferred mattresses bedded with 7.5 kg of sawdust, on which they spent more time lying down and less time standing with only the front hooves in stalls. These results indicate that more sawdust bedding improves cow comfort in stalls with geotextile mattresses.
This citation is from PubMed.

894. Beneficial use of wood ash as an agricultural soil amendment: Case studies from the United States forest products industry.

Vance, E. D. and Mitchell, C. C.
In: Land Application of Agricultural, Industrial, and Municipal By-Products.
Madison, Wis., USA : Soil Science Society of America, 2000; pp. 567-582.
Descriptors: application to land/ field crops/ soil amendments/ soil properties/ trees/ waste utilization/ wastes/ wood ash/ woody plants/ land application/ United States of America
Abstract: Six case studies of individual forest products companies who have developed successful ash application programmes in Louisiana, Washington, Wisconsin and Alabama are discussed. Results from programme research trials and demonstration plots on the effects of ash on soil properties and crop and tree growth are also summarized.
This citation is from AGRICOLA.

895. Beneficial use of wtp residuals and wood ash on agricultural and forest lands.

Vance, E.
In: Proceedings of the 2000 NCASI West Coast Regional Meeting.
Portland, OR; pp. 195-197; 2000.
Notes: Conference code: 60432.
Descriptors: agricultural engineering/ fertilizers/ land fill/ leaching/ moisture/ weed control/ wood products/ forest lands/ forestry/ agriculture/ fertilizers/ forestry/ land fill/ leaching/ moisture/ weed control/ wood products
Abstract: The beneficial use of WTP residuals and wood ash on agricultural and forest lands was discussed. Some of the advantages of land application as a beneficial use are reduced landfill costs, minimal processing and increased forest productivity. Various factors related to the Willamette program were presented.
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896. Biodegradation of nonlignocellulosic substances. II. Physical and chemical properties of sawdust before and after use as artificial soil.

Horisawa, S.; Sunagawa, M.; Tamai, Y.; Matsuoka, Y.; Miura, T.; and Terazawa, M.
Journal of Wood Science 45(6): 492-497. (1999); ISSN: 1435-0211
Descriptors: sawdust/ lignocellulose/ biodegradation/ growing media / water holding capacity/ physicochemical properties/ mechanical damage/ anatomy and morphology/ ultrastructure/ municipal solid waste/ waste treatment/ specific gravity/ cellulose/ adhesion/ porosity/ abrasion/ evaluation/ hollocellulose
This citation is from AGRICOLA.

897. Biofiltration using partially stabilized hog manure compost.

Hong, J.-H.; Keener, H. M.; and Elwell, D. L.
In: 2000 ASAE Annual International Meeting, Technical Papers: Engineering Solutions for a New Century.; Vol. 2. Milwaukee, WI.; pp. 4543-4555; 2000.
Notes: Conference code: 62828.
Descriptors: aeration / ammonia emission/ biofiltration/ composting/ decomposition/ odors/ stabilization/ ammonia/ composting/ decomposition/ filtration/ moisture/ odors/ raw materials/ sawdust/ stabilization/ aeration/ ammonia emissions/ biofiltration/ continuous aeration (ca)/ manures
Abstract: Hog manure amended with sawdust (moisture 56-60% wet basis, C/N 19-21) was composted in pilot-scale vessels using continuous aeration (CA) and intermittent aeration (IA) for 3 and 4 weeks. In two subsequent runs of the same duration, composts resulting from each of the first runs were used as a biofilter on the output air from newly composting material. Conditions between each of these paired sets appeared to be similar. Ammonia was released from the biofilter material during the first week of stabilization while the compost produced ammonia after the first week of composting. In both cases substantial absorption, 61-82%, of ammonia production from the composting raw material was achieved in the stabilizing material during the final weeks of operation and indicates use of the stabilizing hog manure/sawdust compost as a biofilter can reduce ammonia emissions. Total NH₃-N

emissions during run 2 for IA was less than two thirds that of the CA process. Dry solids loss for the stabilized compost (6-8 weeks) was 20-45%.

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898. Biological activity of deflated chestnut soils treated with bark, sawdust, and straw composts in the Baikal region.

Korsunova, Ts D. Ts and Chimitdorzhieva, G. D.

Agrokhimiya 4: 15-19. (2008); ISSN: 0002-1881

Descriptors: chestnut / soil/ sawdust/ wood waste/ biological processes

Abstract: The work is devoted to search for alternate sources of organic fertilizers stimulating biological processes in the soil. Changes in biological activity of chestnut soil under the effect of waste from timber and woodworking industries and agricultural production (bark, sawdust, and straw) were studied. The increase in biological activity of soil under the effect and aftereffect of composts suggests that these wastes are highly efficient organic fertilizers and can be used for increasing soil fertility.

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899. Botanical composition, herbage production and plant mineral contents as affected by application of chemical fertilizer and fermented sawdust pig manure on Cheju brown volcanic ash pasture soil.

Kim, MoonChul; Hyun, HaeNam; and Lee, SungCheol

Journal of the Korean Society of Grassland Science 20(2): 131-138. (2000)

NAL Call #: SB202.K6H352; ISSN: 1013-9354

Descriptors: application rates/ biomass production/ botanical composition/ composts/ crop yield/ grasslands/ nitrogen fertilizers/ pig manure/ sawdust/ sown grasslands/ South Korea/ sown pastures

Abstract: In trials at Cheju Island, Korea Republic from September 1997 to October 1998 the effect of pig manure composted with sawdust (PMC) application on the herbage production on a mixed sown grassland of *Dactylis glomerata*, *Lolium perenne* and *Trifolium repens* in the Cheju brown volcanic ash soil was investigated. Split plot design (main plot: 3 nitrogen application rates of 0, 150 and 300 kg/ha; sub plot: 4 PMC rates of 0, 3, 6 and 12 tons/ha) was used. Plant height and dry matter yield increased significantly with increase in N and PMC rates. There was no difference in the botanical composition of grasses as affected by PMC application rate, but herbage yields of grass species were increased by N application. Proportion of *T. repens* in the sward decreased with increase in N application, but increased with increase of PMC rate. Percentages of weeds were not affected by application rates of N fertilizer and PMC in the mixed species pasture. N, P and K contents of species in the pasture significantly increased with increasing application rates of N fertilizer. It is considered optimum to apply 150 kg N/ha and either 3 or 6 tons/ha of PMC for production of mixed sown grassland on Cheju Island.

This citation is from AGRICOLA.

900. Bovine mortality composting in northern Utah.

Trinca, L. A.; Miller, B.; and Beard, F. R.

In: ASAE/CSAE SCGR Annual International Meeting.Toronto, Ontario, Canada.); pp. 11 pp; 1999.

Descriptors: application to land/ carcasses/ characterization/ climate/ composting/ composts/ decomposition/ mortality/ sawdust/ straw/ temperature/ treatment/ wheat/ wheat straw/ death rate/ land application/ United States of America

Abstract: The objectives of this project were to develop methods of bovine mortality composting that would perform effectively within Northern Utah's (USA) arid climate and be acceptable to local dairy operators from an economic and labour perspective. Ten adult Holstein mortality compost trial replicates were established in June of 1998, five using wheat straw and five using coarse sized soft-wood sawdust as co-composting material. After 15 and 23 weeks, each replicate was opened, photographed, characterized as to carcass decomposition, aerated and re-covered. Interior temperatures of piles reached their operating peak near 60 C and 48.8 C for sawdust and straw piles, respectively. Piles maintained temperatures equal to or above ambient conditions through December. The study showed that either composting material effectively disposed of the carcass. The straw treatments decomposed more rapidly even though the operating temperatures was lower. In May of 1999, the compost treatments were land-applied and incorporated on agricultural ground.

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901. Broiler litter supplementation improves storage and feed-nutritional value of sawdust-based spent mushroom substrate.

Kwak, W. S.; Jung, S. H.; and Kim, Y. I.

Bioresource Technology 99(8): 2947-2955. (May 2008)

NAL Call #: TD930.A32; ISSN: 0960-8524

Descriptors: broiler litter/ storage/ feed-nutritional value/ sawdust/ mushroom

Abstract: A study was conducted to determine the effect of broiler poultry litter (BL) supplementation to spent mushroom substrate (SMS) on its storage and feed-nutritional value improvement. In Exp. 1, the sawdust-based SMS from a king oyster mushroom (*Pleurotus eryngii*) farm was mixed with BL at 0%, 25%, 50%, 75% and 100% levels on a wet basis and deepstack stored for short-term (1-wk) and long-term (3-wk). At 1-wk of short-term deepstack storage, SMS with more than 50% BL levels showed favorable conservation. At 3-wk of long-term storage, all treatments except for BL 100% had a serious fungal problem. Based on chemical parameters, BL-blending to SMS practically improved the feed-nutritional value of the mixtures. Since the deepstacking method was not effective for long term storage, in Exp. 2 SMS ensiled with or without BL was attempted to improve long-term (3-wk) storage. All the ensiled treatments (SMS 100%, SMS 75%+BL 25% and SMS 50%+BL 50%) had desirable fermentation. As in deepstacking, BL-blending to SMS improved the nutritive value of the ensiled mixtures. The populations of total bacteria, lactic acid bacteria and yeast were highest ($P < 0.05$) when 75% SMS was blended with 25% BL. In conclusion, blending 50% or more BL with SMS was effective for the short-term (1-wk) deepstack storage. For long-term (3-wk) storage of SMS, an ensiling method was effective with or without the addition of BL.

This citation is from AGRICOLA.

902. Broiler performance on different types of litter at different depths in summer.

Malakar, P. K.; Fouzder, S. K.; Ahmed, M.; and Wahid, M. A.

Bangladesh Veterinarian 19(1): 34-38. (2002); ISSN: 1012-5949

Descriptors: animal welfare/ broiler performance/ broilers/ chicks/ depth/ litter/ poultry/ poultry housing/ rice/ rice husks/ rice straw/ sawdust/ straw/ summer/ animal rights/ chickens/ domesticated birds/ paddy/ rice hulls

Abstract: A total of 144 day-old straight-run Shaver Starbro broiler chicks were reared on sawdust, chopped rice straw and rice husk litter at different depths (5.08, 6.35 and 7.62 cm) for a period of 49 days to examine the influence of the type and depth of litter on broiler performance. Results indicate that body weight, feed consumption, feed conversion and production number were not significantly affected by litter type and depth. Livability was influenced by the type of litter. No pathological symptoms were found to be detrimental to the survivability of birds and no visual indications of breast blisters or leg abnormalities were found. Major production variables (weight gain, feed intake, feed efficiency, survivability and cost of litter/kg meat) indicate that chopped rice straw with a depth of 6.35 cm is the most suitable litter for raising broilers during summer. Reproduced with permission from the CAB Abstracts database.

903. Carbon addition alters vegetation composition on ex-arable fields.

Eschen, R.; Mortimer, S. R.; Lawson, C. S.; Edwards, A. R.; Brook, A. J.; Igual, J. M.; Hedlund, K.; and Schaffner, U.

Journal of Applied Ecology 44(1): 95-104. (2007)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: abandoned land/ arable land/ botanical composition/ carbon/ forbs/ immobilization/ nitrate/ nutrient availability/ sawdust/ sugar/ wood chips/ Britain/ microbial communities/ restoration ecology/ United Kingdom

Abstract: Recent changes in European agricultural policy have led to measures to reverse the loss of species-rich grasslands through the creation of new areas on ex-arable land. Ex-arable soils are often characterized by high inorganic nitrogen (N) levels, which lead to the rapid establishment of annual and fast-growing perennial species during the initial phase of habitat creation. The addition of carbon (C) to the soil has been suggested as a countermeasure to reduce plant-available N and alter competitive interactions among plant species. To test the effect of C addition on habitat creation on ex-arable land, an experiment was set up on two recently abandoned fields in Switzerland and on two 6-year-old restoration sites in the UK. Carbon was added as a mixture of either sugar and sawdust or wood chips and sawdust during a period of 2 years. The effects of C addition on soil parameters and vegetation composition were assessed during the period of C additions and 1 year thereafter. Soil nitrate concentrations were reduced at all sites within weeks of the first C addition, and remained low until cessation of the C additions. The overall effect of C addition on vegetation was a reduction in above-ground biomass and cover. At the Swiss sites, the addition of sugar and sawdust led to a relative increase in legume and forb cover and to a

decrease in grass cover. The soil N availability, composition of soil micro-organisms and vegetation characteristics continued to be affected after cessation of C additions. Synthesis and applications. The results suggest that C addition in grassland restoration is a useful management method to reduce N availability on ex-arable land. Carbon addition alters the vegetation composition by creating gaps in the vegetation that facilitates the establishment of late-seral plant species, and is most effective when started immediately after the abandonment of arable fields and applied over several years.

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904. Changes in chemical properties and temperature during the composting of tobacco waste with other organic materials, and effects of resulting composts on lettuce (*Lactuca sativa* L.) and spinach (*Spinacea oleracea* L.).

Adediran, J. A.; Mnkeni, P. N. S.; Mafu, N. C.; and Muyima, N. Y. O.

Biological Agriculture and Horticulture 22(2): 101-119. (2004)

NAL Call #: S605.5.B5 ; ISSN: 0144-8765

Descriptors: cattle dung/ composting/ composts/ electrical conductivity/ lettuces/ microbial activities/ mineralization/ nitrogen/ organic wastes/ pH/ pig manure/ poultry manure/ sawdust/ spinach/ temperature/ tobacco/ wood shavings/ hydrogen ion concentration/ potential of hydrogen/ poultry litter

Abstract: This study: (i) investigated changes that take place during the composting of tobacco wastes with other organic materials in Eastern Cape, South Africa; (ii) characterized the resulting composts; and (iii) evaluated their agronomic effectiveness. Four composts were made, all of which contained tobacco waste and sawdust/wood shavings but differed in the third ingredient, which was either cow dung, pig dung, poultry manure or cabbage waste. Changes in pH and electrical conductivity (EC) during composting were consistent with those generally observed, in spite of the presence of toxic tobacco wastes. Changes in temperature regime and the results of a bioassay (germination test) suggested that compost maturity was achieved after 45-59 days in all four composts. Mixing of tobacco waste with other organic wastes reduced the nicotine content of tobacco wastes from 12180 mg kg⁻¹ to 4872 mg kg⁻¹ by dilution while composting reduced it further to <160 mg kg⁻¹ in the final composts. Tobacco waste had a depressing effect on microbial activity in soil but the composts stimulated it, possibly as a result of their lower EC and reduced nicotine and related alkaloid levels. All final composts had C:N ratios <17 and so were considered conducive to N mineralization and thus suitable for horticultural use. However, they had high electrical conductivity (6.0 to 9.3 mS cm⁻¹) and may not be ideal for salt-sensitive crops or as sole components in horticultural growing media without modification. Application of the composts to soil (to supply 80 mg N kg⁻¹) improved the growth of lettuce relative to the control and uncomposted tobacco waste but full growth potential was not attained due to inadequate nitrogen supply. A subsequent experiment with spinach designed to

address the N limitation revealed that satisfactory yields could be obtained by the application of 20 t ha⁻¹ cow dung compost or 10 t ha⁻¹ compost in combination with NPK fertilizer supplying 50 kg N ha⁻¹.
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905. Changes in concentrations of malodorous compounds during controlled aeration composting.

Elwell, D. L.; Borger, D. C.; Blaho, D. V.; Fahrni, J. K.; Keener, H. M.; and Willett, L. B.
Compost Science and Utilization 12(2): 102-107. (2004)
NAL Call #: TD796.5.C58 ; ISSN: 1065-657X
Descriptors: acetates / aeration/ air flow/ ammonia/ animal manures/ ash / butyrates/ carbon dioxide/ carbon nitrogen ratio/ composting/ dairy wastes/ fatty acids/ odours/ oxygen/ P cresol/ pH/ phenolic compounds/ propionates/ sawdust/ skatole/ temperature/ methylindole/ methylphenol/ hydrogen ion concentration/ odors/ potential of hydrogen/ smells

Abstract: Effects of composting on odorous chemicals in dairy manure were investigated in replicated pilot-scale studies. Three 16-day composting trials were conducted, using 205 L vessels containing 83 kg mass. Fresh or 12-day-aged manure, from lactating cows, was mixed with sawdust (3man:1saw w/w). Vessels were either aerated continuously with high (2.3 kg/hr)/low (0.8 kg/hr) air flow controlled by thermostats or intermittently on a 5 min high air flow/55 min off clock controlled cycle. Six vessel replicates were conducted on each manure/air flow treatment combination. Temperatures, air flow, O₂ consumption, and CO₂ production were recorded every 10 minutes. Trapped NH₃ emissions were determined daily. Exhaust air was passed through water-cooled condensers to analyze emitted volatiles, and condensate volume, pH, and volatile fatty acids (VFAs) were quantified at 12 or 24 hour intervals. Solids were collected from each vessel initially, at remix at the end of day 7, and at the end of each trial (day 16) for analysis of moisture, pH, ash, C/N, and odorants. Phenolics and indolics were extracted with ethyl ether. VFAs were recovered with pH 2.0 water. Analysis was by flame or mass selective detection gas chromatography. Temperature increased most rapidly in continuously aerated vessels yet maintained a lower mean temperature (49 vs 58 degrees C) than intermittent aeration. Both returned to near ambient temperature by day 16. Continuous aeration nearly doubled (11 vs 18 L) the amount of condensate released over 16 days. Fresh manure/sawdust mixes contained 6553, 795, 77, 51, 19, and 17 micro g/g of acetate, propionate, isobutyrate, isovalerate, phenol, and p-cresol. Aged manure mixes contained 9350, 3397, 2810, 445, 285, 441, 34, 176, and 18 micro g/g acetate, propionate, butyrate, valerate, isobutyrate, isovalerate, phenol, p-cresol, and skatole, as well as a number of C₁₁ to C₁₇ fatty acids. Both aeration methods maintained conditions that resulted in the destruction of most of the odorous chemicals studied in the composting mass in 7 days with only small quantities of acetate, isobutyrate, and skatole present by the end of day 16. Continuous aeration, as opposed to intermittent, more than doubled (115 vs 55 g) the emissions of NH₃-N and increased the emissions of VFAs in condensate four-fold.

Whereas, limited aeration did not destroy the odorants as rapidly, they remained in the compost until destruction.
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906. Changes in fungal communities in abandoned farmland soil enriched with pine sawdust.

Sierota, Z. and Kwasna, H.
Folia Forestalia Polonica Serie A, Lesnictwo 40: 85-94. (1998); ISSN: 0071-6677
Descriptors: abandoned land/ agricultural land/ agricultural soils/ calcium/ nitrogen/ plant pathogenic fungi/ plant pathogens/ plant pathology/ potassium/ sawdust/ soil amendments/ soil chemistry/ soil fungi/ soil organic matter/ Coelomycetes/ Diaplella coniothyrium/ farmland/ Hyphomycetes/ isolates/ mitosporic fungi/ Mortierella alpina/ Mortierellaceae/ Myxotrichaceae/ Onygenales/ organic matter in soil/ Paecilomyces marquandii/ Penicillium adametzii/ Penicillium janczewskii / Penicillium jensenii/ Penicillium spinulosum/ Penicillium vinaceum/ phytopathogens/ phytopathology/ Pseudogymnoascus/ Pseudogymnoascus roseus/ Zygomycetes
Abstract: In autumn 1995, pine sawdust was applied to abandoned farmlands in Poland not cultivated for 3 years and chemical and mycological analyses were performed. Two years later, the soil was re-examined and results were compared. Before sawdust application 350 fungal isolates belonging to 58 species were found in soil samples (the most common were Paecilomyces marquandii, Penicillium janczewskii, Pseudogymnoascus roseus, Coniothyrium fuckelii and Penicillium jensenii). Two years later, 246 isolates from 27 species (the most common were P. marquandii, C. fuckelii, Penicillium adametzii, P. verruculosum and P. vinaceum) were found in the control soil samples (without sawdust), and 186 isolates from 40 species (the most common were Mortierella alpina, Trichoderma harzianum, Penicillium spinulosum, P. chrysogenum and C. fuckelii) were found in the treated soil (with sawdust). In the treated soil a significant increase in carbon, nitrogen, potassium and calcium content as well as C/N ratio was also recorded.
This citation is from AGRICOLA.

907. Changes in physico-chemical and biochemical parameters of soil following addition of wood ash: A field experiment.

Perucci, Piero; Monaci, Elga; Onofri, Andrea; Vischetti, Costantino; and Casucci, Cristiano
European Journal of Agronomy 28(3): 155-161. (Apr. 2008); ISSN: 1161-0301
Descriptors: wood ash / waste disposal/ soil physical properties/ soil chemical properties/ soil biological properties/ electrical conductivity/ soil pH/ soil microorganisms/ carbon/ nitrogen/ enzymatic hydrolysis/ field experimentation / temporal variation/ application rate/ carbon nitrogen ratio/ enzyme activity/ microbial activity/ waste management/ Italy
Abstract: Here we have investigated the effects of the addition of two different wood ash sizes at two different doses (5 and 20t/ha) on the physico-chemical, microbiological and biochemical properties in the surface soil (0-30cm) of an Italian agricultural system. Over 24

months, the pH, electrical conductivity, soil microbial biomass-C and -N, and total hydrolytic activity were periodically tested, together with alkaline phosphatase, arylsulphatase and o-diphenoloxidase activities. Analysis of variance (ANOVA) was performed to consider the effects of sampling time and wood ash addition on the parameters tested and to reveal possible interactions between the two variables. For electrical conductivity, pH, soil microbial biomass-C and total hydrolytic activity the ANOVA showed a significant 'wood ash type x sampling time' interaction, while no interaction was found for the other enzymatic activities. Significant increases in pH and in electrical conductivity were seen over the first months in all of the treated samples, which were more pronounced at the higher dose. Decreases in microbial biomass-C and changes in the microbial C/N ratios were seen for all of the treatments, which were more pronounced at the higher dose. Increases in soil microbial activity were seen over the first 8 months. The alkaline phosphatase and arylsulphatase activities were significantly inhibited for the first 4 months of soil treatment. The significant increases seen in o-diphenoloxidase activity over the first 8 months under all of the treatments appear to be related to the increases in electrical conductivity. After 12 months, the levels of all of the parameters tested in the treated soils returned to the levels of the untreated soils indicating that the disposal of up to 20t/ha of wood ash per year in Italian agricultural soil does not result in long-term changes in any of these parameters.

This citation is from AGRICOLA.

908. Characteristics of functional and nutritious soilless culture substrate for vegetables.

Zhu, S.; Xu, W.; and Zhao, G.

Journal of Applied Ecology 13(4): 425-8. (Apr. 2002); ISSN: 1001-9332 .

Notes: Article in Chinese. Original journal title: Ying Yong Sheng Tai Xue Bao.

Descriptors: Cucumis sativus: growth & development/ culture media: chemistry/ Lycopersicon esculentum: growth & development/ nitrogen: metabolism / phosphorus: metabolism/ potassium: metabolism/ vegetables: growth & development

Abstract: A functional and nutritious substrate for soilless culture, which consists of peanut shell, sawdust, vermiculite, chicken manure, coal cinder, etc, was used to grow cucumbers, tomatoes and peppers in this experiment. The results showed that the substrate was rich in organic matter, N, available P and K, in which the nutrients were basically in balance for three vegetables. High content of microorganisms and high activity of soil enzymes were propitious to the transformation of organic components in the substrate. The yields of cucumber, tomato and pepper increased by 23.83%, 27.34% and 32.98%, respectively. The production value of peppers increased by 180.85%, and its net income increased by 109.69%. The qualities of three vegetables were coincident with 'harmless vegetable' standards.

This citation is from PubMed.

909. Characteristics of wood ash and influence on soil properties and nutrient uptake: An overview.

Demeyer, A.; Voundi Nkana, J. C.; and Verloo, M. G.

Bioresour. Technology 77(3): 287-95. (May 2001)

NAL Call #: TD930.A32; ISSN: 0960-8524

Descriptors: hydrogen ion concentration/ industrial waste/ industry/ soil: analysis/ soil microbiology/ soil pollutants: analysis/ time factors/ waste management: methods/ wood

Abstract: Wood industries and power plants generate enormous quantities of wood ash. Disposal in landfills has been for long a common method for removal. New regulations for conserving the environment have raised the costs of landfill disposal and added to the difficulties for acquiring new sites for disposal. Over a few decades a number of studies have been carried out on the utilization of wood ashes in agriculture and forestry as an alternative method for disposal. Because of their properties and their influence on soil chemistry the utilization of wood ashes is particularly suited for the fertility management of tropical acid soils and forest soils. This review principally focuses on ash from the wood industry and power plants and considers its physical, chemical and mineralogical characteristics, its effect on soil properties, on the availability of nutrient elements and on the growth and chemical composition of crops and trees, as well as its impact on the environment.

This citation is from PubMed.

910. Chemical and physical properties of soil amended with pecan wood chips.

Tahboub, M. B.; Lindemann, W. C.; and Murray, L.

HortScience: A Publication of the American Society for Horticultural Science 43(3): 891-896. (June 2008)

NAL Call #: SB1.H6; ISSN: 0018-5345

Descriptors: chemical properties/ physical properties/ soil amendment/ wood chips

Abstract: The pruning wood of pecan [*Carya illinoensis* (Wangenh.) K. Koch] is often burned. Chipping and soil incorporation of pruning wood is becoming more popular as a result of environmental constraints on burning. The objective of our research was to determine how pecan wood incorporation into soil affects the soil chemical and physical properties. Pecan wood chips were incorporated into a silty clay soil at rates of 0, 4484, 8968, 13,452, and 17,936 kgp"ha-1 in Summer 2002, 2003, and 2004. Some plots received nitrogen at a rate of 0, 15.2, 30.5, 45.7, and 61.0 kgp"ha-1 to adjust the C : N ratio of trimmings to 30 : 1. Ammonium sulfate, as a nitrogen source to balance the C : N ratio of pecan wood chips, reduced soil pH. However, the wood chip amendments alone did not reduce soil pH. Soil salinity (as determined by electrical conductivity) and bulk density were unaffected by wood chip incorporation regardless of application rate or number of applications. Incorporation of pecan chips had little effect on soil moisture content, but the soil had an inherently high waterholding capacity. Pecan wood chip incorporation significantly increased soil organic matter content and aggregate stability, particularly at the higher application rates and with repeated amendment. The incorporation of pecan pruning wood into the soil appears to improve soil tilth and aggregation while providing growers with an environmentally acceptable means of disposal.

This citation is from AGRICOLA.

911. Chemical and physicochemical characterization of humic acid -like materials from composts.

Quatman, A.; D'Orazio, V.; Hafidi, M.; and Senesi, N.

Compost Science and Utilization 10(1): 39-46. (2002)

NAL Call #: TD796.5.C58 ; ISSN: 1065-657X

Descriptors: chemical composition/ composts/ farmyard

manure/ fulvic acids/ humic acids/ nitrogen/ organic wastes/ sawdust/ FYM

Abstract: Humic acid (HA)-like materials were extracted from composts prepared from domestic organic wastes (HADu), sawdust (HAsC), used coffee (HACf), and farmyard manure (HAFm). The HA-like fractions were characterized for elemental composition, E_4/E_6 ratio, and structural and functional properties by Fourier-transform infrared (FTIR), fluorescence and electron spin resonance (ESR) spectroscopies. Elemental composition and E_4/E_6 ratios were similar to those characteristic of young humic matter. Nitrogen content was related to that in the initial waste being high for HADu and HACf and low for HAFm and HAsC. FTIR spectra of HADu and HACf were dominated by absorptions of N-containing groups (1650 and 1540 cm^{-1}), whereas those of HAsC and HAFm were dominated by bands of aromatic structures (1595, 1511, 1418 and 1125 cm^{-1}). Data from ESR and fluorescence spectroscopy were similar for all the HA-like fractions analysed. The low free radical concentrations and type of fluorescence patterns suggested simple structural components, low degree of aromatic polycondensation and low level of conjugated chromophores. In conclusion, HA-like substances obtained from composted materials exhibited an elemental composition related to the nature of the initial wastes and general characteristics close to those of soil fulvic acids rather than soil HAs.

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912. Chemical effects of wood ash on plant growth in tropical acid soils.

Nkana, J. C. V.; Demeyer, A.; and Verloo, M. G. *Bioresource Technology* 63(3): 251-260. (1998)

NAL Call #: TD930.A32 ; ISSN: 0960-8524

Descriptors: acid soils/ calcium fertilizers/ effects/ lime/ potassium fertilizers/ soil pH/ trace elements/ tropical soils/ Ultisols/ wood ash/ microelements/ potash fertilizers

Abstract: A greenhouse study was conducted to compare chemical effects of wood ash and CaCO_3 on the growth of rye grass (*Lolium perenne*) in three tropical acid soils (Kandiudults) from the forest zone of Central Cameroon. Amendments were applied at rates to attain target pH values of 5.5, 6.0 and 6.5. Generally, plants grown on ash-amended soils showed higher biomass production than did plants grown on lime and control treatments. After wood ash application, plants benefited from Ca and K supplementation, the synergy K-NO_3^- and from changes in soil chemistry similar to lime application: higher ECEC and reduced Al and Mn toxicity. Therefore, wood ash appeared at the same time as a neutralizer of soil acidity and as a supplier of nutrients for tropical acid soils.

This citation is from AGRICOLA.

913. Co-composting of poultry manure with low quantities of carbon-rich materials.

Silva, M. E.; Lemos, L. T.; Cunha-Queda, A. C.; and Nunes, O. C.

Waste Management Resources 27(2): 119-28. (Mar. 2009); ISSN: 0734-242X

Descriptors: composting/ poultry manure/ carbon-rich materials

Abstract: To study the feasibility of co-composting poultry manure with low quantities of high-value, carbon-rich materials experiments to characterize three pilot-scale piles were carried out. The piles comprised poultry manure (pile 1), poultry manure and straw (pile 2) and poultry manure and sawdust (pile 3), using wood chips as bulking agent. Pile 1 presented the highest losses of organic matter and nitrogen contents ($\geq 92.9\%$ and 92.0% , respectively). Although a thermophilic phase (temperature > 40 degrees C) was not verified for this pile, the final compost was stable (class IV) and free of pathogen indicator micro-organisms but it was the most phytotoxic, and presented a humic and fulvic acids ratio (HA/FA) that was less than 1. In contrast, piles 2 and 3 sustained thermophilic phases and produced stable (class V) and mature (HA/FA > 1) composts. Pile 2 showed the lowest loss in nitrogen content (88.9%) and produced the final compost with the highest C/N ratio (14.7) and the lowest value of electrical conductivity (3.9 mS cm^{-1}). This study showed that it is possible to reduce the costs of poultry manure composting, namely the costs associated with the use of carbon-rich materials, given that the final co-composts presented parameters within the range of those recommended by the Second Draft Proposal for compost quality. This citation is from PubMed.

914. Co-composting solid swine manure with pine sawdust as organic substrate.

Zhang, Yun and He, Yong

Bioresource Technology 97(16): 2024-2031. (2006)

NAL Call #: TD930.A32; ISSN: 0960-8524

Descriptors: aeration / carbon nitrogen ratio/ chemical composition/ composting/ composts/ decomposition/ electrical conductivity/ humidity/ leaves/ moisture content/ nitrogen/ organic carbon/ organic matter/ pH/ phosphorus/ physicochemical properties/ pig manure/ pines/ plant residues/ sawdust/ sludges/ substrates/ tea/ temperature/ urea/ waste management/ waste utilization/ hydrogen ion concentration/ potential of hydrogen

Abstract: The main objectives of this work were to investigate the evolution of the principal physicochemical properties, i.e., bulk temperature, pH, electrical conductivity (EC), moisture content, total organic matter, total nitrogen and total phosphorus, in co-composting pine sawdust with increasing percentages of fresh solid swine manure, and thus to evaluate the most desirable manure proportion for producing organic substrates in consideration of the quality of the resulted compost. The composting was in four identical 100.5 l lab vessels, using 5% each tea leaves and herb residues as conditioners. The swine manure was added in the trials at 20%, 30%, 40%, respectively, and was substituted in the control with 30% lake sludge corrected by 0.5% urea. The initial humidity of each treatment was $60 \pm 2\%$. While being aerated actively at approximately 0.3 m^3/min at intervals of 10 min/h, the mixture was composted for 29 days. The results indicated that N and P decomposition primarily occurred in the mesophilic phase, while organic carbon decomposed in the thermophilic phase and 30% swine manure with initial C/N ratio of about 40 was more desirable for composting organic substrates.

This citation is from AGRICOLA.

915. Comparative short-term effects of different quality organic resources on maize productivity under two different environments in Zimbabwe.

Mtambanengwe, F.; Mapfumo, P.; and Vanlauwe, B. *Nutrient Cycling in Agroecosystems* 76(2/3): 271-284. (2006)

NAL Call #: S631 .F422; ISSN: 1385-1314

Descriptors: application rates/ biomass/ biomass production/ cattle husbandry/ clay loam soils/ crop yield/ green manures/ maize/ maize stover/ nitrogen/ nitrogen fertilizers/ nutrient availability/ nutrient content/ sandy soils/ sawdust/ soil types/ sunn hemp/ cattle management/ corn

Abstract: Major challenges for combined use of organic and mineral nutrient sources in smallholder agriculture include variable type and quality of the resources, their limited availability, timing of their relative application and the proportions at which the two should be combined. Short-term nutrient supply capacity of five different quality organic resources ranging from high to low quality, namely *Crotalaria juncea*, *Calliandra calothyrsus*, cattle manure, maize stover and *Pinus patula* sawdust were tested in the field using maize as a test crop. The study was conducted on two contrasting soil types at Makoholi and Domboshawa, which fall under different agro-ecological regions of Zimbabwe. Makoholi is a semi-arid area (<650 mm year⁻¹) with predominantly coarse sandy soils containing approximately 90 g kg⁻¹ clay while Domboshawa (>750 mm year⁻¹) soils are sandy clay loam with 220 g kg⁻¹ clay. Each organic resource treatment was applied at low (2.5 tonnes C ha⁻¹) and high (7.5 tonnes C ha⁻¹) biomass rates at each site. Each plot was sub-divided into two with one half receiving 120 kg N ha⁻¹ against zero in the other. At Makoholi, there was a nine-fold increase in maize grain yield under high application rates of *C. juncea* over the unfertilized control, which yielded only 0.4 tonnes ha⁻¹. Combinations of mineral N fertilizer with the leguminous resources and manure resulted in between 24 and 104% increase in grain yield against sole fertilizer, implying an increased nutrient recovery by maize under organic-mineral combinations. Maize biomass measured at 2 weeks after crop emergence already showed treatment differences, with biomass yields increasing linearly with soil mineral N availability ($R^2=0.75$). This 2-week maize biomass in turn gave a positive linear relationship ($R^2=0.82$) with grain yield suggesting that early season soil mineral N availability largely determined final yield. For low quality resources of maize stover and sawdust, application of mineral N fertilizer resulted in at least a seven-fold grain yield increase compared with sole application of the organic resources. Such nutrient combinations resulted in grain harvest indices of between 44 and 48%, up from a mean of 35% for sole application, suggesting the potential of increasing maize productivity from combinations of low quality resources with mineral fertilizer under depleted sandy soils. At Domboshawa, grain yields averaged 7 tonnes ha⁻¹ and did not show any significant treatment differences. This was attributed to relatively high levels of fertility under the sandy clay loam during this first year of the trial implementation. Differences in N supply by different resources were only revealed in grain and stover uptake. Grain N concentration from the high quality leguminous resources averaged 2% against 1.5% from sawdust treatments. We conclude that early season soil mineral N availability is the primary regulatory factor for maize

productivity obtainable under poor sandy soils. Maize biomass at 2 weeks is a potential tool for early season assessment of potential yields under constrained environments. However, the likely impact on system productivity following repeated application of high N-containing organic materials on different soil types remains poorly understood. Reproduced with permission from the CAB Abstracts database.

916. A comparative study of root activity and mycorrhizal infection incidence of blueberry in different soil conditions.

Tang XueDong; Li YaDong; Li ShiJu; Wu Lin; and Zhang ZhiDong

Journal of Jilin Agricultural University 27(1): 43-47. (2005); ISSN: 1000-5684

Descriptors: blueberries/ endomycorrhizas/ mycorrhizal fungi/ mycorrhizas/ organic amendments/ peat/ roots / sawdust/ soil amendments/ sulfur/ vesicular arbuscular mycorrhizas/ elemental sulphur/ sulphur

Abstract: The effects of soil amendments with moss, peat, sawdust, stillage and element S on root activity and mycorrhizal infection incidence of blueberry cv. Northland were studied in pot and field experiments. The root activity and mycorrhizal infection incidence had significant difference. In the pot experiment, the root activity of Northland with moss+peat treatment was 82.6% higher than the control. Mycorrhizal infection incidence was highest with 1 kg S treatment. In the field experiment, mycorrhizal infection of Northland with moss treatment was the highest, and in sawdust and moss+peat treatments, mycorrhizal infections were respectively 106.3% and 65.1% higher than the control. The root activity in moss+peat and moss treatments was respectively 46.7% and 23.0% higher than the control. Reproduced with permission from the CAB Abstracts database.

917. Comparative study on cultivation and yield performance of oyster mushroom (*Pleurotus ostreatus*) on different substrates (wheat straw, leaves, saw dust).

Shah, Z. A.; Ashraf, M.; and Ishtiaq Ch, M. *Pakistan Journal of Nutrition* 3(3): 158-160. (2004); ISSN: 1680-5194

Descriptors: crop yield/ cultivation/ edible fungi/ growth/ leaves/ medicinal fungi/ sawdust/ spawn/ straw/ wheat/ wheat straw/ Lentinaceae/ Poriales

Abstract: The experiment was carried out to investigate the cultivation of Oyster mushroom on the following substrates: 50% sawdust + 50% wheat straw, 75% sawdust + 25% leaves, 50% wheat straw + 50% leaves, 100% sawdust, 100% wheat straw and 100% leaves. The temperature was kept at 25 degrees C for spawn running and 17-20 degrees C for fruiting body formation. The time for the completion of mycelial growth, appearance of pinheads and maturation of fruiting bodies on the different substrates were recorded. The number of fruiting bodies and the biological efficiency of substrates were observed. The results show that spawn running took 2-3 weeks after inoculation, while small pinhead-like structures formed 6-7 days after spawn running. The fruiting bodies appeared 3-6 weeks after pinhead formation and took 27-34 days later after spawn inoculation. Sawdust at 100% produced the highest yield

(646.9 g), biological efficiency (64.69%) and the number of fruiting bodies (22.11). Therefore, sawdust is recommended as the best substrate for Oyster mushroom cultivation. Reproduced with permission from the CAB Abstracts database.

918. Comparative study on the growth and yield of *Pleurotus ostreatus* mushroom on different lignocellulosic by-products.

Obodai, M.; Cleland-Okine, J.; and Vowotor, K. A.
Journal of Industrial Microbiology and Biotechnology 30(3): 146-9. (Mar. 2003); ISSN: 1367-5435
Descriptors: agriculture: methods/ cellulose: metabolism/ culture media: chemistry/ lignin: metabolism/ pleurotus: growth & development: metabolism
Abstract: Eight lignocellulosic by-products were evaluated as substrates for cultivation of the oyster mushroom, *Pleurotus ostreatus* (Jacq. ex. fr) Kummer. The yields of mushroom on the different substrates were 183.1, 151.8, 111.5, 87.8, 49.5, 23.3, 13.0 and 0.0 g for composted sawdust of *Triplochiton scleroxylon*, rice straw, banana leaves, maize stover, corn husk, rice husk, fresh sawdust, and elephant grass, respectively. The biological efficiency (BE) followed the same pattern and ranged from 61.0% for composted sawdust to 0.0% for elephant grass. The yield of mushroom was positively correlated to cellulose ($r(2) = 0.6$), lignin ($r(2) = 0.7$) and fibre ($r(2) = 0.7$) contents of the substrates. Based on the yield and BE of the substrates tested, rice straw appeared to be the best alternate substrate for growing oyster mushrooms.
 This citation is from PubMed.

919. Comparing wood pulp and sawdust as media for field crops and the glasshouse.

Trolove, S. N. and Reid, J. B.
Agronomy New Zealand 35: 118-128. (2005); ISSN: 0110-6589
Descriptors: available water/ greenhouses/ growing media/ nitrogen/ nutrient deficiencies/ nutrient uptake/ nutrients/ onions/ plant nutrition/ protected cultivation/ radishes/ sawdust/ silt loam soils/ soil types/ sulfur/ water holding capacity/ wood pulp/ Capparales/ cultivation under glass or plastic/ elemental sulphur/ glasshouses/ potting composts/ rooting media/ sulphur
Abstract: Partially composted kraft wood pulp and sawdust were trialled as media for establishing seeds in the glasshouse as well as for establishing and growing onions in the field in a system designed to give growers some control over the nutrient uptake of their crops. Wood pulp stored twice as much easily available water as a silt loam and sawdust, but only half as much as peat. Fast-growing seedlings (radishes) showed symptoms of nitrogen deficiency when grown in wood pulp, even with NutricoteReg. added at 2 g/L (5.7 mgN/plant). Previously we used sawdust in a similar system to grow low sulphur (S) onions in the field on a moderately high S soil (Trolove and Reid, 2003). The wood pulp experiments showed that wood pulp contained too much plant-available S to be used in a system to reduce S uptake by plants; but in other respects it proved to be an effective medium, producing an onion crop with yield and composition of other nutrients similar to crops grown in sawdust. Sawdust contained low

amounts of all plant nutrients, but had a poor water-holding capacity and was susceptible to being blown away by wind. Further research is needed to find a medium that would be suitable for use in the system designed to control the S uptake of a field-grown crop.
 This citation is from AGRICOLA.

920. Comparison of ammonia emission rates from three types of broiler litters.

Atapattu, N. S.; Senaratna, D.; and Belpagodagamage, U. D.
Poultry Science 87(12): 2436-40. (Dec. 2008); ISSN: 0032-5791
Descriptors: ammonia: metabolism/ animal welfare/ animals/ chickens: genetics: physiology/ floors and floorcoverings/ housing, animal/ hydrogen ion concentration/ nitrogen: metabolism/ *Oryza sativa*/ plant leaves/ tea/ water/ wood
Abstract: The objective of this study was to compare the emission of NH₃ from 3 types of broiler litters. Three litter materials (refused tea, RT; sawdust, SDT; and paddy husk, PH) were randomly assigned into 18 cages. Twenty-day-old broiler chicks (n = 216) were randomly allocated into cages and were fed a commercial broiler finisher diet from 21 to 42 d. Three litter samples were taken from each cage on 36 and 42 d. Three subsamples taken from each cage were pooled and analyzed for moisture, pH, and N. Litter samples were incubated for 5 h, and the emitted NH₃ was trapped with boric acid and then titrated with HCl to determine the NH₃ emissions. The emission of NH₃ from RT litter (13.2 mg/kg of litter per h) on d 36 was 61% less than that from SDT and PH. The NH₃ emission rate of RT litter on d 42 (13.0 mg/kg per h) was very similar to that on d 36 (13.2 mg/kg per h). However, emission rates of SDT and PH on d 36 increased by 57.8 and 33%, respectively, when determined on d 42. Emission of NH₃ from RT litter on d 42 (13.0 mg/kg per h) was significantly ($P < 0.05$) less than that from SDT (54 mg/kg per h) and PH (44 mg/kg per h) litters. When the emission rate was computed as grams of NH₃/hour/animal unit (AU), the emission rates of RT litter on d 36 (3.4 g/h per AU) and 42 (5.1 g/h per AU) were significantly ($P < 0.05$) less than that of SDT and PH. The N contents of the RT litter on 36 and 42 d were 6.6 and 6.7%, respectively, and were significantly ($P < 0.001$) greater than the respective values of SDT and PH. It was concluded that emission of NH₃ from poultry houses could be reduced substantially by using RT as a litter material.
 This citation is from PubMed.

921. Comparison of chemical composition of maitake (*Grifola frondosa* (Fr.) S. F. Gray) cultivated on logs and sawdust substrate.

Tabata, T.; Yamasaki, Y.; and Ogura, T.
Food Science and Technology Research 10(1): 21-24. (Feb. 2004); ISSN: 1344-6606
Descriptors: mushrooms/ mushroom growing/ logs/ sawdust/ proximate composition/ free amino acids/ 5' nucleotidase/ protein content/ vitamin D/ moisture content/ lipid content/ ash content/ carbohydrate content/ sensory evaluation / taste
 This citation is from AGRICOLA.

922. Comparison of chemical compositions of shiitake (*Lentinus edodes* (Berk.) Sing) cultivated on logs and sawdust substrate.

Tabata, T.; Tomioka, K.; Iwasaka, Y.; Shinohara, H.; and Ogura, T.

Food Science and Technology Research 12(4): 252-255. (Nov. 2006); ISSN: 1344-6606

Descriptors: *Lentinula edodes*/ mushrooms/ cultivars/ sawdust/ logs/ dried vegetables/ chemical composition/ proximate composition/ free amino acids/ protein content/ umami/ sweetness/ fruiting bodies

This citation is from AGRICOLA.

923. A comparison of sawdust and wood shavings as litter materials for broilers.

Boa Amponsem, K. and Osei Somuah, A.

Ghana Journal of Agricultural Science 33(2): 171-175. (2000); ISSN: 0855-0042

Descriptors: broiler performance/ broilers/ crop/ digestive tract/ feed conversion efficiency/ feet/ gizzard/ growth rate/ litter/ liveweight gain/ moisture/ mortality/ poultry/ sawdust/ trauma/ wood shavings/ chickens/ death rate/ domesticated birds/ gastrointestinal tract/ impaction / liveweight gains/ organ weight/ traumas

Abstract: The suitability of sawdust as litter material for broilers was assessed by comparing broiler performance on it with performance on wood shavings in a 49-day trial. Criteria for assessment included body weight at 21, 35, 42 and 49 days of age, feed efficiency, organ data, mortality, litter moisture and foot pad damage. Broilers raised on shavings were heavier than those raised on sawdust at 49 and 42 days of age for males and females, respectively. Feed conversion efficiency was similar for broilers raised on sawdust and shavings. The heavier gastrointestinal tract (GIT) and gizzard of broilers raised on sawdust, and the higher mortality due to crop impaction of these birds suggest that consumption of sawdust may be the main cause of lowered growth rate. Rate of increase of moisture in litter was higher for shavings than for sawdust which explains the higher incidence of foot pad damage on broilers raised on wood shavings. It was concluded that for short-cycle broiler production programmes (6 weeks), sawdust is less suitable.

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924. Comparison of two litter materials, sawdust and a straw-sawdust mixture for fattening pig on deep litter.

Nicks, B.; Desiron, A.; and Canart, B.

Annales de Zootechnie (France) 47(2): 107-116. (1998); ISSN: 0003-424X.

Notes: Article in French. Original title: Comparaison de l'utilisation de la sciure ou d'un mélange paille sciure comme matériau de litière accumulée pour porcs charcutiers.

Descriptors: litter/ sawdust/ straw/ fattening/ pigs/ deep litter

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925. Comparison on using different materials to cultivate *Pleurotus eryngii*.

Wan, NanAn

Edible Fungi of China 23(4): 24-25. (2004); ISSN: 1003-8310

Descriptors: bagasse/ cotton waste/ cottonseed husks/ crop yield/ cultivation/ edible fungi/ growing media/ growth/ hyphae/ rice/ rice straw/ sawdust/ straw/ Lentinaceae/ paddy/ Poriales/ potting composts / rooting media

Abstract: *P. eryngii* was inoculated on 6 culture media, as follows: control A (78% sawdust), B (78% rice straw powder), C (78% cotton seed hulls), D (78% bagasse), E (78% cotton stalk powder) and F (40% cotton seed hulls + 38% bagasse). Hyphal growth and mushroom yield on the different culture media were investigated. Hyphal growth rate was ranked as C>F>D>E>B>A. Yield was ranked as F>C>E>D>A>B. The biological conversion efficiencies in A, B, C, D, E and F were 43.5, 42.0, 72.4, 64.6, 67.1 and 74.2%, respectively. Hence, using a mixture of cotton seed hulls and bagasse as the main culture materials might result in better cultivation, as compared with their single use.

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926. Compost use in commercial citrus in Florida.

Litvany, M. and Ozores Hampton, M.

HortTechnology 12(3): 332-335. (2002)

NAL Call #: SB317.5.H68; ISSN: 1063-0198

Descriptors: cellulose/ composting/ food wastes/ lignin/ nitrogen/ nutrient availability/ organic fertilizers/ plant residues/ sawdust/ sewage sludge/ Rutales/ United States of America

Abstract: Commercial citrus (*Citrus* sp.) groves in Florida use an average of 150 lb/acre (168 kg.ha⁻¹) of elemental nitrogen (N) per year. There are about 853,000 acres (345,000 ha) of commercial citrus requiring about 63,975 tons (62,652 t) of N. At an average analysis of 12% N, about 533,125 tons (483,811 t) of blended nitrogenous fertilizers are applied to citrus annually. To meet this annual N demand from compost, it would be necessary to produce 3,198,750 tons (2,901,906 t) of 2% N compost. The market for high-quality compost products in Florida is far greater than the current or projected production capacity of the state. As long as the cost benefits of compost are clear to citrus growers, demand will always exceed supply. Not all composts are equal in their nutrient availability. The best composts for use as fertilizers are derived from sewage sludge or biosolids, municipal solid waste and sludge, food waste, and/or animal manure combined with a bulking agent such as sawdust or wood chips. Composts made from wood waste as their only feedstock contain large amounts of lignin and cellulose to break down within a reasonable period to directly offset chemical fertilizers. Ultimately, they will mineralize in the soil and provide all of the benefits described earlier, but their rates of availability are in years rather than months, like the other composts. Reproduced with permission from the CAB Abstracts database.

927. Composted sawdust as a carrier for *Bradyrhizobium*, *Rhizobium* and *Azospirillum* in crop inoculation.

Kostov, O. and Lynch, J. M.

World Journal of Microbiology and Biotechnology 14(3): 389-397. (July 1998)

NAL Call #: QR1 .M562 ; ISSN: 0959-3993 [WJMBEY]

Descriptors: composting/ nitrogen fixing bacteria/ Glycine max/ Arachis hypogaea/ Medicago sativa/ Lotus corniculatus/ crop yield
This citation is from AGRICOLA.

928. Composting cattle manure from zero grazing system with agro-organic wastes to minimise nitrogen losses in smallholder farms in Kenya.

Gichangi, E. M.; Karanja, N. K.; and Wood, C. W.
Tropical and Subtropical Agroecosystems 6(2): 57-64. (2006)

Descriptors: ammonia/ biomass production/ cattle manure/ coffee pulp/ composting/ covers/ crop yield/ filter cake/ maize/ maize stover/ nitrogen/ nitrogen content/ nitrogen retention/ nutrient uptake/ organic amendments/ organic wastes/ polyethylene film/ sawdust/ seedlings/ small farms/ soil fertility/ volatilization/ zero grazing/ clarification mud/ corn/ soilage

Abstract: Livestock manure is a valuable source of plant nutrients for crop production in the Central Kenyan highlands but its quality in terms of available nitrogen (N) is low due to considerable N losses through ammonia volatilization. This study aimed at assessing the potential of agro-organic wastes to reduce N losses from manure heaps during the storage period. Three organic amendments selected from a laboratory simulation experiment were evaluated under farmers' conditions in Karura, Kiambu District for their ability to reduce N losses from cattle manure heaps. The effect of a polyethylene sheet covering of manure heaps on N retention was also determined. There were eight treatments that comprised three agro-organic amendments (maize stover, coffee pulp and sawdust) and the control, with or without a polyethylene cover. Agronomic effectiveness of the "treated" manure samples and N uptake by maize seedlings was evaluated in a glasshouse experiment. Total N content of manure amended with organic materials ranged from 1.26 to 1.85%. The N in manures with organic amendments at the start and at the end of storage was significantly different ($p \leq 0.05$). Cumulative N loss ranged from 1.60 to 6.80 g kg⁻¹ depending on the type of amendment. Nitrogen lost from non-amended manure was 2.74 g kg⁻¹ with polyethylene cover and 6.80 g kg⁻¹ without the polyethylene cover, which represented 19 and 46% of the initial N respectively. Maize growth improved significantly ($p \leq 0.05$) with increasing rates of manure irrespective of the organic treatments except for manure amended with sawdust. Treatments that received the recommended rate of N at 100 kg N ha⁻¹ had significantly higher ($p \leq 0.05$) biomass (21.55 g plant⁻¹) than the control which produced only 2.78 g/plant. Nitrogen uptake increased with increasing rates of manure and was higher ($p \leq 0.05$) with manure amended with coffee pulp. Covering manure heaps to reduce moisture loss was also beneficial in reducing N losses.

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929. Composting characteristics of three bedding materials.

Swinker, A. M.; Tanner, M. K.; Johnson, D. E.; and Benner, L.

Journal of Equine Veterinary Science 18(7): 462-466. (1998); ISSN: 0737-0806

Descriptors: aeration / ammonium sulfate/ comparisons/ composting/ composts/ litter/ materials/ microbial activities/ moisture content/ paper/ sawdust/ straw/ temperature/ wheat/ ammonium sulphate/ United States of America

Abstract: A comparison is made of the composting characteristics for recycled chopped phone book paper, sawdust and wheat straw bedding used as bedding for horses. Manure and soiled bedding types were collected daily and separated prior to composting in bins constructed from wooden pallets (10 cm slats). Temperatures of the composts were taken on the first and every fourth day over the 65-day trial to determine the need for water additions and aeration to keep the composting process active. On Day 37 the C:N ratio was adjusted by the addition of ammonium sulfate, 0.1 kg, 0.1 kg and 0.14 kg for sawdust, phone book paper and straw piles, respectively. Mean standard error and range for compost temperatures (degrees C) were: phone book paper, 33.17 +or-10.33 (13-52); sawdust, 45.6 +or-9.35 (27-58); straw, 30.42 +or-6.57 (16-39). The sawdust composted more readily as compared to the phone book paper or straw. The paper and straw had poorer structure, which caused compaction of the material when moistened thereby adversely affecting the porosity, oxygen supply and microbial activity during the composting process.

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930. Composting hog manure/sawdust mixtures using intermittent and continuous aeration: Ammonia emissions.

Elwell, D. L.; Hong, J. H.; and Keener, H. M.
Compost Science and Utilization 10(2): 142-149. (2002)
NAL Call #: TD796.5.C58 ; ISSN: 1065-657X

Descriptors: aeration / ammonia/ animal manures/ composting/ composts/ emission/ pig manure/ sawdust
Abstract: Odorous emissions from manures have become a significant problem. Preliminary work on composting hog manure with sawdust had indicated that intermittent aeration could reduce ammonia emissions during this process. This paper presents results from four additional runs with a total of 22 pilot-scale vessels that have confirmed that ammonia emissions are affected by aeration. The pilot-scale vessels consisted of insulated, stainless steel, 205 L drums that either received continuous (high/low rate, thermostatically controlled blowers) or intermittent (5 min on high rate, 55 min off) aeration. Ammonia emissions, air flow rates, carbon dioxide production, oxygen utilization, and temperatures at four locations in each vessel were monitored. Ammonia emissions under intermittent aeration were roughly 50% less than those from the continuously aerated vessels. However, this appeared to result more from total air flow than from the aeration technique used. A linear regression of emissions versus total air flow data for all vessels yielded a fit of $y = 0.1309x + 29.385$ (y being total ammonia emitted [in g of N] and x being total air flow [in kg]) with an $R^2 = 0.6808$. Since air flow termination was relatively arbitrary, this only means basically, that ammonia emissions were doubled for a quadrupling of air flow. Under intermittent aeration, the minimum oxygen level in the exhaust air occasionally dropped to as low as 1%. So the aeration pattern used probably represents the lowest one

suitable for maintaining aerobic conditions. Within this constraint, however, lower air flow appears to be suitable for reducing odorous ammonia emissions. This citation is from AGRICOLA.

931. Composting of fish waste with wood by-products and testing compost quality as a soil amendment: Experiences in the Patagonia region of Argentina.

Laos, F.; Mazzarino, M. J.; Walter, I.; and Roselli, L.
Compost Science and Utilization 6(1): 59-66. (Winter 1998)
NAL Call #: TD796.5.C58 ; ISSN: 1065-657X
Descriptors: composting/ fish waste/ wood shavings/ sawdust/ composts/ physicochemical properties/ nitrogen/ phosphorus/ mineralization/ Andisols/ Mollisols/ nutrient availability/ bulking agents/ Argentina/ release/ stability/ quality
This citation is from AGRICOLA.

932. Composting of swine feces with tea grounds as bulking agents.

Sakai, T.; Wakiya, Y.; and Iwanaga, M.
Japanese Journal of Swine Science 41(3): 153-161. (2004);
ISSN: 0913-882X
Descriptors: ammonia/ bulking agents/ composting/ decomposition/ emission/ nitrogen/ organic matter/ phosphorus fertilizers/ pig manure/ potassium fertilizers/ sawdust/ tea/ temperature/ phosphate fertilizers/ potash fertilizers
Abstract: In order to evaluate the application of tea grounds as bulking agents, the composted performance of swine faeces mixed with dry tea grounds was investigated, and the effect of tea grounds was examined for material temperature, bulk weight, ammonia emission, and ingredients. Three sets of compost were mixed with a variety of bulking agents; tea grounds only (TG), sawdust only (S), tea grounds and sawdust mixed at a ratio of 1:1 (M). An admixture of swine faeces and bulking agents was composted in an experimental composting apparatus for 28 days. The temperatures of M and S did not vary, although that of Tea grounds increased later than that of the other sets. Material temperatures of TG, M, and S were amounted to 7668.7, 8135.0 and 8024.6 C, respectively. Initial bulk weights were about 0.57 kg/l. As time passed, bulk weights of M and S decreased to about 0.30 kg/l, while that of TG remained at more than 0.40 kg/l. Data indicate that with the addition of tea grounds only, swine faeces fermentation decreased because of low ventilation inside compost of higher bulk weight, and that with the addition of both TG and S, fermentation did not decrease at all. Ammonia emission of TG decreased with the deterioration of fermentation under lower ventilation conditions because of the absence of deodorizing agents in tea grounds. There was no significant difference in the decomposition rate of organic matter during composting. The addition of tea grounds increased manure ingredients such as nitrogen, phosphate, and potash in the compost. Tea grounds did not interfere with Komatsuna seed germination tests. These results suggested that it is possible to make swine composts using tea grounds as bulk agents by supplementary mixing sawdust, and that this compost, which is rich in manure ingredients, does not pose a problem for crops.
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933. Conserving N from high N crop residues under field conditions by using on and off farm organic biological waste materials.

Chaves, B.; Piulats, L. M.; Neve, S. de; Hofman, G.; and Cleemput, O. van
Acta Horticulturae 700: 249-254. (2006)
NAL Call #: 80 Ac82; ISSN: 0567-7572
Descriptors: carbon nitrogen ratio/ composts/ crop residues/ immobilization/ microbial flora/ mineralization/ nitrogen/ organic wastes/ sandy loam soils/ sandy soils/ sawdust/ soil compaction/ soil texture/ soil types/ microbial biomass/ microflora
Abstract: The objective of this study was to test organic biological waste (OBW) materials for their potential to immobilize N under field conditions. Two field experiments (randomized block design with 3 replicates) were set up: one on a heavy sandy loam and one on a sandy soil in Belgium. Each plot received cauliflower residues and an OBW material (green waste compost (GWC) or sawdust), which were incorporated into the soil with a rotavator. At regular times soil samples were taken to a depth of 0.90 m in 4 layers. The mineral N and microbial N content of the soil samples were determined. In both soils, the mineral N content in OBW treatments was more or less similar to that in the cauliflower treatment, and no significant differences could be determined. The microbial biomass analysis showed that no extra N was immobilized in the OBW treatments compared to the cauliflower treatment. So, neither the GWC nor the saw dust immobilized N released from the cauliflower residues despite their high C:N ratio. Apparently, some factors other than the OBW composition had an effect on the N immobilization. Some of these factors might be the structure of the OBW materials, the degree of mixing between crop residues and OBW materials, a good incorporation into the soil, weather conditions, soil texture and soil compaction.
Reproduced with permission from the CAB Abstracts database.

934. The content and protein yield of winter wheat in the conditions of consecutive effect of waste.

Wiater, J.
Annales Universitatis Mariae Curie Sklodowska Sectio E, Agricultura 59(2): 579-587. (2004)
NAL Call #: 512 L96AE ; ISSN: 0365-1118.
Notes: Original title: Zawartosc i plon biaka pszenicy ozimej w warunkach nastepczego oddziaływania odpadów.
Descriptors: crop yield/ farmyard manure/ green manures/ oats / potatoes/ protein content/ sawdust/ straw/ sugar factory waste/ waste utilization/ wheat/ wheat straw/ winter wheat/ FYM/ sugar factory effluent
Abstract: Studies were conducted in the third year of two field experiments in Poland, in which wastes such as slops, straw, sawdust, sugar factory lime and farmyard manure were applied. Waste was applied once during the first year. Hull-less oats, yellow lupin (as a green manure), and potatoes were the forecrop for winter wheat in the first experiment, while chickling vetch and potatoes were the forecrops in the second experiment. In grain and straw samples, the content of total and specific protein was determined. The protein yield of wheat was calculated based on the grain and straw yield, and protein contents. It was found that the secondary effect of waste influenced the total protein content more strongly than the kind of forecrop

and the specific protein content to a smaller degree. All applied waste influenced, in a secondary way, a higher total and specific protein yield. Yellow lupin, used as a fertilizer for winter wheat forecrop, had a more positive effect than chickling vetch straw on the yield of both protein forms. Reproduced with permission from the CAB Abstracts database.

935. Control of gaseous emissions of ammonia and hydrogen sulphide from cow manure by use of natural materials.

Luo, J.; Kulasegarampillai, M.; Bolan, N.; and Donnison, A. *New Zealand Journal of Agricultural Research* 47(4): 545-556. (2004)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: aerobic conditions/ ammonia/ anaerobic conditions/ cattle manure/ emission/ hydrogen sulfide/ odour emission/ odours/ pine bark/ sawdust/ soil/ waste management/ waste treatment/ wood shavings/ hydrogen sulphide/ odor emission/ odors/ smells

Abstract: Winter management practices involving the use of stand-off pads to reduce problems due to cows grazing on wet soils may require storage of cow manure for extended periods prior to field application. Gaseous losses of nitrogen (N) and sulphur (S) from stored cow manure can be considerable, and these gases are offensive and undesirable. Laboratory incubation studies were conducted to measure gaseous loss of ammonia (NH₃) and hydrogen sulphide (H₂S) from stored cow manure under aerobic and anaerobic conditions. The potential of adding a range of natural materials, including soil, untreated pine bark, sawdust and wood savings, to the manure to reduce these gaseous emissions was investigated. Aerobic incubation of manure resulted in a higher emission of NH₃ than anaerobic incubation, while anaerobic incubation resulted in higher emissions of H₂S. The effectiveness of natural materials in reducing losses of NH₃ was investigated under anaerobic conditions, and pine bark was found to be the most effective. However, all materials reduced NH₃ to some degree. Therefore, the addition of natural materials, such as pine bark and soil, as amendments to cow manure during storage offers potential for reducing emissions of NH₃ and H₂S.

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936. Control of groundnut Kalahasti malady (Tylenchorhynchus brevilineatus) through organic and inorganic soil amendments.

Naidu, P. H.; Mosas, G. J.; and Sitaramaiah, K.

Journal of Mycology and Plant Pathology 30(2): 180-183. (2000); ISSN: 0971-9393

Descriptors: farmyard manure/ groundnuts/ neem extracts/ nematicidal plants/ nematicides/ nematode control/ organic amendments/ plant parasitic nematodes/ poultry manure/ sawdust/ yield increases/ eelworms/ FYM/ neem/ peanuts/ poultry litter/ Secernentea/ Tylenchida

Abstract: Amendment of Kalahasti malady (Tylenchorhynchus brevilineatus Williams) infested soil with organic manures viz., poultry manure (50 q ha⁻¹), farmyard manure (100 q ha⁻¹) and sawdust (25 q ha⁻¹) was found effective in reducing the population of T. brevilineatus and disease severity, and in increasing

groundnut pod yield over non-amended control plots. Neem green leaves at 25 q ha⁻¹ could reduce only the nematode population but could not increase groundnut pod yield. Highest degree of nematode control (33.5%) and highest increase in pod yields (50.3%) were obtained in poultry manure amendment (50 q ha⁻¹) followed by neem cake (10 q ha⁻¹) with a 30.3 per cent decrease in nematode population and 42 per cent increase in pod yield. Farmyard manure (100 q ha⁻¹) was found second best in the reduction of nematode population and disease severity and also in the increase of pod yield. The increase in yield was related to the decrease in nematode population. The application of poultry manure was highly economical with a benefit cost ratio of 8.7 followed by farmyard manure with 3.6.

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937. Control of pollutants using stand-off pads containing different natural materials.

Luo, J.; Donnison, A.; Ross, C.; Ledgard, S.; and Longhurst, B.

Proceedings of the New Zealand Grassland Association 68: 315-320. (2006); ISSN: 0369-3902

Descriptors: ammonia/ animal manures/ carbon/ dairy farms/ drainage water/ excreta/ faecal coliforms/ nitrogen/ pine bark/ pollutants/ polluted water/ pollution control/ public health/ sawdust/ volatilization/ water pollution/ water quality/ wood chips/ zeolites/ fecal coliforms/ water composition and quality

Abstract: Farmers are increasingly using management systems such as moving cows out of paddocks onto stand-off pads to protect wet soils from damage during winter. Studies were carried out to investigate nutrient and faecal bacterial retention or loss from stand-off pad materials. A preliminary laboratory study found that a range of natural materials, including crushed pine bark, wood chips, zeolite and soil can retain between 66% and 76% of applied cows' excreta nitrogen (N). Zeolite was found to be particularly good at reducing ammonia (NH₃) volatilisation losses from the columns. A field-scale standoff pad study at a Waikato dairy farm, in the winter season of 2005, indicated that carbon (C)-rich materials including both bark and sawdust can be used as standoff pad materials with effective retention of N and faecal bacteria. Both bark and sawdust pads retained about 60% of deposited excreta N. Substantially more Escherichia coli were recovered in the drainage from the bark pad (total yield 3.1x10¹¹E. coli) than from the sawdust pad (total yield 7.5x10⁹E. coli) demonstrating that sawdust was more effective than bark in retaining these faecal bacteria.

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938. The control of weed biomass in a realistic field plot study by using an agronomic mulch of Quercus borealis sawdust.

Kessans, S. A.

In: AAAS Annual Meeting and Science Innovation Exposition.; Vol. 168.; pp. A75; 2002.

Descriptors: weed control/ biomass/ field plot study/ mulch/ Quercus borealis/ sawdust
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939. Correlation of the properties of several lignocellulosic substrates to the crop performance of the shiitake mushroom *Lentinula edodes*.

Philippoussis, A. N.; Diamantopoulou, P. A.; and Zervakis, G. I.

World Journal of Microbiology and Biotechnology 19(6): 551-557. (2003)

NAL Call #: QR1 .M562 ; ISSN: 0959-3993

Descriptors: crop yield/ earliness/ edible fungi/ electrical conductivity/ maize cobs/ mycelium/ pH/ salts/ sawdust/ strains/ straw/ substrates/ wheat/ wheat straw/ hydrogen ion concentration/ potential of hydrogen/ Tricholomataceae

Abstract: Two selected *Lentinula edodes* strains (S4080 and SIEF0231) were cultivated on oak-wood sawdust (OS), wheat straw (WS) and corn-cobs (CC) substrates in order to examine the influence of those residues on mycelium growth and on basidiomata production. For both strains, mycelial growth measurements conducted in 'race tubes' demonstrated faster colonization of OS and WS media. Lag-phase and complete colonization periods were correlated to mycelium extension rates in the three substrates tested. Similar patterns of pH and electrical conductivity (Ec) changes were detected in all media and for all strains tested; the pH decreased steadily throughout the colonization process to reach values of 4.49-5.06; Ec increased by the end of mycelium colonization, and it presented the highest and lowest values in the WS and OS media respectively. In addition, a negative correlation was established between final salt content of the substrates and mycelium extension rates. Subjecting fully colonized substrates to a cold-shock treatment resulted in fruiting 58-65 days after inoculation in tubes; WS and CC promoted earlier sporophore initiation than OS. Monitoring CO₂ emissions by strain SIEF0231 in pilot-scale cultivation on synthetic blocks, revealed higher respiration rates from OS and CC than from WS, which were further correlated with substrate colonization rates. Among residues colonized by the same strain, WS appeared to promote earliness and crop productivity (BE 54.17%) by presenting shorter cropping periods and equal yield distribution among flushes, while on OS and CC maximum yields were obtained within the first two flushes. Moreover, heavier basidiomata were produced by WS and OS substrates. Reproduced with permission from the CAB Abstracts database.

940. Cucumber plant growth and yield as affected by using sawdust and peat moss mixes for seedlings production under protected cultivation.

Sawan, O. M.; Eissa, A. M.; and Abou Hadid, A. F.

Egyptian Journal of Horticulture 25(3): 321-334. (1998); ISSN: 0301-8164

Descriptors: chlorophyll/ composts/ crop residues/ cucumbers/ cucurbit vegetables/ fruit vegetables/ fruits/ growing media/ heavy metals/ iron/ manganese/ peat/ plant height/ plant residues/ protected cultivation/ residues/ sawdust/ seasons/ seedlings/ vegetables/ vermiculite/ zinc/ cultivation under glass or plastic/ gherkins/ Mn/ potting composts/ rooting media/ vegetable crops

Abstract: Greenhouse experiments were carried out over 2 growing seasons (1993/94 and 1994/95) in Egypt to examine sawdust as substitute medium for peatmoss in cucumber seedling production. Twenty-five combinations of peatmoss, vermiculite, composted sawdust and crop residues compost were used as soil media for seedling

production (cv. Katia). Seedlings grown in sawdust media were either similar or superior to the control (peatmoss + vermiculite, 1:1 v/v) for plant height, number of leaves, chlorophyll content and fruit yield. The greatest plant growth and, subsequently, the highest total yield were obtained by combining the control medium (peat:vermiculite, 1:1) with sawdust and compost in a 2:2:1 (v/v/v) mixture, i.e. reducing the peatmoss volume from 50% to 20% in the mixture. These results indicate that sawdust can be used as a substitute for high percentages of peatmoss in media for cucumber seedling production. Nutrient contents (N, P, K, Fe, Mn, Zn and Cu) and heavy metals contents (Pb, Cd, Ni, Cr and Co) were determined in the cucumber leaves and fruits.

This citation is from AGRICOLA.

941. Cultivation of cabbage in pine sawdust treated with Agaricales strains.

Valenzuela F. E. and Andrade S. N.

Boletín Micológico 17: 75-79. (2002); ISSN: 0716-114X.

Notes: Original title: Cultivo de repollo en aserrín de pino tratado con cepas de Agaricales.

Descriptors: cabbages / clay soils/ cultivation/ height/ leaves/ organic amendments/ red soils/ sawdust/ seedling emergence/ soil types/ substrates/ survival/ Basidiomycetes/ Capparales/ Cortinariaceae/ Cortinariales/ *Gymnopilus*/ *Gymnopilus spectabilis*/ *Pleuroflammula croceosanguinea*/ red earths

Abstract: The cultivation of cabbage in *Pinus radiata* sawdust pretreated with Agaricales strains UACHMGs-99 (*Gymnopilus spectabilis* [*Gymnopilus spectabilis*]) and UACHMPc-280 (*Pleuroflammula croceosanguinea* [*P. croceosanguinea*]) was tested. Pretreated sawdust was mixed with clayey red soil (1:1 v/v), while the untreated sawdust, clayey red soil and a mixture of both were used as control. Triplicated substrates kept in containers with 50 cabbage seeds (in each container) were sown and cultivated for one month in a chamber under a photoperiod of 16/8 h (light/darkness), 4000 lux, 10-24±0.1 degrees C (night/day). Sixty plantlets per treatment were studied to determine the emergence and survival percentage, radicle length, number of leaves and dry weight. A statistical analysis was performed on the results using a variance analysis and a Tukey test. In the cabbage plantlets cultivated in the substrates with pretreated sawdust the highest survival (97.3-100%), plant height (17.6-19.2 cm) and radicle length (15.4 cm) were determined. A significant difference was obtained for cabbage plantlets cultivated in substrates that included pretreated sawdust as compared with the control. Thus, the pretreated *P. radiata* sawdust could be used for the cultivation of cabbage plantlets. This citation is from AGRICOLA.

942. Cultivation of cauliflower mushroom (*Sparassis crispa*) by use of steam-treated coniferous sawdusts.

Park Hyun; Lee BongHun; Ka KangHyeon; Bak WonChull; Oh DeukSil; Park JunMo; and Chun WooJae

Journal of the Korean Wood Science and Technology 34(3): 84-89. (2006); ISSN: 1070-0715

Descriptors: crop production/ cultivation/ growing media/ growth/ mycelium/ non wood forest products/ sawdust/ waste utilization/ minor forest products/ non timber forest products/ potting composts/ rooting media/ Sparassidaceae/ Sparassis/ *Sparassis crispa*

Abstract: An efficient method of cauliflower mushroom

(*Sparassis crispa*) cultivation was developed to minimize the problem with steam-treated sawdust media of *Larix leptolepis* [L. *kaempferi*], *Pinus densiflora* and *P. koraiensis*. By the treatment, mycelial growth was stimulated by 10% compared to that of untreated sawdust media of *L. leptolepis* and *P. koraiensis* and the productivity of cauliflower mushroom was improved from 12.5% (50.1 g/400 g) to 16.7% (66.7 g/400 g) with the sawdust medium of *P. densiflora* from first harvest in case of KFRI644. Steam treatment is thought to be a good method for cultivation of cauliflower mushroom by minimizing culturing period and increasing productivity, which is an effective way of utilization of coniferous sawdust. This citation is from AGRICOLA.

943. Cultivation of greenhouse tomato using sawdust. Part II: Fruit yield, content of organic substances and organic carbon in soil and content of nutrients in soil and leaves.

Mokrzecka, E.

Roczniki Nauk Rolniczych Seria A, Produkcja Roslinna 114(3/4): 17-30. (2001)

NAL Call #: 20.5 R59 SER. A; ISSN: 0080-3650.

Notes: Original title: Uprawa pomidora szklarniowego z zastosowaniem trocin. Cz II: Plon owocow, zawartosc substancji organicznej, wegla organicznego w glebie oraz skadnikow pokarmowych w glebie i lisciach.

Descriptors: application rates/ crop yield/ nitrogen fertilizers/ protected cultivation/ sawdust/ soil amendments/ soil organic matter/ tomatoes/ cultivation under glass or plastic/ organic matter in soil

Abstract: In an experiment in an unheated plastic tunnel, tomatoes were grown in a mixture of sawdust and soil (30 dm³ sawdust per 1 m² of soil) and given 45, 90 or 135 g N m⁻². Adding sawdust to the soil increased the organic matter and carbon contents of the soil but reduced the mineral N, K Ca and Mg. Tomato yield was highest (26.2 kg m⁻²) with 90 g N m⁻².

This citation is from AGRICOLA.

944. Cultivation of greenhouse tomato with use of sawdust. Part I: Effect of sawdust on physical properties of soil.

Mokrzecka, E

Roczniki Nauk Rolniczych Seria A, Produkcja Roslinna 114(3/4): 9-16. (2001)

NAL Call #: 20.5 R59 SER. A; ISSN: 0080-3650.

Notes: Original title: Uprawa pomidora szklarniowego z zastosowaniem trocin. Cz I: Wplyw trocin na wasciwosci fizyczne gleby.

Descriptors: sawdust/ soil air/ soil physical properties/ soil water content/ tomatoes/ physical properties of soil/ soil amendments/ soil atmosphere

This citation is from AGRICOLA.

945. Cultivation of himematsutake (*Agaricus blazei*) in saw-dust media.

Taguchi, T.; Kawachi, S.; and Meguro, S.

Bulletin of the Faculty of Agriculture, Miyazaki University 54(1): 13-18. (2008); ISSN: 0544-6066

Descriptors: casing/ cultivation/ cultural methods/ culture media/ growing media/ mushroom casing soils/ rice bran/ sawdust/ temperature/ water content/ Agaricaceae/ *Agaricus blazei*/ potting composts/ rooting media

Abstract: Cultivation of himematsutake (*A. blazei*) in

sawdust and rice bran media instead of the regular cultivation in a compost media was attempted for commercial mushroom production at a low cost. Mushroom could be produced in the media containing sawdust:rice bran at 1:1 with water content of 75%. Lowering the temperature to 15 degrees C from 25 degrees C at 5-10 days after casing the media with soil was effective for producing mushrooms. The period of low temperature treatment also affected the production of young fruit bodies; the optimum period was at ~10 days after casing. The highest level of mature fruit body production was recorded by casing the media with unsterilized soil and sprinkling water.

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946. Cultivation of shiitake using sawdust from widely available local woods in Argentina.

Pire, D. G.; Wright, J. E.; and Alberto, E.

Micologia Aplicada International 13(2): 87-91. (July 2001); ISSN: 1534-2581

Descriptors: *Lentinula edodes*/ strains/ *Nothofagus*/ *Pinus elliottii*/ *Eucalyptus camaldulensis*/ *Araucaria angustifolia*/ *Salix babylonica*/ sawdust/ wheat bran/ millets/ seeds/ chalk/ mushroom growing/ growing media/ fruiting/ plant growth/ crop yield/ Argentina/ Internet resource

This citation is from AGRICOLA.

947. Cultivation of the basidiomycete *Hericium erinaceus* (Bull. ex. Fr.) Pers.

Ehlers, S. and Schnitzler, W. H.

Angewandte Botanik 72(1/2): 43-47. (1998); ISSN: 0066-1759.

Notes: Original title: Untersuchungen zum Wachstum des Basidiomyceten *Hericium erinaceus* (Bull. ex. Fr.) Pers.

Descriptors: cultivation/ cultural methods/ edible fungi/ growing media/ growth/ medicinal fungi/ plant development/ production/ sawdust/ vegetables / wheat/ wheat bran/ Basidiomycetes/ Hericiaceae/ Hericiales/ *Hericium*/ *Hericium erinaceus*/ Oleales/ potting composts/ rooting media/ vegetable crops

Abstract: *H. erinaceus* is a Chinese edible and medicinal fungus. Mycelium growth and fruiting body production of different strains (obtained from USA, Thailand, China and Taiwan) were investigated on 4 substrates (Malt peptone agar (MPA) and mixtures of sawdust (ash or beech) + wheat bran). Yields were in the range 100-300 g/kg substrate (wet weight). Similar yields were obtained from all strains on fine beech sawdust + wheat bran (~250 g/kg). Over all media, the strain from USA had the best yield and a mean biological efficiency of 73.6%. The highest number of fruiting bodies was produced by this strain.

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948. Cultivation of the monkey head mushroom (*Hericium erinaceus*) in Egypt.

Hassan, F. R. H.

Journal of Applied Sciences Research: 1229-1233. (Oct. 2007); ISSN: 1816-157X

Descriptors: chemical composition/ crop residues/ crop yield/ edible fungi/ growing media/ herbal drugs/ lignocellulose/ medicinal fungi/ nutritive value/ phenols/ phytochemicals/ sawdust/ straw/ substrates/ traditional Chinese medicines/ traditional medicines/ waste utilization/

wheat/ wheat straw/ herbal medicines/ Hericiaceae/ Hericiales/ Hericium/ Hericium erinaceus/ nutritional value/ potting composts/ quality for nutrition/ rooting media

Abstract: Hericium erinaceus a Chinese edible and medicinal mushroom (newly introduced to Egypt from China) was grown under local conditions in Egypt using the available lignocellulosic wastes as growing media. Incubation time, yield, biological efficiency (BE%) were determined through three consecutive growing seasons. Also, chemical composition of fruit bodies were estimated. The incubation time for the tested growing media ranged from 37 to 46 days. The highest yield of H. erinaceus (184 g/1 kg media) and BE 50.3% were obtained when grown on sawdust. Also, using a mixture of sawdust with wheat straw as growing medium gave a good yield (165 g/1 kg medium) and BE of 46.5%. H. erinaceus mushroom grown on different media in Egypt contained 24.07-26.8% crude protein. Cultivation of H. erinaceus in Egypt is a very important achievement, since this mushroom type is highly prized for their nutritive and medicinal benefits. Reproduced with permission from the CAB Abstracts database.

949. The deep litter system for heavy pig production: Comparison between the use of straw and sawdust.

Zoccarato, I.; Gasco, L.; Lussiana, C.; Bergese, R.; and Ferrero, S.
Rivista di Suinicoltura 41(10): 135-140. (2000); ISSN: 0035-662X.

Notes: Original title: La lettiera permanente nella produzione del suino pesante: confronto tra l'impiego di paglia o segatura.

Descriptors: air quality/ carcass quality/ deep litter housing/ fat/ fattening performance/ fatty acids/ pig housing/ sawdust/ straw/ hogs/ piggeries/ sties/ swine/ swine housing

Abstract: 24 Large White x Landrace pigs were reared on slatted floors, wheat straw or sawdust from 31 to 141 kg. All pigs were fed the same diet on a restricted basis. Weight gain and feed and water intake were recorded twice a month and NH₃, H₂S, CO₂ and litter temperature were recorded once a week. Dressing percentage, backfat thickness and pH₄₅ were measured at slaughter and a backfat sample was also taken for analysis of fatty acids. There was no difference among the groups in fattening performance although pigs reared on sawdust had lower backfat thickness than those reared on the slatted floor (22 vs. 29 mm). Pigs reared on the deep litter systems had a higher proportion of linoleic acid in their back fat than those reared on the slatted floor (13.26, 13.25 and 10.64% for straw, sawdust and slatted floor). Air quality was superior in the deep litter systems than the slatted floor with sawdust having the lowest levels of gases. The sawdust system had a higher evaporation rate and a lower running cost than the straw system.

This citation is from AGRICOLA.

950. Development of non-routine feeds for rabbits and their application.

Liang, XingLong; Ren, KeLiang; and Yang, JinQing
Chinese Journal of Rabbit Farming 3: 18-19, 24. (2005)
Descriptors: agricultural byproducts/ agricultural wastes/ agroindustrial byproducts/ brewery byproducts/ byproducts/

feeds/ fermentation wastes/ industrial wastes/ kitchen waste/ maize cobs/ maize meal/ organic wastes/ products/ sawdust/ sources/ waste utilization/ wood dust/ wood residues/ farm wastes/ plant waste

Abstract: In rabbit farming, feed occupied >70% of total costs. In order to decrease the costs, it is important to develop rabbit feeds using by-products from various industries, including by-products from the production of sugar, malt, beer, vinegar, medicines and wine, and using cobs, water melon skins, residues of sunflower and mushroom culture, sawdust and corn protein meal. Details for the application of each of these materials as rabbit feed are described.

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951. Does amendment of soak solution with sucrose and urea increase production of shiitake mushrooms on sawdust blocks?

Sabota, C.; Beyl, C.; and Ghale, G.
HortTechnology 14(3): 393-397. (July 2004)
NAL Call #: SB317.5.H68; ISSN: 1063-0198

Descriptors: mushrooms/ Lentinula edodes/ sucrose/ urea/ soaking/ sawdust

Abstract: This study evaluated whether adding either sucrose or urea to the soak water could enhance production of shiitake mushrooms (*Lentinula edodes*) on sawdust blocks. For both sucrose and urea experiments, sawdust blocks inoculated with "QR" and "26" strains of *L. edodes* were placed in the soak water amended with either sucrose or urea at the first soaking only, at the second soaking only, or at all six soakings. Control blocks were soaked in tap water. In Experiment I, blocks were soaked in water containing 0, 20,000, or 40,000 ppm (mg.L⁻¹) sucrose. Strain 26 produced significantly more mushrooms and greater mushroom weight than QR. Addition of sucrose to the soak water resulted in fewer mushrooms harvested and lower yields than controls. There was a significant interaction between the sucrose rate and strain for both mushroom number and biological efficiency (BE). Both strains produced fewer mushrooms and less BE as the concentration of sucrose in the soak water increased; however, QR was less affected by the increasing concentration of sucrose. In Experiment II, sawdust blocks inoculated with QR and 26 strains of shiitake were soaked in water containing 0, 2400, or 3600 ppm (mg.L⁻¹) urea. Strain 26 produced significantly more mushrooms and greater BE than QR. The addition of 2400 ppm of urea to the soak water resulted in more mushrooms per block harvested and a 12% increase in BE over the control. The 2400 ppm rate added at each soak produced more mushrooms and mushroom weight than the control and also produced more mushrooms than any of the blocks in the higher rate of urea (3600 ppm) treatments. Adding 16.9 oz (480 g) of urea per tank to obtain 2400 ppm urea in the soak water results in the minimal increase in cost of about \$0.20 per soak (52 sawdust blocks), but potentially increases the value of the mushrooms harvested from each block by \$0.75. In an average-sized shiitake mushroom block production facility containing 500 blocks, continuous addition of 2400 ppm urea to the soak water would provide an increased return of about \$375 over the entire season. This citation is from AGRICOLA.

952. Dry matter yield of Japanese millet (*Echinochloa crusgalli* var. *Frumentacea* (Roxb.) Wight), chemical properties and microbial population of soil as affected by the application of fermented sawdust swine manure in Cheju volcanic ash soil area.

Kim, M. C.; Kim, T. G.; Lee, J. E.; and Moon, B. C.

Journal of the Korean Society of Grassland Science 25(3): 159-168. (2005)

NAL Call #: SB202.K6H352; ISSN: 1013-9354

Descriptors: calcium/ chemical composition/ dry matter accumulation/ exchangeable potassium/ herbage/ magnesium/ nitrogen fertilizers/ phosphorus/ phosphorus fertilizers/ pig manure/ plant composition/ potassium/ potassium fertilizers/ sawdust/ soil chemical properties/ soil pH/ soil types/ volcanic ash soils/ chemical constituents of plants/ chemical properties of soil/ microbial communities/ phosphate fertilizers/ potash fertilizers/ South Korea

Abstract: This experiment was carried out during May to October 1998 to determine the effect of fermented sawdust swine manure application (SSM) on the herbage production of Japanese millet (*Echinochloa crus-galli* var.

frumentacea) and soil properties in the Cheju brown volcanic ash soil, Korea Republic. The treatments were: T1: basic chemical fertilizer, N 200 kg/ha + P₂O₅ 300 kg/ha + K₂O 200 kg/ha; T2: 1/2 basic chemical fertilizer, N 100+P₂O₅ 150 + K₂O 100 kg/ha; T3: 1/2 basic SSM, N 100 kg/ha; T4: basic SSM, N 200 kg/ha; T5: 2 times basic SSM, N 400kg/ha; T6: 4 times basic SSM, N 800 kg/ha. At the same application level of N 200 kg/ha, the application of 100% chemical fertilizer (T1) had significantly lower dry matter yield than that of 50% chemical fertilizer and 50% SSM (T2) or 100% SSM (T4). Dry matter yield increased with an increase of SSM to N 400 kg/ha, but decreased at N 800 kg/ha. P, K and Ca contents of Japanese millet tended to decrease with an increase in SSM level. The application of chemical fertilizer lowered the P and K content of Japanese millet in comparison with that of SSM. pH, available phosphorus, exchangeable potassium, Ca, Mg content of soil showed a significant increase with an increase of SSM application level. However, at the same application level of N 200 kg/ha, there was no statistically significant difference between chemical fertilizer and SSM in the soil. The bacterial number of soil among microbial population increased with an increase of SSM level in June 1988, but there was no regular tendency in October. The ratio of bacteria to fungus in soil had a tendency to decrease with an increase of SSM level. It is recommended to use N 400 kg/ha of SSM or N 100 kg/ha of chemical fertilizer + N 100 kg/ha of SSM for Japanese millet.

This citation is from AGRICOLA.

953. Ecological resistance of strawberry cultivars and possibility of its improvement.

Trunov, I. A. and Bryukhina, S. A.

Sadovodstvo i Vinogradarstvo 6: 11-12. (2007); ISSN: 0235-2591

Descriptors: cold resistance/ crop quality/ crop yield/ disease resistance/ fungal diseases/ mulches/ pest resistance/ plant diseases/ plant pathogenic fungi/ plant pathogens/ sawdust/ strawberries/ stress/ varietal reactions/ cold hardiness/ Hyphomycetes/ mulching materials/ phytopathogens/ resistance to disease

Abstract: Resistance of 15 strawberry cultivars to low temperature, fungal and bacterial diseases, as well as cultivar productivity and fruit quality were studied in the

Tambov Region, Russia, in 2000-06. Cultivars Lirovidnaya, K-106, Korona and Divnaya are highly resistant against botrytis [*Botrytis cinerea*] disease. Cultivars Gardian and Korona have the highest yield of 163.7 and 139.7 t/ha. Cultivars Lirovidnaya, K-106, Korona, Gardian and Divnaya have stable yields and the highest fruit quality. Effect of mulch application on strawberry ecological resistance is discussed and sawdust mulch application is recommended. Reproduced with permission from the CAB Abstracts database.

954. Effect of amended growth media on the production of *Coffea canephora* seedlings in the nursery.

Adeyemi, E. A. and Daniel, M. A.

In: 21st International Conference on Coffee Science. Montpellier, France.; pp. 1209-1211; 2007.

Descriptors: coffee/ growing media/ leaf area/ leaves/ NPK fertilizers/ plant height/ sawdust/ seedlings/ stems/ topsoil/ potting composts/ rooting media

Abstract: Five growing media namely; topsoil sawdust (cured) topsoil+sawdust (1:1 ratio), topsoil+sawdust+N.P.K at two levels: 60:30:30 and 30:15:15 kg/ha were used in raising pre-germinated two-leaf stage coffee seedlings in the nursery. The assay of the growth media was taken prior to the experimentation. Treatments were arranged in randomized complete block design in four replicates. Agronomic data were taken at two months interval for six months on plant height, number of leaves, leaf area and stem diameter. Data obtained were analyzed using analysis of variance (ANOVA) and means separated with Duncan's Multiple Range Test (DMRT). Results indicated that, topsoil was not significantly different ($P \leq 0.05$) from topsoil+sawdust (1:1 ratio) and topsoil+sawdust+N.P.K 60:30:30 kg/ha in all growth parameters measured. Least performance was observed in 100% sawdust, which was significantly different from other treatments. Topsoil+sawdust (1:1 ratio) could therefore be preferred in the raising of coffee seedlings thereby reducing the amount of topsoil that will be excavated from the field annually. Reproduced with permission from the CAB Abstracts database.

955. Effect of amount of reutilized sawdust after enokitake cultivation on growth and yield of tomato plants (*Lycopersicon esculentum* Mill) in recycled or non-recycled hydroponics.

Lee SangWoo; Sim SangYeon; Lee SuYeon; Seo MyeongWhoon; Lim JaeWook; Lee HaeGil; and Park KuenWoo

Korean Journal of Horticultural Science and Technology 23(4): 372-376. (2005); ISSN: 1226-8763

Descriptors: blossom end rot/ calcium/ crop yield/ culture media/ growth/ hydroponics/ leaves/ magnesium/ phosphorus/ plant disorders/ porosity/ potassium/ sawdust/ soilless culture/ stems/ tomatoes

Abstract: A study was carried out to investigate the possibility of reusing wood sawdust substrates after enokitake (*Flammulina velutipes*) cultivation as culture medium for tomato production in hydroponics. Tomato plants cultivated in 2, 4, and 8 l of reused substrates of enokitake (RSE)/plant were compared with those in perlite medium. In the first cultivation, tomato plants were cultivated in recycled hydroponics. Growth elements such as leaf width and length, and stem diameter were increased when the amount of RSE was increased, but marketable

yields in RSE were lower by 25% than those in perlite medium due to higher occurrence of blossom-end rot in RSE. In the second cultivation, non-recycled hydroponics reduced the occurrence of blossom-end rot in RSE compared to recycled hydroponics. Marketable yields of tomato plants grown in 4 l of RSE on non-recycled hydroponics was 6% higher than those in perlite medium on recycled hydroponics. Total porosity and container capacity of RSE were higher. Moreover, the amounts of P, K, Mg and Ca in RSE after tomato cultivation were also higher than those in perlite medium, but did not affect the yields of tomato.

This citation is from AGRICOLA.

956. The effect of amount of sawdust on the impact force of the stall measured with a new test apparatus.

Takeuchi, M.; Morita, S.; Takahashi, K.; Hoshiba, S.; Haruta, T.; and Shimada, T.

Journal of Rakuno Gakuen University, Natural Science 30(2): 239-244. (2006); ISSN: 0388-001X

Descriptors: acceleration/ accelerometers/ apparatus/ cow housing/ forces/ impact strength/ impact tests/ sawdust/ stalls/ cowsheds

Abstract: This study was conducted to examine the influence of the amount of sawdust on impact force with a new test apparatus that used the accelerometer. In the new test apparatus, the accelerometer was attached to a 4.75 kg drop-mass and dropped from the height of 200 mm. Data was recorded from the accelerometer with a personal computer via the interface. The impact force was calculated from the maximum acceleration when drop-mass collided with the stall. Measurement was operated at 16 points, 8 points in front and 8 points in rear. Using sawdust as floor material, the examination was operated with 0, 1.3, 3.0 and 4.3 kg/m³ of sawdust. The correlation between the amount of sawdust and impact force was negative, in front and in rear. It was shown that the impact force when sawdust was not used and the effect of decreasing impact force when 1 kg/m² sawdust was used were different in front and in rear of the stall. When amount of sawdust was 0 kg/m², the average impact force was 4100 N. To decrease the impact force of this stall to 2400 N, that is the impact force in the rubber chip mattress used for one year, it is suggested to use sawdust of 3 kg/m². When the amount of sawdust was 1.3 kg/m² and 3.0 kg/m², the coefficient of variation was larger than in the cases of 0 kg/m² and 4.3 kg/m².

Therefore, it is necessary to use a large amount of sawdust of 4.3 kg/m² to decrease the impact force of the stall. The impact force of the stall was decreased by increasing sawdust, and the comfort when dairy cows are lying can be adjusted by using a large amount of sawdust. However, it is difficult to always keep the sawdust of 4.3 kg/m².

Therefore, it is necessary to improve this rubber chip mattress including cow comfort.

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957. Effect of applying different substrates and sulphur on mineral nutrition of blueberry leaves and cultivated soil.

Tang XueDong; Li YaDong; Ding ShaoWen; Wu Lin; Zhang ZhiDong; and Dou Sen

Journal of Jilin Agricultural University 29(3): 279-283. (2007); ISSN: 1000-5684

Descriptors: application rates/ blueberries/ iron/ leaves/ mineral content/ nitrogen/ nitrogen content/ peat/ phosphorus/ pot experimentation/ protected cultivation/ sand/ sawdust/ soil fertility/ substrates/ sulfur fertilizers/ cultivation under glass or plastic/ sulphur fertilizers

Abstract: In an experiment conducted to determine the mineral element content of blueberry leaves and cultivated soil, the different substrates (moss, peat, sawdust, distiller and sand) and different S rates changed the soil mineral element content, which influenced leaf mineral element absorption of blueberry. The soil N and P concentrations were 160.8 and 15.46 mg/kg, respectively. The leaf N, P and Fe concentrations were 1.42%, 1.30% and 731 mg/kg, respectively, when moss and peat treatment was conducted in pot experimentation. The soil and leaf concentrations of N and P were 3.89 and 3.07 mg/kg, and 1.684 and 0.109%, respectively, when 2.0 kg S/m³ and 2.5 kg S/m³ were added in the greenhouse.

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958. Effect of C/N on composting of pig manure with sawdust.

Huang, G. F.; Wong, J. W.; Wu, Q. T.; and Nagar, B. B. *Waste Management* 24(8): 805-13. (2004); ISSN: 0956-053X

Descriptors: animals/ bacteria, aerobic/ biodegradation, environmental/ carbon: analysis: metabolism/ manure/ nitrogen: analysis: metabolism/ refuse disposal/ sodium chloride/ swine/ wood

Abstract: The aim of this composting trial was to evaluate the effect of C/N on the composting process of pig manure with the purpose of reducing the amount of sawdust normally used as co-composting materials. Two aerobic static piles were prepared consisting of pig manure mixed with sawdust at an initial C/N of 30 (pile A) and 15 (pile B), respectively. Pile B containing larger amount of pig manure showed a slower rise in temperature, lower maximum temperature, and shorter thermophilic phase than pile A. It also resulted in higher pH and electrical conductivity (EC) values, and even higher contents of soluble NH₄-N and volatile solids throughout the composting period. Chemical and biological parameters including dissolved organic carbon (DOC) (4932 mg kg⁻¹), soluble NH₄-N (371 mg kg⁻¹), C/Nsolid (18.3), C/Naqueous (5.8) and seed germination index (GI) (66.5%) indicated that pile A achieved maturity after 49 days of composting. After 63 days of composting, pile B contained 5352 and 912 mg kg⁻¹ of DOC and soluble NH₄-N content, respectively, which was much higher than the criterion of 5% and 400 mg kg⁻¹, indicating its immature nature. Pile B showed a relatively low GI value of 46%, which may be due to its high indigenous EC value as a result of larger amount of pig manure. Therefore, co-composting of pig manure with sawdust at a low initial C/N would require a composting longer than 63 days, and, the high salinity due to the large amount of pig manure would pose a potential inhibition on plant growth.

This citation is from PubMed.

959. Effect of C:N ratio on numbers and types of fungi in Egyptian soil.

Shaban, G. M.; Fadl Allah, E. M.; and Yaser, M.

Egyptian Journal of Microbiology 33(3): 339-352. (1998); ISSN: 0022-2704

Descriptors: amendments/ carbon/ carbon nitrogen ratio/ cellulose/ chitin/ clay soils/ glucose/ loam soils/ sandy soils/ sawdust/ soil/ soil fungi/ soil treatment/ soil types/ starch/ testing/ dextrose/ Hyphomycetes

Abstract: Amendment of three different soil types (loamy, clay and sandy) with different carbon sources (glucose, cellulose, starch, chitin and sawdust) increased the total count of fungi in comparison with non-amended soil. Treatment with chitin increased densities of *Trichoderma harzianum*. Testing the effect of different C:N ratios (5:1, 10:1, 40:1) on soil fungi in a loamy soil sample using glucose or cellulose and NaNO₃ showed that a narrow C:N ratio better stimulated the development of the fungal flora in presence of glucose. While a wide C:N ratio was more favourable, when cellulose was used as a carbon source it showed that sugar fungi and cellulose decomposers responded differentially. *Trichoderma* was favoured by a wide C:N ratio (40:1) using either glucose or cellulose as the carbon source.

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960. Effect of compost and manure soil amendments on nematodes and on yields of potato and barley: A 7-year study.

Kimpinski, J.; Gallant, C. E.; Henry, R.; Macleod, J. A.; Sanderson, J. B.; and Sturz, A. V.

Journal of Nematology 35(3): 289-293. (2003); ISSN: 0022300X

Descriptors: bacterial-feeding nematodes/ barley/ beef manure/ clover cyst nematode/ compost/ cull potato/ diplogaster lheritieri/ heterodera trifolii/ potato/ root-knot nematode/ root-lesion nematode/ sawdust/ bacteria (microorganisms)/ diplogaster/ heterodera trifolii/ hordeum/ hordeum vulgare/ hordeum vulgare subsp. vulgare/ meloidogyne/ meloidogyne hapla/ meloidogyne javanica/ nematoda/ pratylenchus/ pratylenchus penetrans/ solanum/ solanum tuberosum/ trifolium

Abstract: A 7-year study located in Prince Edward Island, Canada, examined the influence of compost and manure on crop yield and nematode populations. The compost used in this study consisted of cull waste potatoes, sawdust, and beef manure in a 3:3:1 ratio, respectively. No plant-parasitic nematodes were detected in samples collected from windrow compost piles at 5- and 30-cm depths prior to application on field plots. Low population densities of bacterial-feeding nematodes were recovered from compost windrows at the 5-cm depth. Field plots of potato (*Solanum tuberosum* cv. Kennebec) received compost applied at 16 metric tonnes per hectare, or beef manure applied at 12 metric tonnes per hectare. An adjacent trial with barley (*Hordeum vulgare* cv. Mic Mac) received only the compost treatment. In both trials the experimental design was a complete randomized block with four replicates. Data averaged over seven growing seasons indicated that population levels of root-lesion nematodes (primarily *Pratylenchus penetrans*) were higher in root-zone soil in potato plots treated with either compost or manure compared to the untreated control plots. The soil amendments did not affect root-knot nematode (*Meloidogyne hapla*) population densities in the potato plots, but clover-cyst nematodes (*Heterodera trifolii*) were more numerous in the root-zone soils of barley treated with compost compared to the untreated plots. Numbers of bacterial-feeding nematodes (primarily *Diplogaster lheritieri*)

were greater in soil in potato plots treated with manure and in soil around barley roots than in untreated plots. Total yields of potato tubers averaged over seven growing seasons increased by 27% in the plots treated with either compost or manure. Grain yields of barley also were increased by 12% when compost was applied. These results indicated that organic amendments increased crop yields, but the impacts on different nematode species varied and usually increased soil population levels.

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961. Effect of conifer sawdust bedding on calf housing conditions.

Szyndler, J. and Kaczor, A.

Roczniki Naukowe Zootechniki 30(2): 389-396. (2003); ISSN: 0137-1657.

Notes: Original title: Wpływ gebokiej ścioki z trocin drzew iglastych na warunki utrzymania cielat.

Descriptors: acidity/ animal behaviour/ behaviour/ body weight/ calf housing/ calves/ deep litter housing/ environmental temperature/ hygiene/ litter/ microclimate/ sawdust/ straw/ animal behavior/ behavior

Abstract: The effects of using deep litter from conifer sawdust on housing conditions of Simmental calves grouped and kept in pens from 4 to 6 months of age were investigated. The calves were kept on deep litter of sawdust supplemented with Stalosan F biopreparation (group II), on deep litter (50% sawdust + 50% straw by volume; group III) and on shallow straw bedding (control group K). The behaviour, weight gains, and cleanliness of the calves and house microclimate were studied. Chemical analyses and measurements of sawdust and sawdust manure acidity, temperature inside the manure, and consumption of sawdust per bedding were done. Ethological observations showed no negative effect of conifer sawdust bedding on the behaviour of the calves. Lying time (48-50% of 24 h) and feeding time (20-22% of 24 h) conformed to the standard for this age group. Cleanliness of calves kept on sawdust bedding was similar and in some cases slightly better than with straw housing. Measurements of basic parameters of microclimate and harmful gas admixtures in the calf house did not show any deviations from the standard. Type of bedding had no effect on weight gains of the calves. The results of sawdust acidity before bedding out (pH < 6) and sawdust manure (pH > 8) disproved the common view that sawdust bedding acidified the soil when used as a fertilizer in field crops. It is concluded that conifer sawdust is useful as a bedding material for calves. Reproduced with permission from the CAB Abstracts database.

962. The effect of continuous and intermittent aeration on composting hog manure amended with sawdust: Progress report.

Hong, J. H.; Keener, H. M.; and Elwell, D. L.

In: ASAE Annual International Meeting, Orlando, Florida, USA.; 21pp.; 1998.

Descriptors: aeration / ammonia/ biotechnology/ composting/ decomposition/ emission/ manures/ nitrogen/ odour abatement/ odours/ pig manure/ sawdust/ odor abatement/ odors/ smells

Abstract: The effects of using intermittent aeration during composting on ammonia emissions and dry matter loss were determined during composting of hog manure amended with sawdust. Composting trials lasted 3 weeks

and used 4 pilot-scale 200 litre vessels. The experimental design used replication of 2 treatments, continuous aeration (CA) and intermittent aeration (IA), in 2 series of experiments (total of 8 tests). In the CA sequence, compost temperatures were controlled at 60 degrees C using feedback control on high and low air flow fans while the IA sequence consisted of 5 minutes of air flow followed by 55 minutes of rest. Mixing ratios of pig manure to sawdust were 1:1.1 and 1:1.7 dry weight basis with resulting C/N ratios of 18.2 $\pm$ 1.2 and 23.7 $\pm$ 2.2 for the 2 series of tests. Airflow reduction was 63% for IA compared to CA. Percentage nitrogen loss between treatments were moderately statistically different ($\alpha = 0.14$) with average nitrogen loss 29.7% for CA and 23.0% for IA. Nitrogen loss as ammonia-N was higher for CA than IA (25.9 versus 14.3) but was not statistically different. No significant differences existed in dry solids loss between treatments and the physical and chemical properties of the compost produced from IA were similar to that from CA for each series. Results showed that IA compared to CA may be a practical way to reduce nitrogen loss and ammonia emissions during composting of pig manure with sawdust. This citation is from AGRICOLA.

963. Effect of continuous application of compost made from cattle waste and sawdust on the growth and nitrogen uptake of spinach (*Spinacia oleracea* L.).

Kodashima, R.; Takahashi, M.; Hiraka, M.; Ono, T.; Ae, N.; and Matsumoto, S.

Horticultural Research Japan 5(4): 389-395. (2006); ISSN: 1347-2658

Descriptors: ammonium nitrate/ cattle manure/ composts/ leaf area index/ leaves/ manures/ nitrate/ nitrogen/ nitrogen fertilizers/ nutrient uptake / phosphorus fertilizers/ plant morphology/ potassium nitrate/ sawdust/ seedling growth/ soil fertility/ spinach/ LAI/ phosphate fertilizers

Abstract: Spinach (*S. oleracea*) is one of the major agricultural products in Iwate prefecture, Japan. To evaluate the effect of compost made from cattle waste and saw dust, the growth and nitrogen (N) uptake of spinach were examined between 1998 and 2001, compared to those with standard fertilizer application using a chemical fertilizer. The compost was applied annually at a rate of 45 g N.m⁻² before sowing, then spinach was cultivated 2-4 times per year without supplemental N application. In the standard fertilizer application using ammonium nitrate, super phosphate and potassium chloride, N, P₂O₅ and K₂O were applied to the soil at rates of 16-20 g.-2, 20-24 g.-2 and 16-20 g.m⁻², respectively. Morphological index, i.e. leaf length, leaf width and number of spinach leaves in plants receiving compost were comparable to those of plants treated with chemical fertilizer. Dry matter production and N uptake in spinach applied with the compost was higher than that applied with chemical fertilizer, while the concentration of inorganic N in soil treated with compost was much lower than that treated with chemical fertilizer after every cultivation. Furthermore, the proportion of nitrate to total N in spinach receiving compost was much lower than that in spinach treated with chemical fertilizer, a though N uptake was higher in spinach treated with compost than that treated with chemical fertilizer. These findings suggest that N uptake in spinach would not be fully explained by the

concentration of inorganic N in soil. However, concentration of phosphate buffer extractable organic N, which is considered an easily decomposable organic N, increased in soil treated with compost compared to that in soil treated with chemical fertilizer.

This citation is from AGRICOLA.

964. Effect of continuous soil amendment with coniferous sawdust on nematodes and microorganisms.

Brzeski, M. W. and Szczech, M.

Nematologia Mediterranea 27(1): 159-166. (1999)

NAL Call #: QL391.N4N42; ISSN: 0391-9749

Descriptors: amendements/ ecology/ effects/ free living nematodes / microorganisms/ nematology/ sandy soils/ sawdust/ soil amendements/ soil density/ succession/ Aphelenchida/ Hyphomycetes/ micro organisms/ Secernentea/ Tylenchida

Abstract: Sandy soil was amended for 6 consecutive years with coniferous sawdust at the rate of 8 metric tonnes/ha. The treatment resulted in a considerable increase in the population of fungi, including *Trichoderma* spp., while there was no apparent effect on bacteria. This was associated with an increase in the density of microbivorous nematodes. Among bacterial feeders, cephalobids increased more than rhabditids. Among fungal feeders succession was observed where *Aphelenchoides* spp. increased after the first treatment and decreased later; this was followed by *Ditylenchus* spp., and later by *Filenchus* spp. The treatment also improved soil density and capillary binding of water, and is considered beneficial for soil biotic and abiotic conditions.

This citation is from AGRICOLA.

965. Effect of culture medium and its physico-chemical properties on bulblet growth of *Lilium Oriental Hybrid*.

Woo, JinHa; Sim, YongGu; Han, YounYol; Nam, HyoHoon; Choi, KyeongBae; and Kim, KiuWeon

Journal of the Korean Society for Horticultural Science 42(4): 465-468. (2001)

NAL Call #: SB13.H28; ISSN: 0253-6498

Descriptors: bulk density/ carbohydrates/ chlorophyll/ culture media/ growth/ nitrogen/ nutrient content/ peat soils/ physicochemical properties/ sawdust/ soil/ water content/ saccharides

Abstract: This study was carried out to search for suitable media for enhancing the growth of scale-propagated lily bulblets of *Lilium* sp. cultivars Casa Blanca and Marco Polo. The physico-chemical properties of media were also investigated. pH of upland soils was 7.6, and ranged between 4.0-5.4 in all other media. Organic contents were above 27.8% in all media except upland soils (4.2%). In upland soils, bulk density was higher than the other media but water content differed. The TKS-2 + peatmoss mixture gave most vigorous shoot growth of Casa Blanca and sawdust was most effective for Marco Polo. Casa Blanca grown under TKS-2 + peatmoss mixture was high in chlorophyll content (1.40 mg.g⁻¹). Chlorophyll content of Marco Polo grown under sawdust + TKS + peatmoss mixtures gave an even higher chlorophyll content of 1.45 mg.g⁻¹. The sawdust mixture gave lowest chlorophyll

content. The sawdust+TKS mixture gave a high C/N ratio as well as contents of carbohydrate and nitrogen compound in both cultivars.

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966. Effect of culture parameters on the production of the edible mushroom *Grifola frondosa* (maitake) in tropical weathers.

Barreto, S. M.; Lopez, M. V.; and Levin, L.

World Journal of Microbiology and Biotechnology 24(8): 1361-1366. (2008)

NAL Call #: QR1 .M562 ; ISSN: 0959-3993

Descriptors: barley/ crop yield/ edible fungi/ environmental factors/ maize/ medicinal fungi/ rice/ rotation/ sawdust/ substrates/ tropical climate/ Coriolaceae/ corn/ *Grifola frondosa*/ paddy/ Poriales

Abstract: Hitherto, little effort has been directed to improve culture conditions for commercial development of maitake (*Grifola frondosa*), an edible and medicinal fungus, due to the short history of cultivation, particularly in tropical weathers. The purpose of this research was analyzing the environmental factors required for successful basidiome development on synthetic substrates in Colombia. We evaluated different cereal grains (corn, barley, sorghum and rice) for spawn production; and industrial by-products (such as coffee spent-ground and oak-sawdust) as substrates for mushroom production. Exploiting these residues for *G. frondosa* solid culturing would primarily provide edible mushroom and simultaneously help in resolving their disposal problem. The use of corn grains as substrate for spawn production results an important factor for reducing crop cycle time. A cold shock to 10 degrees C was requisite for basidiome formation. Coffee spent-ground was a good substrate for mycelial growth, but not for mushroom production. When using oak sawdust plus corn bran as substrate, we obtained consistent yields with combined high biological efficiency (BE) (35.3%), best quality mushrooms, and a crop cycle of 12-14 weeks. The results achieved in this investigation contribute to expand the knowledge on this fungus, and compare favorably with previous works in the northern hemisphere with respect to BE, mushroom quality and crop cycle time.

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967. The effect of different cultivation media on the yield of *Flammulina velutipes* (Curtis: Fries) Singer.

Pawlak, R. and Siwulski, M.

Vegetable Crops Research Bulletin 54(2): 93-96. (2001); ISSN: 1506-9427

Descriptors: crop yield/ cultivars/ culture media/ edible fungi/ genetic variation/ plant residues/ sawdust/ substrates/ cultivated varieties/ genetic variability/ genotypic variability/ genotypic variation

Abstract: Yielding of two *Flammulina velutipes* cultivars (F-01 and F-04) on sawdust cultivation media was evaluated. Sterilized pine or beech sawdust as well as a mixture of both types were used. It was found that cultivation media influenced the yield of *Flammulina velutipes*. Both cultivars yielded best on the mixture of pine and beech sawdust, worse on the beech sawdust and worst on the pine sawdust. Higher yield was obtained with F-04 cv. than F-01

cv. with the exception of the beech sawdust medium, where both cultivars gave the same yield.

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968. The effect of different growing media on cucumber seedling production, fruit yield and quality under greenhouse conditions.

Sawan, O. M.; Eissa, A. M.; and Abou Hadid, A. F.

Acta Horticulturae 491: 369-376. (1999)

NAL Call #: 80 Ac82; ISSN: 0567-7572

Descriptors: chlorophyll/ composts/ crop residues/ cucumbers/ cucurbit vegetables/ fruit vegetables/ fruits/ growing media/ heavy metals/ iron/ manganese/ peat/ plant height/ quality/ residues/ sawdust/ seedlings/ vegetables/ vermiculite/ yield components/ yields/ zinc/ gherkins/ Mn/ potting composts/ rooting media/ vegetable crops

Abstract: Twenty-five combinations of peat, vermiculite, composted sawdust (composted for 1, 2, 3 or 4 months) and crop residues compost were used as growing media for cucumber (cv. Katia) seedling production. Seedlings grown in sawdust media were either similar to or superior to controls grown in peat + vermiculite (1:1, v/v) for each of the parameters plant height, number of leaves, chlorophyll content and fruit yield (both early and total), as well as number of fruits per plant. The best plant growth and the highest yield were obtained by mixing the control medium with sawdust and plant residues compost 2:2:1 (v/v/v), i.e. reducing the peat volume from 50% to 20% in the mixture. These results indicate that sawdust can be used as a substitute for high percentages of peat in media for cucumber seedling production. Nutrient contents (N, P, K, Fe, Mn, Zn and Cu) and heavy metals contents (Pb, Cd, Ni, Cr and Co) were determined in the cucumber fruits. Reproduced with permission from the CAB Abstracts database.

969. The effect of different kind of litter on the broiler performance.

Ogan, M.

Veteriner Fakultesi Dergisi, Uludag Universitesi 19(3): 1-6.

(2000); ISSN: 1301-3173.

Notes: Original title: Farkl altlk materyalinin broyler performansna etkisi.

Descriptors: body weight/ broiler performance/ broilers/ chicks/ feed conversion/ litter/ moisture content/ pH/ poultry/ rice husks/ sawdust/ straw/ wheat/ wheat straw/ wood shavings/ chickens/ domesticated birds/ hydrogen ion concentration/ potential of hydrogen/ rice hulls

Abstract: The study was conducted to investigate the effects of using wood shavings, chopped wheat straw, sawdust, mixture of sawdust and whole wheat straw, rice hulls and whole wheat straw as litter material on broiler production performance. For each litter group, a 11.2 m² division was separated and 150 day-old Avian Farm chicks were placed in each division in accordance with 14 chicks/m². Six week body weights of broilers housed on the litter groups of wood shavings, chopped wheat straw, sawdust, mixture of sawdust and whole wheat straw, rice hulls and whole wheat straw were 2210, 2235, 2171, 2136, 2075 and 2040 g (P<0.05); and feed conversions were 1.64, 1.65, 1.80, 1.71, 1.77 and 1.98 kg, respectively. The litter pH values and moisture ratios showed increases

during the trial. The best results were obtained with the broiler groups housed on chopped wheat straw and mixture of sawdust and whole wheat straw. In conclusion, these litters could be an alternative to wood shavings. Reproduced with permission from the CAB Abstracts database.

970. Effect of different levels of soil moisture, soil amendment with sawdust and soil treatment with straw burning and chemicals on the incidence of damping-off of seedlings from true potato seed.

Islam, M. R.; Dey, T. K.; Islam, M. T.; Saifullah, M.; and Khorsheduzzaman, A. K. M.

Bangladesh Journal of Plant Pathology 16(1/2): 57-59. (2000); ISSN: 1012-9279

Descriptors: burning/ captan/ chemical control/ cultural control/ fungal diseases/ plant disease control/ plant diseases/ plant pathogenic fungi/ plant pathogens/ potatoes/ sawdust/ seedlings/ soil water/ straw/ *Athelia rolfsii*/ *Atheliaceae*/ *Corticaceae*/ flaming/ formalin/ *Hyphomycetes*/ *Peronosporomycetes*/ phytopathogens/ *Pythiaceae*/ soil moisture/ *Stereales*/ *Straminipila*

Abstract: An experiment was conducted during 1995-96 and 1996-97 in Bangladesh on true potato seed (FPS) seed line HPS- IIX13. The treatments were soil moisture at 40, 60, and 80% field capacity (FC), soil amendment with sawdust (0.75 t/ha), soil treatment with straw burning (15 cm thick), formalin (1%), Vitavax 200 (0.2%), ridomil MZ 72 (0.2%), apron 35SD (0.2%) and captan (0.2%) at 5 litres a.i./m². Five soil-borne fungal pathogens (*Sclerotium rolfsii*, *Rhizoctonia solani* and *F. solani*) were identified to be associated with damping off of seedlings from TPS. All the treatments were effective in reducing the damping-off disease of potato seedlings in TPS but their efficacy significantly differed. Formalin and Vitavax 200 showed excellent performance in controlling the disease. Soil moisture at 60% FC, straw burning and sawdust amendments also reduced damping-off incidence. This citation is from AGRICOLA.

971. Effect of different media on propagation of bi-color Bougainvillea cuttings.

Rahman, N.; Hussain, I.; and Awan, A. A.

Pakistan Journal of Biological Sciences 2(3): 877-878. (July 1999)

NAL Call #: QH301 .P355; ISSN: 1028-8880.

Descriptors: propagation media/ sand/ silt/ sawdust/ *Bougainvillea*/ cuttings

Abstract: The maximum sprouting percentage (70.83%), plant survival (51.16%) and plant height (19.03 cm) was recorded in silt. Similarly maximum root length (10.33 cm) and root number (9.33) was noted in sand. Minimum plant height (3.50 cm) was recorded in sawdust whereas minimum root length (3.33 cm) and root number (2.66) was recorded in mixture of sand, silt and clay (1:1:1). F.Y.M. give zero survival.

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972. The effect of different methods of soil mulching on the quality and yield of garlic.

Rekowska, E.

Roczniki Akademii Rolniczej w Poznaniu, Ogrodnictwo 27: 251-256. (1998); ISSN: 0137-1738.

Notes: Original title: Wpływ różnych sposobów ściokowania gleby na wielkość oraz jakość plonu czosnku.

Descriptors: bulbs/ crop yield/ garlic/ mulching/ peat/ plastic film/ rye/ sawdust/ size/ straw/ vegetables/ vegetable crops

Abstract: In a field experiment at Szczecin in 1986-88, garlic cv. Nizinny Topolski was planted out on 20 October and mulched with transparent or black plastic mulch, rye straw, sawdust or peat. Mulching increased bulb yields. Marketable yields were highest with transparent or black plastic (5.74 or 5.58 t/ha, respectively). Bulb quality was also highest in these treatments.

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973. The effect of different mixtures of organic and inorganic materials and growing positions on vegetative growth of aubergine (*Solanum melongena* L.) grown in bag culture in greenhouse.

Uzun, S.; Balkaya, A.; and Kandemir, D.

Ondokuz Mays Universitesi, Ziraat Fakultesi Dergisi 22(2): 149-156. (2007); ISSN: 1300-2988

Descriptors: application rates/ aubergines/ biomass production/ coal/ composts/ crop residues/ dry matter accumulation/ dry matter distribution/ farmyard manure/ growth/ hazelnuts/ husks/ leaves/ organic amendments/ pine needles/ plant height/ rice husks/ roots/ sawdust/ soil amendments/ stems/ tobacco/ biomass distribution/ brinjal/ eggplants/ FYM/ hulls/ rice hulls

Abstract: The aim of this study was to determine the effect of different mixtures of organic and inorganic materials and plant growing positions provided by utilizing wooden benches with different heights on vegetative growth of aubergine (*Solanum melongena*) grown in bag culture in unheated plastic greenhouse for late autumn growing season, at The University of Ondokuz Mays, Faculty of Agriculture, in the Black Sea region, Turkey. The organic and inorganic materials used in the study were decomposed farmyard manure, hazelnut husk, rice hull, decomposed pine leaves, tobacco waste, sawdust, decomposed bark, sieved garden soil, sand of 2 mm, coal dust and coal ash. Cv. Megal F1 of aubergine was used in the study. Six different mixtures of organic and inorganic materials were blended and used in horizontal growing bag culture. The experiment was carried out at three different heights in the greenhouse, namely 0, 25 and 50 cm from the ground. Plant height (cm), stem diameter (mm), leaf number per plant, dry matter partitioning to leaf, stem and root of the plants (g) were investigated as well as determining plant canopy light interception (%). In general, the best results were obtained from the mixtures named A (decomposed farmyard manure, sieved garden soil, hazelnut husk, rice hull, sand of 2 mm, decomposed pine leaves, tobacco waste, coal ash and coal dust as ratios of 2:1:1:1:1/3:1:1/2:1/2:1/4, respectively), F (Decomposed farmyard manure, sieved garden soil and sand (2 mm), as ratios of 1:1:1, respectively) and D (rice hull, sieved garden soil, decomposed bark, decomposed farmyard manure, sand of 2 mm, decomposed pine leaves, tobacco waste, coal dust and coal ash as ratios of 2:1:1:2:1/2:1:1:1/2:1/2, respectively). At any given growing positions, the mixture named B (decomposed pine leaves, decomposed farmyard manure, saw dust, coal dust, decomposed bark, hazelnut husk, tobacco waste and coal ash, as ratios of 2:3:1:1/2:1/2:1:1:1, respectively) gave the lowest values in terms of selected plant growth parameters. There were also significant differences between growing positions in

affecting vegetative growth of aubergine depending on media such as there appeared to be a tendency of obtaining higher values at higher growing positions. Reproduced with permission from the CAB Abstracts database.

974. Effect of different soil media on seed germination, seedlings growth and NPK content in *Caesalpinia pulcherrima* and *Thevetia peruviana*.

Mahmood, S. M.

University of Aden Journal of Natural and Applied Sciences 9(2): 319-330. (2005); ISSN: 1606-8947

Descriptors: diameter / growing media/ leaf area/ leaves/ nitrogen/ nutrient content/ phosphorus/ plant height/ potassium/ roots/ sand/ sawdust/ seed germination/ seedling growth/ seedlings/ seeds/ shoots/ potting composts/ rooting media

Abstract: Experiments were conducted in Yemen during May-November 2003 and May-November 2004 using four different soil media: sand; sand + soil; sand + sawdust; and sand + soil + sawdust. *Caesalpinia pulcherrima* and *Thevetia peruviana* were analysed for germination percentage, plant height, stem diameter, number of leaves per seedling, leaf area, fresh and dry weight of leaves, stem per seedlings, root length, fresh and dry weight of roots, and N, P and K content in leaves. Results showed that all observed parameters exhibited maximum values under the soil + sand medium while minimum values were observed under the soil + sawdust medium.

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975. Effect of different types of mulches and their duration on the growth and yield of garlic (*Allium sativum* L.).

Jamil, M.; Munir, M.; Qasim, M.; Jalal ud Din Baloch; and Rehman, K.

International Journal of Agriculture and Biology 7(4): 588-591. (2005); ISSN: 1560-8530

Descriptors: bulbs/ crop yield/ garlic/ mulches/ mulching/ plant height/ plastic film/ sawdust/ straw/ survival/ yield components/ mulching materials

Abstract: The effects of plastic, straw and sawdust mulches on the yield and yield components of garlic (cv. Bannu Local) were studied in Dera Ismail Khan, Pakistan, during the spring of 2003. Plants without mulch (control) were smaller by 6 and 13 cm than the plants mulched with plastic and straw, respectively. Mulching throughout the cropping season increased plant height. Bulb survival was greatest (71.83%) with plastic mulch used throughout the cropping season and lowest (50%) in the control. Bulb diameter did not significantly vary with the mulching duration (one month or throughout the cropping season). Bulb diameter was greatest with plastic mulch (4.71 cm), and lowest with sawdust mulch (4.33 cm) and in the control (4.18 cm). The type of mulch and mulching duration had no significant effects on the number of cloves per 10 bulbs and neck diameter. Straw mulch resulted in the greatest bulb weight (385.9 g) and yield (6.35 t/ha). Bulb weight was significantly correlated with yield per hectare. Straw mulch, which is cheaper and effective in enhancing garlic yield, is recommended under the agroclimatic conditions of Dera Ismail Khan.

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976. Effect of growing media and commercial fertilizers on *Furcraea maccougallii* L. plants. I. Effect on vegetative growth.

El Maadawy, E. I. and Habib, A. M. A.

Bulletin of Faculty of Agriculture, Cairo University 56(3): 543-561. (2005); ISSN: 0526-8613

Descriptors: clay/ crop residues/ fertilizers/ growing media/ growth/ sawdust/ substrates/ *Furcraea maccougallii*/ potting composts/ rooting media

Abstract: A pot experiment was carried out during two successive seasons 2001-02 and 2002-03 at the Experimental Nursery of the Ornamental Horticulture Department, Faculty of Agriculture, Cairo University, to study the effects of growing media and some commercial fertilizers on vegetative growth of *F. maccougallii* plants. The plants were grown in the following media: sand, sand + clay, sand + clay + sawdust, sand + clay + peanut shell or sand + clay + corn cob, and were sprayed every 3 weeks with Agro-top (19:19:19), Multi (12:2:43), Agro-mor (13:4:42) and Poly-feed (14:7:37) at the rate of 2 g/litre. Control plants were sprayed with tap water. The obtained results revealed that the plants grown in a mixture of sand+clay+peanut shells (1:1:1) and fertilized with Poly-feed or Multi fertilizer had the longest leaves. The plants grown in the mixture of sand + clay + corn cobs (1:1:1) and treated with Multi or Agro-mor fertilizers formed the highest number of leaves. The best leaf width was obtained as a result of growing the plants in a mixture of sand + clay + peanut (1:1:1) or sand + clay + corn cob and fertilized with Poly-feed. A mixture of sand + clay (1:1) plus Multi fertilizer produced the heaviest fresh weight of foliage. Meanwhile, plants grown in sand+clay (1:1) or sand + clay + corn cob (1:1:1) mixtures had the heaviest dry weight of foliage. The longest roots were formed on plants grown in sand + clay + sawdust (1:1:1) mixture and received the Multi fertilizer or sand medium plus Poly-feed fertilizer. Whereas, growing plants in sand + clay plus Multi fertilizer or in sand + clay + corn cob mixture with Agro-mor fertilizer gave the greatest number of roots.

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977. Effect of growing medium on early growth and survival of *Uapaca kirkiana* Muell Arg. seedlings in Malawi.

Mhango, J.; Akinnifesi, F. K.; Mng'omba, S. A.; and Sileshi, G.

African Journal of Biotechnology 7(13): 2197-2202. (2008) NAL Call #: TP248.13 .A37; ISSN: 1684-5315

Descriptors: forest soils/ grafting/ growing media/ nitrogen fertilizers/ phosphorus fertilizers/ plant height/ potassium fertilizers/ roots/ sand/ sawdust/ seedling growth/ survival/ phosphate fertilizers/ potash fertilizers/ potting composts/ rooting media/ *Uapaca*/ *Uapaca kirkiana*

Abstract: The use of appropriate growing medium has been an important factor influencing growth and survival of seedlings in the nursery. Raising *Uapaca kirkiana* rootstocks from seeds has been a challenge as pencil-size stem thickness is required before grafting can be done. An experiment was carried out with the objective of determining an effective growing medium that ensures survival and rapid growth of *U. kirkiana* seedlings. Ten different combinations of sand, forest soil and sawdust amended with four different levels of nitrogen, phosphorus and potash fertilizer were evaluated. The result showed that

the growing medium comprising 75% forest soil and 25% sawdust produced the tallest seedlings with larger root collar diameter and higher survival at ten months after planting. Amending the same growing medium with fertilizer improved the root collar diameter of the seedlings. It is concluded that a growing medium comprising 75% forest soil and 25% sawdust and amended with NPK fertilizer was superior in improving *U. kirkiana* seedling growth to attain a suitable diameter for grafting within ten months.

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978. Effect of growth media and fertilizer application on biomass allocation and survival of *Uapaca kirkiana* Muell Arg seedlings.

Sileshi, G.; Akinnifesi, F. K.; Mkonda, A.; and Ajayi, O. C. *Scientific Research and Essays* 2(9): 408-415. (2007); ISSN: 1992-2248

Descriptors: biomass/ diameter/ dry matter distribution/ forest soils/ growing media/ growth/ liquid fertilizers/ mortality/ plant diseases/ plant height / root shoot ratio/ sawdust/ seedlings/ soil fumigation/ survival/ biomass distribution/ death rate/ potting composts/ rooting media/ *Uapaca kirkiana*

Abstract: The effects of potting mixture, soil and foliar fertilizer application on plant growth, biomass allocation and survival of *U. kirkiana* seedlings in the nursery were studied. Growth in height and diameter was greatest in plants with a root to shoot ratio of <1 or 2.5-4. Growth in height and diameter significantly differed ($P < 0.01$) with treatment main effects and interactions. Growth was most pronounced in plants grown on unsterilized forest soil and soil, then treated with foliar fertilizer. The probability of plant mortality was significantly higher ($P < 0.01$) in the potting mixture where sawdust was added (mean=0.47) than in the mixture without sawdust (mean=0.12). Mortality was also significantly higher ($P < 0.05$) in unsterilized soil (mean=0.30) than in sterilized soil (mean=0.13). Potting mixtures amended with soil-applied fertilizer had lower probability of plant mortality compared to those without. Disease incidence and seedling survival were related to biomass allocation in a curvilinear manner. It was concluded that the survival of *U. kirkiana* seedlings in the nursery is a function of disease incidence, plant growth and biomass allocation, which in turn are functions of the growth medium and nutrient availability. Reproduced with permission from the CAB Abstracts database.

979. Effect of growth media on germination and seedling growth of *Dacryodes edulis* (Don. G. Lam H. J.).

Okunomo, K.; Ojeifo, I M.; and Oghenerhor, E. O. *Discovery and Innovation* 18(1): 11-14. (2006); ISSN: 1015-079X

Descriptors: clay soils/ girth/ growing media/ leaves/ plant height/ sandy soils/ sawdust/ seed development/ seed germination/ seedling emergence/ seedling growth/ seedlings/ seeds/ soil types/ topsoil/ potting composts/ rooting media

Abstract: The consumption of *Dacryodes edulis* is high in Nigeria, however, its cultivation has not gained popularity and hence its production is on a small scale because of dearth of information on its germination, seedling growth and development. Consequently, the effect of soil type on

germination and seedling growth of *D. edulis* was investigated. Four soil types (topsoil, sawdust, sharp sand and clay soil) were used. Results showed that there were significant differences in plant height, girth, number of leaves and leaf length as influenced by various growth media. However, no significant differences were observed between topsoil and sawdust on their influence on plant height of *D. edulis*. It is recommended that top soil and sawdust could be utilized for germination of *D. edulis* seeds.

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980. Effect of growth media on propagation of four varieties of cassava.

Okpara, D. A. and Baiyeri, S. O. *Global Journal of Agricultural Sciences* 5(2): 131-134. (2006); ISSN: 1596-2903

Descriptors: cassava/ cultivars/ growing media/ growth/ leaves/ plant height/ poultry manure/ propagation/ sawdust/ sprouting/ topsoil/ cultivated varieties/ manioc/ plant propagation/ potting composts/ poultry litter/ rooting media/ tapioca plant

Abstract: A 4x3 factorial experiment in a completely randomized design (CRD) with three replicates was conducted during 2004, in southeastern Nigeria, to evaluate the propagation (sprouting and growth) of 4 cassava cultivars (3 improved - TMS 30572, TMS 4(2) 1425 and NR8082; and one local - Nwaibibi) on 3 growth media (sawdust + poultry manure, sawdust and topsoil). On average, at 28 days after planting, number of sprouts per cutting ranged from 1.4 in topsoil to 6.7 in sawdust; plant height ranged from 1.8 cm in topsoil to 5.4 cm in sawdust + poultry manure; and number of leaves per plant ranged from 2.8 in topsoil to 5.3 in sawdust. Sawdust and sawdust + poultry manure significantly enhanced sprouting, vigour, plant height and number of leaves per plant than topsoil. The improved cultivars were superior to the local Nwaibibi in terms of all attributes measured. On average, TMS 30572 and TMS 4(2) 1425 were more vigorous than NR8082, and plants were taller in the former in sawdust + poultry manure.

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981. Effect of inoculation with phosphate-bacteria, sawdust compost and nitrogen sources on okra yield and some properties of calcareous soil.

Estefanous, A. N. and Sawan, O. M. *Acta Horticulturae* 608: 85-94. (2003) NAL Call #: 80 Ac82; ISSN: 0567-7572

Descriptors: application rates/ calcium nitrate/ chemical composition/ composts/ crop yield/ dry matter/ enzyme activity/ enzymes/ liquid fertilizers/ nitric acid/ nitrogen/ nitrogen fertilizers/ nutrient availability/ nutrient uptake/ okras/ oxidoreductases/ phosphorus/ plant composition/ plant nutrition/ potassium/ sawdust/ seed inoculation/ shoots/ soil bacteria/ soil organic matter/ soil pH/ urea/ yield components/ biofertilizers/ chemical constituents of plants/ organic matter in soil/ redox enzymes

Abstract: A pot experiment was conducted to study the effects of phosphate-dissolving bacterial (PDB) inoculation, sawdust compost, and N fertilizer on the growth and yield of okra cv. Esmaily grown on calcareous soil. Seeds were inoculated with *Bacillus megaterium* var. *phosphaticum* at

600 g/40 kg seeds. Sawdust compost was mixed with the soil at 2.5 or 5.0% (soil weight basis). Beginning on the third week, N (40 kg/feddan) was applied as nitric acid solution (0.1 N), nitric acid-calcium nitrate solution (1:1), calcium nitrate solution or urea solution at 2-week intervals. Changes in soil biochemical properties were also studied at 175 days after planting. PDB, sawdust compost and N application significantly enhanced shoot dry weight, fruit fresh and dry weights, fruit yield, and N and P uptake. Sawdust compost was more effective when applied at the higher rate. The greatest increase in the aforementioned parameters was recorded for inoculated plants treated with sawdust compost and N in the form of nitric acid solution. Microbial counts, PDB and dehydrogenase [oxidoreductase] activity in the soil, as well as N, P and K availability, were enhanced by sawdust compost and PDB. The incorporation of sawdust compost also increased soil organic matter and slightly reduced pH. Thus, sawdust compost and acidic N fertilizer application, along with PDB inoculation, can enhance okra yield and nutrient uptake in calcareous soil. [1 feddan=0.42 ha]. This citation is from AGRICOLA.

982. Effect of levels of nitrogen and forms of pre-conditioned urea on grain yield and N status in plant and soil of rainfed rice (*Oryza sativa*).

Lakpale, R.; Pandey, N.; and Tripathi, R. S.
Indian Journal of Agronomy 44(1): 89-93. (1999)
NAL Call #: 22 IN235; ISSN: 0537-197X

Descriptors: farmyard manure/ mineral uptake/ nitrogen fertilizers/ nutrient uptake/ rice/ rice straw/ sawdust/ soil fertility/ sources/ straw/ urea fertilizers/ FYM/ paddy
Abstract: In a field experiment during the rainy seasons of 1992 and 1993 at Raipur, Madhya Pradesh, India, rice was given 60 or 120 kg N/ha as prilled urea, urea mixed with soil (1:3) or urea + sawdust or farmyard manure or rice straw dust + soil (1:3:1). Urea + farmyard manure + soil gave the highest grain yield, N accumulation in plants, plant N content, and soil N status at harvest. Grain yield and N accumulation of rice increased significantly with increasing N rate. Reproduced with permission from the CAB Abstracts database.

983. Effect of media on propagation of *Lilium*.

Manish Kapoor; Grewal, H. S.; and Arora, J. S.
Journal of Ornamental Horticulture New Series 3(1): 58-59. (2000)

Descriptors: bulb scales/ bulbs/ growing media/ leaves/ lilies/ perlite/ planting stock/ propagation/ roots/ sand/ sawdust/ size/ soil/ vermiculite/ nursery plants/ nursery stock/ plant propagation/ planting materials/ potting composts/ rooting media
Abstract: The effects of different growing media for the propagation of bulb scales of *Lilium*, cultivar Chianti, were investigated. Bulb scales were planted in pots containing sawdust, soil + sawdust (1:1), moss grass [sic], perlite, vermiculite, sawdust + moss grass (1:1) and sand. The pots were kept in a shade house and watered for 16 weeks. The highest number of bulblets/scale (6.2) was obtained with vermiculite followed by moss grass and the least was with soil + sawdust (1.7). The mean diameter and weight of the bulblets was significantly higher with vermiculite than with the other treatments. The number of leaves was

significantly higher with vermiculite, moss grass, perlite and sand compared with the other treatments. Root length was greatest with vermiculite. Reproduced with permission from the CAB Abstracts database.

984. Effect of mulch materials on growth and yield of apple (*Malus domestica* Borkh.) cv. Red Delicious under rainfed conditions of Kashmir.

Wani, G. M.; Nagoo, G. A.; Bhat, A. R.; and Lone, I. A.
Applied Biological Research 2(1/2): 135-137. (2000); ISSN: 0972-0979

Descriptors: apples/ crop quality/ crop yield/ growth/ mulches/ polyethylene/ rice/ rice straw/ sawdust/ straw/ yield components/ Kashmir/ mulching materials/ paddy/ polythene
Abstract: Five different mulch materials namely sawdust, paddy straw, cut grass, polyethylene (punched) and polyethylene (unpunched) were compared in a field experiment conducted in Jammu and Kashmir during 1990 to determine their effects on growth, yield and quality of Red Delicious variety of apple. The growth of the fruit trees in terms of shoot length was highest under cut grass in comparison with all the other treatments. Highest fruit yield, fruit weight, fruit colour and fruit size was obtained from the trees under cut grass mulch materials followed by paddy straw and polyethylene. In case of total soluble sugar and acidity, mulch materials did not play significant role. Reproduced with permission from the CAB Abstracts database.

985. Effect of mulching materials on growth and flowering of oriental hybrids lilies in alpine area.

Hong SaeJin; Kim HakKi; and Park SeWon
Korean Journal of Horticultural Science and Technology 19(4): 585-590. (2001); ISSN: 1226-8763

Descriptors: bulbs/ crop quality/ crop yield/ cultivars/ cut flowers/ flowering/ foliage/ growth/ lilies/ mulches/ mulching/ plant development/ plastic film/ protected cultivation/ roots/ sawdust/ anthesis/ cultivated varieties/ cultivation under glass or plastic/ mulching materials/ South Korea
Abstract: Bulbs of *Lilium* Oriental hybrid cultivars Casablanca and Marco Polo were grown in a plastic house in an alpine area of Pyongchang Kangwondo, Korea Republic. Sawdust, black film, reflective film, transparent film, and white/black double film were used as mulching materials to ascertain the growth of foliage, quality of flower, and size of bulbs. Foliage weights of both lilies were higher when grown with mulching materials than with the control. There were no differences in bulb weight among the control and mulching treatments, except delayed bulb growth in black film and white/black double film. Mulching cultivation with sawdust and reflective film stimulated foliage growth, root growth and bulb production. Black film delayed the growth and development. Transparent and white/black double films showed no effects on foliage growth and bulb development than the control. Since mulching materials tended to delay lily growth, including foliage and bulb, an extension of growing term might be better to produce high quality lilies than common cultivation in an alpine area. Reproduced with permission from the CAB Abstracts database.

986. Effect of mulching on the growth and yield of cotton.

Raman, R.; Kuppuswamy, G.; and Krishnamoorthy, R.
Journal of Ecobiology 16(4): 275-278. (2004)
 NAL Call #: QH540.J56 ; ISSN: 0970-9037
Descriptors: coir/ cotton/ crop residues/ crop yield/ cultural control/ mulches/ mulching/ rice/ rice straw/ sawdust/ straw/ sugarcane trash/ weed control/ weeds/ coconut fibre/ Madras/ mulching materials/ paddy/ Pontederiales
Abstract: A field study was conducted in Annamalai, Tamil Nadu, India during 1999 to investigate the effect of mulching on the weed control, and growth and yield of cotton. The treatments were: no mulch; mulching with water hyacinth (*Eichhornia crassipes*) at 10 cm thickness; coir pith at 2 cm thickness; sawdust at 2 cm thickness; paddy straw at 10 cm thickness; and sugarcane trash at 10 cm thickness. The treatment with sugarcane trash reduced the weed number to 20 weeds/m² and weed biomass to 15.19 g/m². Sugarcane trash mulching increased weed control efficiency (91%), weed control index, and growth and yield of cotton (1464 kg/ha). Coir pith mulching followed sugarcane trash mulch in terms of efficiency. All mulching treatments suppressed weeds and improved seed cotton yield.
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987. Effect of mulching rates on evaporation, water and salt distribution in two soils with different texture from upper soil layer, in Derab Region, Kingdom of Saudi Arabia.

Al Harby, A. A. B. O.; Al Darby, A. M.; and Abdel Aziz, R.
Arab Gulf Journal of Scientific Research 23(3): 140-149. (2005); ISSN: 1015-4442
Descriptors: clay loam soils/ evaporation/ horizons/ loam soils/ mulches/ mulching/ salts in soil/ sandy soils/ sawdust/ soil profiles/ soil texture/ soil types/ soil water content/ soil water retention/ spatial distribution/ waste utilization/ water conservation/ mulching materials
Abstract: This study was conducted in Saudi Arabia to determine measures on how to minimize evaporation using mulching at different rates in two soils loamy sand (S1), and sandy clay loam (S2). Sawdust mulch rates used were (zero, 2 and 4 cm) depth. Tape water was added to soil columns based on the required water to saturate soil. After the leachate (free water drainage) ceased, an evaporation experiment was carried out until stable weight of the control (no mulch) was achieved (83 days). The cumulative evaporation (E) was determined by daily weighing soil columns. Soil water and salts distribution were determined before and after evaporation experiments. Results indicated that the two soils had different hydrophysical properties such that sandy clay loam soil was higher in water retention. The study revealed that sawdust mulching reduced evaporation significantly on both soils. Mulching with 2-cm depth was enough for evaporation reduction to a rate lower than that of water flow toward soil surface. Results indicated that there is a linear relationship between evaporation and time for all mulching rates of both soils. It has been found that soil water profile distribution was significantly higher with mulched soil columns compared with the control for both soils. However, there were no significant differences between sawdust mulching with 2- or 4-cm depth. These results were reflected on the soil water storage, where mulched soil columns were higher than that

of the control. In general, results of evaporation, soil water distribution and water storage proved that sawdust mulching with 2-cm depth was enough to limit evaporation and conserve water for both soils. The effect was more pronounced in loamy sand soil. Generally, the results of the electrical conductivity and salts distribution after the leachate ceased showed the salts were decreased on the upper soil layers, and increased on the lower soil layers for both soils and also in leachate. Results also showed that salts were redistributed after evaporation period, where salts, moved toward the upper soil layers especially in the control soil columns. Salt distribution reached equilibrium state in mulched soil columns of loamy sand soil, whereas sandy clay soil did not reach such equilibrium in loam soil. This study emphasizes the importance of mulching to limit evaporation, increase soil water storage and thus availability of water for plant growth. Two-cm depth and 28.41 tonnes sawdust mulch/ha were found to be enough to achieve that target.
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988. The effect of nutrient supplements on the yield of *Pleurotus ostreatus* mushroom grown on composted sawdust of *Triplochiton scleroxylon*.

Obodai, M. and Johnson, P. N. T.
Tropical Science 42(2): 78-82. (2002); ISSN: 0041-3291 [TROSAC]
Descriptors: *Pleurotus ostreatus*/ yields/ mushrooms/ *Leucaena leucocephala*/ leaves/ sawdust/ composts/ mixtures/ NPK fertilizers/ urea/ epsom salts/ cocoa byproducts/ peanut husks/ cocoa nib dust
 This citation is from AGRICOLA.

989. Effect of organic amendments and carbofuran on population density of four nematodes and growth and yield parameters of rice (*Oryza sativa* L.) var. IRRI 6.

Aly Khan and Shahid Shaukat, S.
Pakistan Journal of Zoology 32(2): 145-150. (2000); ISSN: 0030-9923
Descriptors: carbofuran/ chemical control/ farmyard manure/ horse manure/ neem extracts/ nematicides/ nematode control/ oilseed cakes/ organic amendments/ plant extracts/ plant parasitic nematodes/ population density/ poultry manure/ rice/ sawdust/ straw/ sugarcane bagasse / wheat/ wheat straw/ eelworms/ FYM/ *Hoplolaimus indicus*/ oil cakes/ paddy/ poultry litter/ *Secernentea*/ *Tylenchida*
Abstract: The effect of nine organic amendments, namely castor oil cake, mustard oil cake, sugarcane bagasse, farmyard manure, horse manure, sawdust, poultry manure, wheat straw and neem leaves (coarsely crushed) and a chemical nematicide carbofuran on the growth parameters of rice and population density of *Hirschmanniella oryzae*, *Tylenchorhynchus annulatus*, *Hoplolaimus indicus* and *Pratylenchus zeae* were investigated in microplot experiments. Poultry manure, horse manure and neem leaves significantly increased shoot length while root length was markedly increased by castor oil cake, poultry manure, neem leaves and horse manure as compared to the untreated control. Shoot weight was significantly increased by poultry manure and horse manure, and root weight by poultry manure over the controls. Grain yield was significantly enhanced over the controls by carbofuran,

castor oil cake, mustard oil cake, poultry manure and horse manure. Population density of *H. oryzae* was significantly reduced over the controls by carbofuran, neem leaves, mustard oil cake, castor oil cake, sawdust and wheat straw, that of *T. annulatus* by castor oil cake, mustard oil cake, carbofuran, sugarcane bagasse and farmyard manure. Population level of *H. indicus* was markedly reduced by castor oil cake, mustard oil cake, carbofuran, sugarcane bagasse, sawdust, horse manure, poultry manure, neem leaves and farmyard manure while that of *P. zeae* by castor oil cake, carbofuran, horse manure, mustard oil cake, sugarcane bagasse, poultry manure, neem leaves, wheat straw and farmyard manure.
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990. Effect of organic amendments and solarisation on Fusarium wilt in susceptible banana plantlets, transplanted into naturally infested soil.

Nasir, N.; Pittaway, P. A.; and Pegg, K. G.

Australian Journal of Agricultural Research 54(3): 251-257. (2003); ISSN: 0004-9409

Descriptors: ammonium nitrogen/ bananas/ cultivars/ cultural control/ fungal diseases/ organic amendments/ plant disease control/ plant diseases/ plant pathogenic fungi/ plant pathogens/ poultry manure/ sawdust/ solar radiation/ survival/ susceptibility/ ammonia nitrogen/ cultivated varieties/ Hyphomycetes/ phytopathogens/ poultry litter/ sunlight

Abstract: Despite extensive research since pathogenicity was first established in 1919, no cultural or chemical control strategy has proven effective against *Fusarium* wilt of bananas. The efficacy of cultural control is attributed to the suppression of pathogen activity. Yet, amending naturally infested soil with aged chicken manure has been shown to enhance disease severity, without any change in the activity of the pathogen *Fusarium oxysporum* f. sp. *cubense* (Foc) in the soil. In this study, the effect of amending soil with composted sawdust, and of solarising soil, was compared with the effect of amending soil with chicken manure. Bioassays comparing the activity of Foc in the soil with the extent of invasion of banana pseudostem tissue by Foc were used to investigate why strategies targeting pathogen survival have not proven successful in controlling this disease. The enhancement of Foc invasion of the banana plantlets was reproduced with the addition of chicken manure to the naturally infested soil. However, changes in the activity of Foc in the soil were not associated with changes in the frequency of invasion of the plantlets. Invasion of banana pseudostems in the sawdust and solarisation treatments was not significantly different from invasion in the respective control treatments, despite a reduction in the activity of Foc in the sawdust-amended soil and an enhancement in the solarised soil. Moreover, the increase in Foc activity in the solarised soil recorded during the bioassays occurred despite the effectiveness of solarisation in reducing the survival of Foc in pre-colonised banana root tips buried in the soil. Changes in the frequency of invasion were associated with changes in the availability of mineral nitrogen, particularly ammonium N. These results suggest that the physiological response of banana cultivars to ammonium N may be associated with their susceptibility to *Fusarium* wilt.

Accordingly, cultural strategies for controlling Panama disease will only be effective if they enhance the ability of the host to resist invasion.

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991. Effect of organic amendments for the management of Meloidogyne incognita on greengram and blackgram.

Bornali Mahanta and Aparajita Borah

Journal of the Agricultural Science Society of North East India 11(1): 73-76. (1998)

Descriptors: chemical control/ grain legumes/ green gram/ multipurpose trees/ mustard/ neem seed cake/ nematicidal plants/ nematicides/ nematology/ oilseed cakes/ organic amendments/ plant nematology/ plant parasitic nematodes/ poultry manure/ sawdust/ trees/ woody plants/ eelworms/ mung bean/ neem/ neem seed oilmeal/ oil cakes/ poultry litter/ pulses/ Secernentea/ Tylenchida

Abstract: Sawdust, poultry manure, mustard cake and neem cake [*Azadirachta indica*] each at 3 doses (0.5, 1.0 and 1.5% w/w) were found to be effective for the management of *M. incognita* on green gram [*Vigna radiata*] and black gram [*Vigna mungo*] under greenhouse conditions. The highest dosage level was found to be the most effective. Poultry manure and neem cake were found to be most effective in reducing galls, egg masses, and increasing yield of both green gram and black gram.
Reproduced with permission from the CAB Abstracts database.

992. Effect of organic amendments for the management of Tylenchulus semipenetrans on Khasi mandarin.

Sinha, A. K. and Neog, P. P.

Indian Journal of Nematology 32(2): 232-233. (2002)

NAL Call #: QL391.N4I5; ISSN: 0303-6960

Descriptors: cattle manure/ cultural control/ growth/ mandarins/ mustard oilmeal/ nematode control/ nitrogen fertilizers/ organic amendments/ pest control/ phosphorus fertilizers/ plant parasitic nematodes/ plant pests/ potassium fertilizers/ roots/ sawdust/ shoots/ eelworms/ phosphate fertilizers/ potash fertilizers/ Rutales/ tangerines

Abstract: The effect of 3 organic amendments, alone or in combination with NPK, was investigated against *T. semipenetrans* on mandarin cv. Khasi. The treatments were: 150 g N+120 g P₂O₅+100 g K₂O (NPK), NPK+sawdust at 5 tonnes/ha, NPK+sawdust at 10 tonnes/ha, NPK+cowdung at 5 tonnes/ha, NPK+cowdung at 10 tonnes/ha, NPK+mustard oil cake at 5 tonnes/ha, NPK+mustard oil cake at 10 tonnes/ha, sawdust at 5 tonnes/ha, sawdust at 10 tonnes/ha, cowdung at 5 tonnes/ha, cowdung at 10 tonnes/ha, mustard oil cake at 5 tonnes/ha, mustard oil cake at 10 tonnes/ha, and a control (without NPK and organic amendments). Organic amendments were applied 15 days before planting of seedlings. Five-month-old seedlings raised in large cement pots containing steam-sterilized soil were transplanted singly in each pot (20x25 cm) containing 4 kg of steam-sterilized soil. Four weeks after transplanting, each seedling was inoculated with 5000 active second stage juveniles of *T. semipenetrans*. After 6 weeks, NPK treatments were applied in 4 split doses. Observations were recorded 12 months after inoculation. The highest fresh and dry weight

of shoots and roots, and reduction in nematode population were recorded from NPK+mustard oil cake at 10 tonnes/ha treatment, followed by NPK+sawdust at 10 tonnes/ha. All treatments were effective in increasing plant growth compared to the control.
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993. Effect of organic amendments in the interaction of VAM fungus (*Glomus fasciculatum*) and root-knot nematode (*Meloidogyne incognita*) on greengram.

Neog, P. P. and Gogoi, B. B.

Crop Research Hisar 26(1): 159-162. (2003)

NAL Call #: SB4.C66 ; ISSN: 0970-4884

Descriptors: cultural control/ endomycorrhizas/ galls/ green gram/ growth/ mycorrhizal fungi/ mycorrhizas/ nematode control/ organic amendments/ pest control/ plant height/ plant parasitic nematodes/ plant pests/ plant residues/ poultry manure/ roots/ sawdust/ shoots/ vesicular arbuscular mycorrhizas/ eelworms/ Glomaceae/ mung bean/ poultry litter/ Secernentea/ Tylenchida

Abstract: The effect of four organic amendments, mustard cake, sawdust, poultry manure and decaffeinated tea waste (DCTW), was studied on green gram in the presence of the vesicular arbuscular mycorrhizal (VAM) fungus, *Glomus fasciculatum*, and the root-knot nematode, *Meloidogyne incognita*. Of the different treatments, DCTW gave the highest values for the different green gram growth parameters (plant height, fresh and dry weight of shoots, and fresh and dry weight of roots) in the presence of nematode and VAM. The highest reduction in the gall number and final nematode population in soil was recorded in this treatment.

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994. Effect of organic amendments on the population of antagonists and survival of apple seedlings under glasshouse inoculated with *Dematophora necatrix*.

Ashwani Tapwal; Sharma, Y. P.; and Lakhanpal, T. N.

Indian Journal of Horticulture 61(3): 261-262. (2004); ISSN: 0019-5251

Descriptors: apples/ biological control/ biological control agents/ fungal antagonists/ fungal diseases/ inoculation/ oilseed cakes/ organic amendments/ pine needles/ plant disease control/ plant diseases/ plant pathogenic fungi/ plant pathogens/ rhizosphere fungi/ sawdust/ biocontrol agents/ biological control organisms/ Hyphomycetes/ oil cakes/ phytopathogens/ Xylariaceae/ Xylariales

Abstract: The organic amendments, sawdust, pine needles (chopped, 7-12 mm) and oil cake (powdered), were tested under glasshouse conditions with the apple root rot pathogen (*Dematophora necatrix* [*Rosellinia necatrix*]) to evaluate their effects on the population of different antagonists (*Gliocladium virens*, *Trichoderma harzianum* and *T. viride* strains TV1, TV2 and TV3). The amendments were mixed with fumigated soil at 5% (v/v) in nursery bags (5x9 inch). One-year-old dormant apple seedlings were transplanted into the nursery bags containing the amended soil with 5% formalin. Five grams of pathogen and antagonist inocula were mixed per nursery bag. Soil samples were collected after 30, 45, 60 and 75 days, and colony forming units (cfu) were determined by soil plate method. The population of all antagonists was higher in amended soil than in the non-amended control. Soil

amended with sawdust recorded the maximum population of antagonists, followed by soil amended with pine needles and oil cake, respectively. The highest cfu was recorded in the case of TV1, followed by TV3, TV2, *T. harzianum* and *G. virens*, respectively. Maximum disease control was obtained in amended soil sawdust and pine needles and inoculated with TV1, *T. harzianum* and TV3. These results indicate that organic amendments increase the rhizosphere population of selected antagonists and reduce root rot of apple seedlings by inhibiting the pathogen.

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995. Effect of organic material on soil properties, plant growth, leaf photosynthesis, nutrient uptake and mycorrhizal infection of blueberries.

Li YaDong; Tang XueDong; Wulin ; and Zhang ZhiDong

Acta Horticulturae 715: 375-380. (2006)

NAL Call #: 80 Ac82; ISSN: 0567-7572

Descriptors: cultivars/ growth/ leaves/ mycorrhizal fungi/ mycorrhizas/ nutrient uptake/ organic amendments/ peat/ photosynthesis/ plant nutrition/ roots/ sand/ sawdust/ soil acidity/ soil pH/ soil physical properties/ soil properties/ sulfur fertilizers/ tillage/ carbon assimilation/ carbon dioxide fixation/ cultivated varieties / Kirin/ physical properties of soil/ soil cultivation/ sulphur fertilizers

Abstract: Experiments were conducted in Jilin, China, in 2001 to elucidate the relationship between soil conditions and growth, leaf photosynthesis, nutrient uptake, and mycorrhizal infection of 2 highbush blueberry (*Vaccinium corymbosum*) cultivars (Bluecrop and Northland). Mineral soils were amended with organic materials and sulfur in the field and in pots. For the soil amendment treatment, the organic materials were mixed with soil at 1:1 ratio in volume. Sulfur was applied at 1 kg/m³. The treatments were: (1) moss plus sulfur; (2) peat plus sulfur; (3) sawdust plus sulfur; (4) tillage plus sulfur; (5) sand plus sulfur; (6) moss and peat plus sulfur; (7) peat and sawdust plus sulfur; (8) sulfur (1 kg/m³); (9) sulfur (2 kg/m³); and (10) control. Plant growth was increased by all amendments and elemental sulfur. In the control treatment, growth appeared to be limited by high soil pH. For the sulfur treatment, a decrease in the soil pH with a concomitant increase of elemental sulfur probably stimulated plant growth. For all amendments, plant growth response was probably related to both a decrease in soil pH and an improvement in soil physical conditions. Further, organic materials and sulfur addition influenced leaf photosynthesis, nutrient uptake, root activity, and mycorrhizal infection. It was detrimental by amending soil with sulfur alone, while the mixing of organic materials with sulfur produced better plant growth. Elemental sulfur was effective in increasing soil acidity with the 1 kg/m³ rate decreasing pH by 2 units and the 2 kg/m³ rate decreasing pH by 2.7-3 units.

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996. Effect of organic matter addition to the pen surface and pen cleaning frequency on nitrogen mass balance in open feedlots.

Adams, J. R.; Farran, T. B.; Erickson, G. E.; Klopfenstein, T. J.; Macken, C. N.; and Wilson, C. B.

Journal of Animal Science 82(7): 2153-63. (July 2004);

ISSN: 0021-8812 .

15309964

Descriptors: animal feed: analysis/ animals: cattle: growth & development: metabolism/ dietary fiber: metabolism/ digestion/ feces: chemistry/ housing, animal/ hygiene/ male/ manure: analysis/ nitrogen: analysis/ random allocation/ weight gain: drug effects/ Zea mays

Abstract: Three finishing trials were conducted to determine the effects of dietary manipulation and management on N losses from open feedlots. In each experiment, 96 steers were assigned randomly to 12 nutrient balance pens. In Trial 1, calves were fed for 180 d during the winter/spring months; in Trial 2, yearlings were fed for 132 d in the summer. In Trials 1 and 2, N losses from pens were compared directly by adding OM to the pen surface or indirectly by feeding digestible ingredients designed to increase OM excretion. The dietary treatment (BRAN) included 30% corn bran (DM basis) replacing dry-rolled corn. Pens where OM was directly added received sawdust applications (SAWDUST) at a rate to match OM excretion from the BRAN diet. These two treatments were compared with a conventional, 75% dry-rolled corn diet (CON). Because CON and SAWDUST diets were identical, performance for both treatments was similar during Trials 1 and 2. The BRAN diet decreased ($P < 0.10$) gain efficiency during Trials 1 and 2 by 9.5% relative to CON. Fecal N excretion was greater ($P < 0.01$) for calves and yearlings when BRAN was fed compared with CON. Adding OM to the pen surface increased ($P < 0.01$) the amount of N in manure removed from pens and reduced ($P < 0.10$) N losses in Trial 1. Nitrogen losses were not significantly different among treatments in Trial 2. In Trial 3, calves were fed for 166 d during the winter/spring months. A 2 x 2 factorial design was used to evaluate pen cleaning frequency and diets similar to CON and BRAN. Pens were either cleaned monthly or once at the end of the feeding period. Daily DMI was greater ($P = 0.01$) and ADG was lower ($P < 0.01$) when cattle were fed BRAN compared with CON. Responses from all three trials indicate a negative effect of BRAN on gain efficiency. Dietary treatment and cleaning frequency interacted for N balance in the feedlot. Nitrogen losses decreased and manure N increased ($P < 0.10$) for cattle fed BRAN compared with CON when pens were cleaned monthly. Feeding BRAN did not affect total manure N, but resulted in higher N losses when pens were cleaned only once. For all trials, BRAN increased the amount of N remaining in composted manure. Adding OM to pen surfaces and/or cleaning pens more frequently may decrease N losses from open feedlot pens and from compost, although responses seem influenced by ambient temperature or season.

This citation is from PubMed.

997. Effect of organic mulching on growth and yield of raspberry cv. Heritage.

Pedrerros, A.; Gonzalez, M. I.; and Manosalva, V.

Acta Horticulturae 777: 473-475. (2008)

NAL Call #: 80 Ac82; ISSN: 0567-7572

Descriptors: crop yield/ growth/ manual weed control/ mulches/ mulching/ physical control/ pine bark/ pines/ raspberries/ rice husks/ sawdust/ straw/ suckers/ weed control/ weeding/ wheat/ wheat straw/ mulching materials/ rice hulls

Abstract: Mulching to control weeds is frequently used in organic production; however, the mulching material could affect the crop. The objective of this research was to evaluate the effect of different plant materials, coming from

agriculture and forest industry, as mulching on raspberry growth and yield. There were four mulch treatments: pine bark, pine sawdust, wheat straw and rice hull; plus two controls: bare soil without weeds (hand-weeded) and bare soil with weeds (weedy check). Mulches were distributed on the rows of raspberry plants and were 1 m width and 10 cm deep. Experimental design was a randomized complete block with four replicates, and the experimental unit was a 3 m long row. Treatments were applied during two seasons, in September 2003 and in August 2004, in an 8 year old organic orchard of raspberry 'Heritage', located at the Bio Bio region, Chile. The number and height of suckers, number of laterals in the florican and yield were evaluated in the central meter of each row and only during the second season. Number of suckers in hand-weeded and weedy check was higher than in the other treatments, except for the pine sawdust mulching. The wheat straw mulching had the lowest number of suckers, only 10 suckers m⁻¹, in contrast to the weedy check that had 38 m⁻¹. The hand-weeded control had the tallest suckers (79 cm) and the smallest ones were in the wheat straw mulching (40.5 cm), which was significantly lower than all other treatments ($P \leq 0.05$). Number of laterals per stalk (10 in average) was not affected by treatments. The lowest fruit yield in the first harvest was obtained in the pine bark mulching treatment (2.64 t ha⁻¹), which only differed from the pine sawdust mulching (3.69 t ha⁻¹). In the primocane harvest the lowest yield was in the wheat straw mulching treatment (4.3 t ha⁻¹), but it only differed from the rice hull mulching treatment (5.96 t ha⁻¹). When summing both harvests, florican and primocane the highest yield was in the pine sawdust treatment (9.07 t ha⁻¹) and lowest on the wheat straw mulching (7.82 t ha⁻¹), but they were not significantly different ($P \leq 0.05$). We conclude that wheat straw mulching affected raspberry plant growth and therefore it is not recommended.

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998. Effect of physicochemical properties of growing media on growth, nutrient uptake and soil nutrient concentration in pot plant production of asiatic hybrid lily 'Orange Pixie'.

Choi JongJin; Lee JongSuk; and Choi JongMyung
Journal of the Korean Society for Horticultural Science
43(6): 747-753. (2002)

NAL Call #: SB13.H28; ISSN: 0253-6498

Descriptors: buds/ composts/ electrical conductivity/ flowering date/ growing media/ growth/ lilies/ nutrient uptake/ peat/ perlite/ pine bark/ plant height/ porosity/ rice husks/ roots/ sawdust/ soil air/ soil chemical properties/ soil ph/ vermiculite/ chemical properties of soil/ potting composts/ rice hulls/ rooting media/ soil atmosphere

Abstract: The effects of physicochemical properties of root media containing various ratios of organic and inorganic materials on the growth and nutrient uptake of Asiatic hybrid lily (*Lilium* sp.) 'Orange Pixie' were examined. Changes in the nutrient concentrations in growing media were also determined. The total porosity of growing medium containing perlite + composted sawdust + composted rice hull at 1:1:1 (v/v/v) (T₃) was 75.5% and that of growing medium containing peat moss + composted rice hull at 1:1 (v/v) (T₁) as 91.0%. The air space of growing medium containing peat moss + vermiculite at 1:1 (v/v) (T₄) was 4.6% and that of growing medium containing

composted sawdust + rice hull at 1:1 (v/v) (T₂) was 27.6%. pH of media T₂ and T₃ were higher than 6.95. pH of T₄, peat moss + vermiculite + perlite at 1:1:1 (v/v/v) (T₅), and composted rice hull + sawdust + pine bark at 1:1:1 (v/v/v) (T₆) were in the range of 5.35-5.41. However, pH of T₁ was 4.52. The electrical conductivity of T₄ and T₅ was lower than 0.25 dS/m and that of T₁, T₂ and T₃ containing composted rice hull or sawdust was >0.5 dS/m. Days to emergence, to visible flower bud and to flowering were not affected by the growing media. The highest number of leaves and fresh weight were obtained in T₆ and T₁, respectively. However, plant height and plant width did not show significant differences. T₁, T₄ and T₅, which had high container capacities, recorded higher tissue nutrient contents and medium nutrient concentrations than the other treatments. Reproduced with permission from the CAB Abstracts database.

999. Effect of pine sawdust on the structure of fungi communities in the soils of post agricultural land.

Sierota, Z. and Kwasna, H.

Acta Mycologica 33(1): 77-90. (1998); ISSN: 0001-625X

Descriptors: biological control agents/ communities/ forest soils/ forest trees/ plant pathology/ population dynamics/ sawdust/ trees/ woody plants/ biocontrol agents/ biological control organisms/ Hyphomycetes/ phytopathology

Abstract: Addition of sawdust to pine forest soils in Poland, resulted in an increase, one year later in 1996, of *Trichoderma harzianum*, *T. pubescens*, *T. virens* and numerous species of *Penicillium*. The presence of these *Trichoderma* species which are antagonistic to plant pathogenic fungal species, is considered beneficial. This citation is from AGRICOLA.

1000. Effect of plantation mulching on the growth, flowering and fructification of strawberry (*Fragaria ananassa* D.).

Kesik, T and Maskalaniec, T

Annales Universitatis Mariae Curie Sklodowska Sectio EEE, Horticultura 13: 243-248. (2003)

NAL Call #: SB317.63 .A55; ISSN: 1233-2127.

Notes: Original title: Wpływ sciokowania plantacji na wzrost, kwitnienie i owocowanie truskawki (*Fragaria ananassa* D.).

Descriptors: bark/ flowering/ fruit set/ fruiting/ growth/ inflorescences/ leaves/ mulches/ mulching/ peat/ plant development/ plastic film/ protected cultivation/ rye/ rye straw/ sawdust/ straw/ strawberries/ anthesis/ cultivation under glass or plastic/ mulching materials

Abstract: An experiment was conducted from 1994 to 1997 to investigate the effectiveness of mulching on the growth and development of strawberry cv. Senga Sengana plants under the climatic and soil conditions of the Vilnius Region in Lithuania. The strawberry plantation was covered by mulches with compost (peat and organic farm materials), rye straw, sawdust from needle trees, wood bark from needle trees and black plastic foil. Strawberries from the control plot and those covered with black plastic foil had the most number of leaves. Soil mulching with rye straw and wood bark, compared with the control, significantly decreased the number of leaves. The mean number of inflorescences was highest in plants from the control and black foil treatments, and lowest in plants from the rye

straw and wood bark mulches. Among the studied mulches, black foil had the best positive effect on the rate of fruit setting.

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1001. Effect of planting time, mulching and irrigation on the growth and yield of cabbage.

Islam, M. M.; Rahim, M. A.; and Alam, M. S

Bangladesh Journal of Training and Development 15(1/2): 169-174. (2002); ISSN: 1013-0306

Descriptors: ash/ cabbages/ crop yield/ growth/ irrigation/ mulches / mulching/ planting date/ polyethylene film/ rice husks/ sawdust/ straw mulches/ Capparales/ mulching materials/ Pontederiales/ rice hulls/ watering

Abstract: An experiment was conducted in Mymensingh, Bangladesh, from November 1999 to March 2000 to investigate the effect of planting time, mulching and irrigation on the growth and yield of cabbage cv. Atlas-70. The treatments consisted of 3 planting times, i.e. 15 November, 30 November and 15 December, and 10 levels of mulching and irrigation, i.e. no mulch and no irrigation (control), irrigation at 15 days interval, irrigation at 30 days interval, irrigation at 45 days interval, ash mulch, straw mulch, sawdust mulch, water hyacinth [*Eichhornia crassipes*] mulch, black polyethylene mulch, and rice husk mulch. The growth and yield of cabbage were affected by planting time. The highest gross yield (59.62 kg/plot) and marketable yield (82.10 t/ha) of cabbage were obtained from 30 November planting. Mulching and irrigation also significantly affected the growth and yield of cabbage. The highest gross yield (71.85 kg/plot) was obtained from the black polyethylene mulch followed by water hyacinth mulch (65.99 kg/plot). Considering marketable yield, both black polyethylene mulch (103.01 t/ha) and water hyacinth mulch (90.99 t/ha) exerted statistically similar effects followed by irrigation at 15 days interval (85.85 t/ha), whereas non-mulching and non-irrigated plots (control) exhibited the lowest marketable yield (38.87 t/ha). When the combined effects of planting time, mulching and irrigation were considered, different combinations of planting time and mulching, planting time and irrigation showed significant effect on the growth and yield of cabbage. The maximum gross yield (161.64 t/ha) and marketable yield (116.11 t/ha) were found in the treatment combination of 30 November planting and black polyethylene mulch.

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1002. Effect of potting materials for marigold cultivation.

Rahman, M. J.; Begum, R. A.; Mondol, A. T. M. A. I.;

Ahman, M. N. R.; and Alam, M. K.

International Journal of Sustainable Agricultural Technology 3(5): 72-76. (2007); ISSN: 1815-1272

Descriptors: cattle manure/ composts/ flowers/ pot plants/ poultry manure/ sawdust/ substrates/ poultry litter

Abstract: An experiment was conducted in the Bangladesh Agricultural Research Institute, Gazipur (Aeric Haplaquepts) to find out the suitable potting material (s) for marigold (*Tagetes patula*) cultivation during the winter seasons of 2002-2003 and 2003-2004. The potting

materials were T1: Soil, T2: 1 kg Sawdust+3 kg Soil, T3: 4 kg Soil+3 kg Cowdung, T4: 4 kg Soil+3 kg Compost, T5: 4 kg Soil+3 kg Poultry manure, T6: 1 kg Sawdust+3 kg Cowdung+1.5 kg Soil, T7: 1 kg Sawdust+3 kg Compost+1.5 kg Soil, T8: 1 kg Sawdust+3 kg Poultry manure+1.5 kg Soil and T9: 4 kg Sand+3 kg Cowdung. The treatment T6 (Sawdust with cowdung and soil) was found to be better as potting material for marigold cultivation in respect of flower diameter (5.62 cm in 2002-2003 and 5.93 cm in 2003-2004) and single flower weight (14.5) g in 2002-2003 and (13.5 g) in 2003-2004 followed by sawdust with poultry manure and soil.

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1003. Effect of poultry manure and sawdust on survival of sclerotia of *Macrophomina phaseolina* in soil.

Shaikh, A. H. and Ghaffar, A.

Pakistan Journal of Botany 36(2): 425-428. (2004); ISSN: 0556-3321

Descriptors: plant pathogenic fungi/ plant pathogens/ poultry manure/ sawdust/ sclerotia/ survival/ Coelomycetes/ phytopathogens/ poultry litter

Abstract: Using wet sieving and dilution technique, the sclerotial population of *M. phaseolina* in soil amended with poultry manure and sawdust was studied. Sclerotial population declined after a 15-day period when poultry manure at 1, 3 and 5% (w/w) was used. No significant change in sclerotial population was observed when sawdust was used.

This citation is from AGRICOLA.

1004. Effect of pre-germination treatment and substrate on seeds of orange jasmine (*Murraya paniculata*).

Alvarez, R.; Gonzalez, D.; and Sivoli, N.

Proceedings of the Interamerican Society for Tropical Horticulture 45(90-91)(2001); ISSN: 0245-2528.

Notes: Original title: Efecto de la aplicacion de tratamientos pregerminativos de semillas de *Murraya paniculata* solterradas en diferentes sustratos.

Descriptors: acetic acid/ organic soils/ propagation/ sand/ sawdust/ seed germination/ seed treatment/ seeds/ substrates/ plant propagation/ Rutales

Abstract: We evaluated different seed treatments and substrates for the propagation of orange jasmine (*M. paniculata*). The best substrate was a mixture of equal parts organic soil: sand: sawdust. The most effective pretreatment was with 50% acetic acid. We do not recommend soaking seed in water prior to planting.

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1005. Effect of recycling wood ash on microbiological and biochemical properties of soils.

Perucci, P.; Monaci, E.; Casucci, C.; and Vischetti, C. *Agronomy for Sustainable Development* 26(3): 157-165. (July 2006-Sept. 2006)

Descriptors: agricultural soils/ wood ash/ soil amendments/ soil microorganisms/ soil biological properties/ soil chemical properties/ soil enzymes/ enzyme activity/ Italy/ microbial biomass/ Internet resource

This citation is from AGRICOLA.

1006. Effect of sand and sawdust bedding materials on the fecal prevalence of *Escherichia coli* O157:H7 in dairy cows.

LeJeune, Jeffrey T. and Kauffman, Michael D.

Applied and Environmental Microbiology 71(1): 326-330. (Jan. 2005); ISSN: 0099-2240

Descriptors: dairy cows/ *Escherichia coli* O157:H7/ population density/ feces/ litter (bedding)/ sand/ sawdust/ cattle manure/ cattle housing/ dairy farming/ bovine mastitis/ *Escherichia* infections/ disease prevalence

Abstract: Farm management practices that reduce the prevalence of food-borne pathogens in live animals are predicted to enhance food safety. To ascertain the potential role of livestock bedding in the ecology and epidemiology of *Escherichia coli* O157:H7 on farms, the survival of this pathogen in used-sand and used-sawdust dairy cow bedding was determined. Additionally, a longitudinal study of mature dairy cattle housed on 20 commercial dairy farms was conducted to compare the prevalence of *E. coli* O157:H7 in cattle bedded on sand to that in cattle bedded on sawdust. *E. coli* O157:H7 persisted at higher concentrations in used-sawdust bedding than in used-sand bedding. The overall average herd level prevalence (3.1 versus 1.4%) and the number of sample days yielding any tests of feces positive for *E. coli* O157:H7 (22 of 60 days versus 13 of 60 days) were higher in sawdust-bedded herds. The choice of bedding material used to house mature dairy cows may impact the prevalence of *E. coli* O157:H7 on dairy farms.

This citation is from AGRICOLA.

1007. Effect of sawdust ash on nutrient status, growth and yield of cowpea (*Vigna unguiculata* L. walp).

Awodun, M. A.

Asian Journal of Agricultural Research 1(2): 92-96. (2007); ISSN: 1819-1894

Descriptors: application rates

Abstract: The study investigated suitability of sawdust ash as nutrient source for cowpea. Six rates of ash: 0, 2, 4, 6, 8 and 10 t ha⁻¹ were applied in two trials and soil and leaf nutrient composition and growth parameters were determined. Sawdust ash treatments applied to soil significantly increased soil and leaf N, P, K, Ca and Mg contents and numbers of pods, pod weight, number of branches, number of leaves and grain yield. Soil nutrient contents increased with the amount of sawdust ash up to 8 t ha⁻¹ before it declined.

Reproduced with permission from the CAB Abstracts database.

1008. Effect of sawdust ash plus urea on maize performance and nutrient status.

Awodun, M. A.; Otaru, M. S.; and Ojieniyi, S. O.

Asian Journal of Agricultural Research 1(1): 27-30. (2007); ISSN: 1819-1894

Descriptors: crop yield/ leaves/ maize/ nutrient content/ organic amendments/ plant height/ sawdust/ urea fertilizers/ corn

Abstract: Sawdust ash (SDA) is a waste from wood and sawmilling industries. Effect of SDA combined with urea was investigated in plant height, yield and nutrient content of leaves of maize in two experiments in Okene, in the Guinea Savanna zone of Nigeria. Treatments were a 4 t ha⁻¹

1 SDA, (b) 250 kg ha⁻¹ urea, (c) 1 t ha⁻¹ SDA+187.5 kg ha⁻¹ urea/d, 2 t ha⁻¹+125 kg ha⁻¹ urea, (e) 3 t ha⁻¹ SDA+62.5 kg ha⁻¹ urea and f, untreated control. The SDA at 4 t ha⁻¹ increased height of maize insignificantly. The 1 t ha⁻¹ SDA+187.5 kg ha⁻¹ urea gave highest maize yield and leaf N. Compared with untreated control, DSA, combined application of reduced rates of SDA and urea, the urea alone increased leaf N, P, K, Ca and Mg concentrations. Combined application of SDA and urea is a suitable option for maize cultivation.

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1009. Effect of soil amendments on soil microflora with special reference to rice sheath blight pathogen (*Rhizoctonia solani*).

Surulirajan, M. and Janki Kandhari

Journal of Mycopathological Research 44(2): 243-247. (2006)

NAL Call #: QK600.J68 ; ISSN: 0971-3719

Descriptors: cultural control/ farmyard manure/ plant disease control/ plant pathogenic fungi/ plant pathogens/ sawdust/ soil amendments/ soil fungi/ FYM/ Hyphomycetes/ phytopathogens

Abstract: The mean fungal and bacterial population from pots and field soil after the addition of soil amendments (sawdust 1% and FYM 1%) was increased significantly over the control two weeks after the addition of soil amendments, it further increased after 10th week of addition of soil amendments. However, 14 weeks after the addition of soil amendments, the population level drastically declined while the population of *R. solani* had significantly reduced over the control two weeks after soil amendments. However 10 weeks later, it declined further and after 14 weeks, there was no significant reduction in the population level of *R. solani*.

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1010. Effect of soil amendments with sawdust and viability of *Trichoderma harzianum* in different carriers.

Deshmukh, V. V.; Chore, N. S.; and Jiotode, D. J.

Crop Research Hisar 26(3): 508-511. (2003)

NAL Call #: SB4.C66 ; ISSN: 0970-4884

Descriptors: biological control/ biological control agents/ carriers/ charcoal/ crop residues/ farmyard manure/ fungal antagonists/ fungal diseases/ non wood forest products/ peat soils/ plant disease control/ plant diseases/ plant pathogenic fungi/ plant pathogens/ safflower/ sawdust/ seed treatment/ seeds/ substrates/ talc/ viability/ biocontrol agents/ biological control organisms/ Coelomycetes/ FYM/ Hyphomycetes/ minor forest products/ neem/ non timber forest products/ phytopathogens

Abstract: A study was conducted to investigate the effects of sawdust + soil (at sawdust:soil ratios of 1:100, 1:50 and 1:10) supplied alone or in combination with *T. harzianum* seed treatment (at 4 g/kg seed) on the control of root rot disease (*Rhizoctonia bataticola* [Macrophomina phaseolina]) on safflower. The different carriers used were 500 g each of the following: farmyard manure (FYM), peat soil, charcoal, talc powder (aluminium silicate) and finely powdered neem seed. The parameters measured included seed germination, and pre- and post-emergence mortality (at 7 and 105 days after sowing, respectively). Sawdust applied alone neither improved seed germination nor

reduced pre-emergence mortality. However, the sawdust:soil ratio of 1:10 resulted in 100% germination and the lowest pre-emergence mortality (8.89%) when combined with *T. harzianum*. The lowest post-emergence mortality (17.58%) was obtained in the treatment 1:100 (sawdust:soil) + *T. harzianum*. The most rapid decrease of *T. harzianum* viability was observed on neem seed powder, followed by charcoal powder, peat soil and talc powder. The lowest rate of decrease in *T. harzianum* viability was observed on FYM.

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1011. Effect of soil media on peach seed germination and seedling growth in climatic conditions of Orakzai Agency (FATA).

Hafeez ur Rahman ; Muhammad Rafiq; Ghulam Nabi; and Abdul Samad

Sarhad Journal of Agriculture 23(3): 689-691. (2007)

NAL Call #: RA565.S365 S322.P32S37; ISSN: 1016-4383

Descriptors: farmyard manure/ girth/ growing media/ peaches/ plant height/ sawdust/ seed germination/ seedling growth/ seeds/ silt/ silty soils/ soil types/ FYM/ potting composts/ rooting media

Abstract: An experiment was conducted to study the effects of different soil media on seed germination and seedling growth of peach during 2001 and 2002 in Pakistan. The different soil media, used alone and in combination, were farmyard manure (FYM), sawdust, canal silt, FYM+sawdust, FYM+canal silt, sawdust+silt and FYM+sawdust+silt. The different media showed non significant effect on seed germination of peach. However, the highest percent seed germination (44%) was observed in sawdust+canal silt, followed by silt alone (36.66%). The lowest seed germination (26.66%) was recorded in ordinary soil. Significant effect of different media was observed on seedling height and seedling girth. The maximum seedling height (98.67 cm) was recorded in FYM+sawdust, while the maximum seedling girth (5.25 cm) was found in FYM alone, closely followed by FYM+sawdust (5.24 cm). The minimum seedling height (57.00 cm) and girth (2.87 cm) were recorded in canal silt alone. The soil media used in combination improved both the germination and subsequently the growth compared to the soil media used alone.

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1012. Effect of soil moisture conservation techniques and levels of irrigation on soil moisture retention and yield of oriental pickling melon.

Veeraputhiran, R.; Joseph, P. A.; Nair, P. V.; Jaikumaran, U.; and Unnithan, V. K. G.

Madras Agricultural Journal 85(5/6): 215-220. (1998)

NAL Call #: 22 M262; ISSN: 0024-9602

Descriptors: canopy/ clay loam soils/ coir/ flowering/ fruit crops/ fruits/ incorporation/ irrigation/ melons/ moisture content/ plant water relations/ rice byproducts/ sandy soils/ sawdust/ soil amendments/ soil water/ wastes/ water use efficiency/ yields/ anthesis/ coconut fibre/ crown cover/ leaf canopy/ soil moisture / watering

Abstract: A field experiment conducted in the summer rice fallows at the Agricultural Research Station, Mannuthy, Kerala during 1996 revealed that incorporation of coir pith, sawdust and paddy waste into the sandy clay loam soil

increased soil moisture content over controls by 10.9, 1.6 and 7.1%, respectively and field water use efficiency (WUE) of the oriental pickling melon crop by 9.9, 5.3 and 19.9%, respectively. Consumptive use was also increased by the moisture conservation techniques. Levels of irrigation showed a negative relationship with WUE and a positive relationship with consumptive use. The peak consumptive use and crop coefficient coincided with the fullest canopy development and flowering stage of the crop. The crop depleted about 50% of soil water from the top 15-cm layer. The crop needed frequent irrigations as dictated by an IW/CPE ratio of 1.2 for maximum yield. Incorporation of paddy waste, coir pith and sawdust increased yields by 27, 17 and 10%, respectively compared with controls. It was concluded that the incorporation of moisture conservation materials can save 5 irrigations required by the crop. Reproduced with permission from the CAB Abstracts database.

1013. Effect of some agrotechnical factors on emergence, growth and yield of Hamburg parsley, cultivated on soil subject to puddling. Part IV. Quality features of roots.

Bazewicz Wozniak, M.

Annales Universitatis Mariae Curie Skodowska Sectio EEE, Horticultura: 89-102. (1998)

NAL Call #: SB317.63 .A55.

Notes: Original title: Wpływ czynników agrotechnicznych na wschody, wzrost i plonowanie pietruszki korzeniowej, uprawianej na glebie zlewnej o nietrwalej strukturze. Czesc IV. Cechy jakosciowe korzeni.

Descriptors: bark/ dry matter/ growth/ mulches/ mulching/ peat/ plant density/ plastic film/ ploughing/ root crops/ roots/ rotary cultivation/ sand/ sawdust/ seedling emergence/ size/ sowing date/ sowing depth/ tillage/ vegetables/ Araliales/ mulching materials/ plowing/ rotovation/ soil cultivation/ vegetable crops

Abstract: The effect of 3 methods of pre-sowing cultivation (ploughing, rotary tillage, cultivator tillage), 2 sowing dates, 2 sowing depths and 5 kinds of mulch (sand, peat, sawdust, bark, plastic film) on the growth and yield of Hamburg parsley cv. Berlinska was studied in 1991-94 on loess soil at Lublin-Felin. The longest parsley roots were obtained with spring ploughing. The roots had the greatest diameter and average weight and were shortest after sowing at a depth of 2 cm. Date of sowing had no significant influence on the shape of roots or on the content of dry matter.

Mulching with peat, sawdust, bark and plastic film decreased diameter and average root weight. Reproduced with permission from the CAB Abstracts database.

1014. Effect of sprouting medium on the survival of yam peelsetts.

Godwin Egein, M. I. and Igwilo, N. H.

International Journal of Agriculture and Biology 7(2): 315-317. (2005); ISSN: 1560-8530

Descriptors: crop residues/ fungal diseases/ growing media/ insect pests/ plant diseases/ plant pathogenic fungi/ plant pathogens/ plant pests/ sawdust/ sets/ sprouting/ straw/ phytopathogens/ potting composts/ rooting media/ setts

Abstract: The presprouting survival of yam peelsetts (*Dioscorea rotundata* cv. Obiaturugo; and *D. alata* cv. Um.680), 1 cm thick, and 2 cm² 3 cm² and 4 cm² periderm surfaces, in sprouting media (direct soil, soil in container, straw, river sand and sawdust) was investigated. Sprouting was achieved in all media. Optimum sprout count was observed in sawdust media and the lowest sprout count was in straw. Insect larvae (crickets), nymphs and millipedes physically ate up setts and the rot (dry and wet) conditions observed were associated with fungi (*Apergillus* sp., *Penicillium* sp., *Mucor* sp., *Botryopodia* sp. and *Fusarium* sp.; and *Penicillium* sp., *Trichoderma* sp., *Sclerotium* sp., *Mucor* sp. and *Fusarium* sp., respectively) which were suspected to be the causative agents. The preferred medium for pre-sprouting peelsetts was sawdust, which can be hot water- or steam-sterilized for maximum results.

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1015. Effect of substrate and irrigation water acidification on the nutrition, growth, and yield of rabbiteye blueberries (*Vaccinium ashei* Reade).

Ferreira E.R.; Peralta C. J.; Sadzawka R. A.; Munoz S. C.; and Valenzuela B. J.

Agricultura Tecnica 61(4): 452-458. (2001); ISSN: 0365-2807.

Notes: Original title: Efecto de la acidificacion del sustrato y del agua de riego en la nutricion, desarrollo y produccion de arandano ojo de conejo (*Vaccinium ashei* Reade).

Descriptors: crop production/ crop yield/ growing media/ growth/ irrigation/ irrigation water/ manganese / organic amendments/ pH/ plant nutrition/ sawdust/ hydrogen ion concentration/ Mn/ potential of hydrogen/ potting composts/ rooting media/ watering

Abstract: An experiment was carried out in Santiago, Chile during 1990-93 to determine the effect of using a mix of soil and sawdust, and irrigation water with pH 2, 4, 5 and 7.8 (control) on the growth and production of rabbiteye blueberries (*V. ashei*). Foliar analysis showed that only the Mn concentration was lower compared with the control treatment. Plants irrigated with water at pH 2 did not develop chlorosis, and had better growth and production, making possible economic production under these climatic conditions.

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1016. Effect of substrates with sawdust on yielding of greenhouse tomato.

Mokrzecka, E.

Annales Universitatis Mariae Curie Skodowska Sectio EEE, Horticultura 8: 11-18. (2000)

NAL Call #: SB317.63 .A55; ISSN: 1233-2127

Descriptors: crop yield/ growing media/ nitrogen fertilizers/ sawdust/ tomatoes/ potting composts/ rooting media

Abstract: An experiment with greenhouse tomatoes was carried out in a high unheated plastic tunnel. The following substrates were tested: sawdust from coniferous trees; grey-brown podzolic soil with a 2% humus content; sawdust mixed with soil in the ratio 3:1; sawdust mixed with soil in the ratio 1:1. N fertilizer was applied at 0.8, 1.6 or 2.4 g N.dm⁻³ of substrate. The tomato plants were grown till 6

clusters were formed. Plants grown in a 3:1 mixture of sawdust and soil and fertilized with 0.8 g N.dm⁻³ gave the highest yield (5.83 kg per plant). The content of nutrients in tomato leaves did not depend on the rates of N or on the growing medium.
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1017. Effect of successive application of manure added sawdust and calcium cyanamide, to paddy field in yellow soils on growth and yield of rice plant [*Oryza sativa*], cabbage plant [*Brassica oleracea*] and on soil properties.

Azuma, T.; Kakiuchi, J.; and Hayashi, Y.
Bulletin of the Wakayama Research Center of Agriculture, Forestry and Fisheries (Japan) 6: 45-56. (Mar. 2005); ISSN: 1345-5028.

Notes: Summary (Ja). Citation notes: JP (Japan).
Descriptors: successive applications/ manure/ sawdust/ calcium cyanamide/ paddy fields/ yellow soils/ growth/ yield/ rice/ *Oryza sativa*/ cabbage/ *Brassica oleracea*/ soil properties

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1018. Effect of two different thermal units and three types of mulch on weeds in apple orchards.

Rifai, M. N.; Astatkie, T.; Lacko Bartosova, M.; and Gadus, J.

Journal of Environmental Engineering and Science 1(5): 331-338. (2002); ISSN: 1496-2551

Descriptors: 2,4 D/ apples/ bark/ burning/ chemical control/ cost benefit analysis/ costs/ crop growth stage/ cultural control/ flame cultivators/ glyphosate/ hay/ herbicides/ integrated control/ leaves/ methodology/ models/ mortality/ mulches/ mulching/ paraquat/ sawdust/ simazine/ statistical analysis/ steam/ technology/ velocity/ weed control/ weeds/ costings/ death rate/ flame weeders/ flaming/ integrated plant protection/ methods/ mulching materials/ statistical methods/ weedicides/ weedkillers
Abstract: The effect of two different thermal units (flame and hot steam) and three types of mulch on the percentage of weeds killed was studied in a series of experiments over 2 years (1998-99) in Nova Scotia, Canada. The factors studied were driving speed (2, 3, and 4 km/h), flame treatment (first, second, third), growth stage (< 6, 6-8, >8 true leaves), hot steam treatment (single, double), mulch type (none, coarse bark, sawdust, hay), and chemical application (paraquat, 2,4-D Amine [2,4-D], simazine, and glyphosate). The results suggest that a driving speed of 2 km/h kills the highest percentage of weeds, and for weed species with unprotected growth points and thin leaves, the first flame application can completely kill weeds with <6 leaves. However, a second or third flame application is required for those with 6 or more leaves. The hot steam method is effective when it is applied twice, with the second application 1 week after the first. However, there is room for improving its technology to make it cost effective for large-scale applications. Mulches after chemical herbicide application are effective for controlling weeds. However, mulching cannot be recommended with flaming because of fire hazard. The effectiveness of herbicide depends on the weed species and on whether the same herbicide was used in the preceding years. Compared to using herbicide with

mulching, herbicide alone was less effective in controlling weeds and more costly in terms of cost per hectare and the environment.

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1019. The effect of using different mulches and growth substrates on half -highbush blueberry (*Vaccinium corymbosum* x *V. angustifolium*) cultivars 'Northblue' and 'Northcountry'.

Starast, M.; Karp, K.; and Paal, T.
Acta Horticulturae 574: 281-286. (2002)

NAL Call #: 80 Ac82; ISSN: 0567-7572

Descriptors: growing media/ growth/ mineral soils/ mulches/ peat/ sawdust/ soil types/ winter hardiness/ mulching materials/ potting composts/ rooting media/ *Vaccinium corymbosum* x *Vaccinium angustifolium*
Abstract: Much attention has been paid to the cultivation of half-highbush blueberry (*Vaccinium corymbosum* x *Vaccinium angustifolium*). At the Department of Horticulture, Estonian Agricultural University, a blueberry-growing project started in 1997. Two half-highbush blueberry cultivars 'Northblue' and 'Northcountry' were used, and different cultivation methods were employed. The experiment was carried out in Tartu County (South Estonia). Our results showed that the half-highbush blueberry grew best when peat was used (ground mixtures and peat mulch). Plastic mulch tended to increase plant growth but sawdust mulch did not favour growth. Winter hardiness of half-highbush blueberry is problematic in the Estonian climate. In the experiment, an average winter hardiness of 'Northblue' was 5.5..6.0 points. Winter hardness of 'Northcountry' was 5.4..6.7 points and the blueberry plants had more damage when plastic mulch was used. The plants did not stop growing in autumn and the herbaceous shoots were damaged when the first frosts started. 'Northcountry' hibernated better than 'Northblue'.
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1020. Effect of various mulches and soil amendments on germination, growth and fresh rhizomes yield of ginger.

Hussain, S. I.; Khokhar, K. M.; Amanullah Jan; and Farooq, M.

Sarhad Journal of Agriculture 17(1): 87-89. (2001)

NAL Call #: RA565.S365 S322.P32S37; ISSN: 1016-4383

Descriptors: crop yield/ farmyard manure/ germination/ ginger / mulches/ plant development/ rhizomes/ sand/ sawdust/ FYM/ mulching materials
Abstract: An experiment was conducted in Pakistan during 1993 to determine the response of various mulches (sand, sawdust and sand+sawdust) and soil amendments (soil, sand, and farmyard manure) on the germination, growth and yield of ginger. The germination percentage under different mulches and soil amendments ranged from 69 to 98% whereas the lowest percentage of germination was recorded in unmulched (control) beds. Maximum germination (98%) was observed in the beds mulched with sawdust followed by sand+sawdust and wherein soil, sand and farmyard manure were used in the ratio of 1:1:1 with 92% germination. Sawdust mulching significantly enhanced

the number of sprouts (tillers) per rhizome (4.7) and fresh rhizome yield (7.4 t/ha). Sawdust mulching and treatments with 1:1:1 soil:sand:farmyard manure increased plant height.

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1021. Effect of various mulches on growth, flowering, fruiting, yield and quality of strawberry (*Fragaria x Ananassa* Duch.) cv. Chandler.

Ram, R. B.; Dwivedi, A. K.; and Yadav, A. K.

Bioved 16(1/2): 61-64. (2005); ISSN: 0971-0108

Descriptors: acidity/ ascorbic acid/ crop quality/ crop yield/ flowering/ flowering date/ fruiting/ fruits/ growth/ leaves/ maturity/ mulches/ plant height/ plastic film/ polyethylene/ rice/ rice straw/ sawdust/ straw/ straw mulches/ strawberries/ sugars/ wheat/ wheat straw/ anthesis/ Bermuda grass/ *Fragaria x ananassa*/ mulching materials/ paddy/ polythene/ vitamin C

Abstract: A field experiment was laid out on strawberry cv. Chandler to evaluate the effect of various mulches on growth, flowering, fruiting, yield and quality during winter-spring season of 2003-04 in Uttar Pradesh, India. Treatments were mulched with black polythene (M₁), sawdust (M₂), wheat straw (M₃), paddy straw (M₄) and doob grass (M₅) and without mulch (control) (M₆). The maximum plant height (16.53 cm), plant spread (27.73 cm), number of leaves (22.66 cm), early flowering (53.33 days) and fruit maturity (25.33 days), highest fruit weight (8.44 g), total number of fruit (13.33) and maximum average yield per plant (109.68 g) were recorded under the treatment M₁. Delayed flowering (58.33 days) was observed in M₆. Highest fruit weight (8.44 g) was recorded in (M₁). Quality parameters such as TSS (8.23 degrees B), ascorbic acid (60.93 mg/100 g), low acidity (0.633%) and maximum sugar (8.60%) was recorded under black polythene followed by paddy straw. Hence, mulch with black polythene was found to be the superior on growth, flowering, fruiting, yield and quality of strawberry cv. Chandler under Lucknow conditions.

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1022. The effect of wood ash application on soil characteristics and plant productivity was studied using a lisimetric system .

Cortez, N.; Madeira, M.; Marques, P.; and Araujo, M. C. *Revista de Ciencias Agrarias* 24(3-4): 144-157. (2001); ISSN: 0871-018X.

Notes: Original title: Influencia da aplicacao de cinza de biomassa florestal na producao de plantas forrageiras e nas caracteristicas do solo.

Descriptors: wood ash / soil characteristics/ plant productivity lisimetric systems

Abstract: This study was carried out to compare biomass production and characteristics of a vetch (*Vicia benghalensis*) grown alone or in association with oats (*Avena sativa*), under six treatments: control, without ash or fertiliser (A); with NPK fertiliser (B); with three different amounts of ash (corresponding to 5,07, 10,14 and 20,28 t/ha) and the same amount of N that was used in B (C, D and E); with the same amount of ash as used in E, but without N (F). Dry weight of *V. benghalensis* biomass was significantly higher in treatment F than in treatments A, B and C; and it was slightly higher than the weight in

treatment E. Dry weight of *V. benghalensis* X *A. sativa* association was similar in treatments B, C, D and E, and it was three times higher than that measured in treatment A; dry biomass in treatment F was about twice that of treatment A, but treatments B, C, D and E had even higher values. Ash application did not significantly affect N concentration in the biomass of *V. benghalensis* grown alone, but increased Ca and Mg concentrations, in comparison to treatments A and B. Potassium concentration in the biomass of plants of treatment A was significantly lower than in those of other treatments. Phosphorus concentration was significantly higher in plants from treatment B, when compared with plants from treatments A, C, D, E and F. Similar effects of ash plus N application, on Ca, Mg and K concentrations in biomass, were observed when *V. benghalensis* and *A. sativa* were in association. Ash application had a very strong effect on soil characteristics, increasing pH values and base cations concentration, as compared with treatments A and B, especially in the top soil layer. Extractable P and K concentrations in treatments with higher amounts of ash (E and F) were similar or higher than in NPK fertilised soil (treatment B).

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1023. Effect of wood ash application on soil solution chemistry of tropical acid soils: Incubation study.

Voundi Nkana, J. C.; Demeyer, A.; and Verloo, M. G.

Bioresource Technology 85(3): 323-325. (Dec. 2002)

NAL Call #: TD930.A32 ; ISSN: 0960-8524 [BIRTEB]

Descriptors: soil amendments/ waste utilization/ tropical soils/ soil chemistry

Abstract: The objective of this study was to determine the effect of wood ash application on soil solution composition of three tropical acid soils. Calcium carbonate was used as a reference amendment. Amended soils and control were incubated for 60 days. To assess soluble nutrients, saturation extracts were analysed at 15 days intervals. Wood ash application affects the soil solution chemistry in two ways, as a liming agent and as a supplier of nutrients. As a liming agent, wood ash application induced increases in soil solution pH, Ca, Mg, inorganic C, SO₄ and DOC. As a supplier of elements, the increase in the soil solution pH was partly due to ligand exchange between wood ash SO₄ and OH⁻ ions. Large increases in concentrations of inorganic C, SO₄, Ca and Mg with wood ash relative to lime and especially increases in K reflected the supply of these elements by wood ash. Wood ash application could represent increased availability of nutrients for the plant. However, large concentrations of basic cations, SO₄ and NO₃ obtained with higher application rates could be a concern because of potential solute transport to surface waters and groundwater. Wood ash must be applied at reasonable rates to avoid any risk for the environment. This citation is from AGRICOLA.

1024. The effect of wood ash applications on soil pH and production of barley and canola in central Alberta.

Paterson, S. J.; Thomas, J. E.; Bertschi, A. B.; and Acharya, S. N.

Canadian Journal of Plant Science 81(1): 119. (2001)

NAL Call #: 450 C16; ISSN: 0008-4220

Descriptors: wood ash / soil pH/ barley/ canola/ Alberta/ Canada

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1025. Effect of wood ash extract treatment on the feeding value of sorghum (cv. Sekedo) for broiler chicks.

Kyarisiima, C. C.; Okot, M. W.; and Svihus, B. *Muarik Bulletin* 4: 30-36. (2001); ISSN: 1563-3721
Descriptors: broilers / chicks/ digestibility/ fat/ feed conversion efficiency/ feed intake/ growth rate/ nutritive value/ poultry/ protein digestibility/ tannins/ treatment/ wood ash/ chickens/ domesticated birds/ nutritional value/ quality for nutrition/ tannic acid
Abstract: Two feeding experiments were conducted to investigate the effects of treating sorghum (*Sorghum bicolor*), cv. Sekedo (S) with wood ash extract on its feeding value for broiler chicks. Sekedo was either soaked in water and germinated (WG), soaked in wood ash extract (AS), germinated after soaking in ash extract (AG) or left untreated (UT). The grain constituted 50% of the experimental diets. Treatment of S reduced its tannin content. In the first feeding trial (Experiment 1), significant improvements in growth rate and feed efficiency were realized only for the AG diet. There was no significant difference ($P>0.05$) between diets in feed intake. Ileal digestibility of dietary protein and fat were significantly ($P<0.05$) higher for the AS and AG diets. When maize was replaced with sorghum (Experiment 2), chicks that were fed the maize-based diet grew faster ($P<0.05$) than those on the sorghum-based diets. The UT diet caused a significant ($P<0.05$) depression in growth. Feed efficiency was similar across the four dietary treatments. Ileal digestibility dry matter and crude protein for the UT diet was inferior ($P<0.05$) to that of the AS and AG diets. Generally, treatment of S with wood ash extract improved its feeding value. Germination following wood ash treatment caused a further reduction in tannin content thereby improving the feeding value of the grain.
 This citation is from AGRICOLA.

1026. Effect of wood fly ash and compost on nitrification and denitrification in agricultural soil.

Odlare, M. and Pell, M. *Applied Energy* 86(1): 74-80. (2009); ISSN: 03062619 [APEND].
Notes: doi: 10.1016/j.apenergy.2008.04.004.
Descriptors: bioremediation/ compost/ heavy metals/ soil microbial indicators/ soil quality/ wood ash/ ammonium compounds/ coal ash/ denitrification/ experiments/ fly ash/ hand held computers/ heavy metals/ industrial poisons / metals/ microbiology/ microorganisms/ nitrification/ oxidation/ personal digital assistants/ soils/ toxic materials/ waste incineration/ wood/ agricultural soils/ ammonium oxidation/ anthropogenic activities/ arable soils/ bio fuels/ bioremediation/ combustion plants/ compost/ dose responses/ high concentrations/ household wastes/ metal contents/ microbial responses/ plant nutrients/ potential denitrification/ soil micro organisms/ soil microbial activities/ soil microbial indicators/ soil quality/ soil structure/ toxic effects/ with or without/ wood ash/ composting/ agricultural soil/ assay/ biofuel/ bioremediation/ combustion/ comparative study/ compost/ denitrification/ domestic waste/ dose-response relationship/ experimental study/ fly ash/ microbial activity/ mitigation/ nitrification/ soil amendment/ soil microorganism/ soil structure/ toxicity/ wood/ ammonium compounds/ ash/ coal/ combustion/

composting/ fly ash/ heavy metals/ microbiology/ microorganisms/ nitrification/ oxidation/ soil/ wastes/ wood
Abstract: Wood ash from biofuel combustion plants and compost from source-separated household waste are commonly spread on forest, agricultural and horticultural soils as a valuable source of plant nutrients. However, due to anthropogenic activities, wood ash may contain high concentrations of heavy metals. Heavy metals are toxic to microorganisms and therefore, soil microbial response to wood ash should be considered when soil is amended with ash. Compost is known to improve soil structure and may also act as a bioremediating agent, mitigating any toxic effects of wood ash on soil microorganisms. In the present study, the aim was to investigate whether wood ash has any toxic effect on soil microbial activity and, if this is the case, whether compost could mitigate these effects. The effect of wood fly ash on potential ammonium oxidation rate (PAO) and potential denitrification rate (PDA) in arable soil was investigated in one dose-response assay and in two pot experiments with or without plants, respectively. The treatments were amendment with wood fly ash, compost or a combination of wood fly ash and compost. PAO and PDA were assessed immediately or after 7 and 90 days in the different experiments. Wood fly ash decreased PDA to 16-56% compared to the control, while PAO varied between 82% and 205%. Sole compost addition stimulated both processes. This positive effect was also observed in the combined wood fly ash-compost treatment. In conclusion, wood ash had a toxic effect on PDA, both on an immediate, short-term and long-term basis. Amendment of compost clearly mitigated this toxic effect. The observed toxicity could be an effect of the metal content of ash. © 2008 Elsevier Ltd. All rights reserved.
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1027. Effectiveness of organic amendments and chemicals in controlling black scurf disease of potato.

Dey, T. K.; Bari, M. A.; Saha, A. K.; Rahman, M.; and Ayub, A. *Bangladesh Journal of Plant Pathology* 20(1/2): 17-20. (2004); ISSN: 1012-9279
Descriptors: application rates/ boric acid/ carbendazim/ carboxin/ chemical control/ crop yield/ cultural control/ fungal diseases/ fungicides/ metalaxyl/ oilseed cakes/ organic amendments/ oxycarboxin/ plant disease control/ plant diseases/ plant pathogenic fungi/ plant pathogens/ potatoes/ quitozene/ sawdust/ tubers/ carbendazol/ DCMO/ Homai/ Hyphomycetes/ MBC/ medamine/ oil cakes/ PCNB/ pentachloronitrobenzene/ phytopathogens
Abstract: Two organic amendments, i.e. sawdust (2.0, 2.5 and 3.0 t/ha) and mustard oil cake (2.0 and 2.5 t/ha), and 7 chemicals, i.e. boric acid (2.0 and 3.0%), Vitavax [carboxin] (0.15%), Bavistin [carbendazim] (0.1%), Homai (0.2%), Plantvax [oxycarboxin] (0.2%), Terraclor [quintozene] (12 and 20 kg/ha) and Apron [metalaxyl] (0.2%), were tested against stem canker or black scurf disease of potato caused by *Rhizoctonia solani* during 1995-96 and 1996-97 crop seasons in Gazipur, Bangladesh. All the treatments were effective in controlling black scurf disease. Among them, sawdust amendment (3 t/ha) and Terraclor (20 kg/ha) performed better in reducing black scurf disease of potato and increasing tuber yield.
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1028. Effectiveness of used true mushroom and sawdust usage in artificial mixtures when cultivated plants take root.

Skaliy, L. P.

Izvestiya Timiryazevskoi Sel'skokhozyaistvennoi Akademii 3: 48-58. (2005); ISSN: 0021-342X

Descriptors: mushroom waste/ sawdust/ artificial soil mixtures/ cultivated plants/ rooting

Abstract: Used true mushroom and sawdust substratum's possible use in artificial mixtures was studied propagating cultivated crops with green grafts, the effectiveness of a new substratum in comparison with the traditional turf-sand mixtures being evaluated. New substratum is believed to meet the requirements to artificial mixtures most fully.

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1029. Effects of acidification on pH changes in horticultural substrates used for highbush blueberry cultivation (*Vaccinium corymbosum*).

Mikiciuk, G.; Grajkowski, J.; Ochmian, I.; Ostrowska, K.; and Chepinski, P.

Folia Universitatis Agriculturae Stetinensis, Agricultura 96: 119-124. (2004); ISSN: 1506-1973.

Notes: Original title: Wpływ zakwaszania na zmiany odczynu trzech typów podłoża w uprawie borówki wysokiej (*Vaccinium corymbosum*).

Descriptors: acidification/ blueberries/ cocoa husks/ cultivars/ growth/ peat/ pH/ plant development/ sawdust/ soilless culture/ substrates/ sulfuric acid/ trickle irrigation/ cultivated varieties/ hydrogen ion concentration/ potential of hydrogen/ sulphuric acid

Abstract: Experiments were conducted in Poland, during 2001-03 to determine the effects of acidification on the pH changes in substrates (peat, sawdust and cocoa husk) used for highbush blueberry (*Vaccinium corymbosum* cultivars Patriot and Sierra) cultivation. Trickle irrigation with water at pH 3.5 was used for substrate acidification and sulfuric acid for water acidification. Irrigation with water at pH 3.5 reduced the pH of sawdust and cocoa husk. Acidification did not reduce peat pH but ensure optimum pH for the growth and development of highbush blueberry in all the substrates.

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1030. Effects of bedding quality on lying behavior of dairy cows.

Fregonesi, J. A.; Veira, D. M.; von Keyserlingk, M. A.; and Weary, D. M.

Journal of Dairy Science 90(12): 5468-72. (Dec. 2007)

NAL Call #: 44.8 J822 ; ISSN: 1525-3198 .

18024737

Descriptors: animal welfare/ animals/ bedding and linens: standards: veterinary/ behavior, animal/ cattle: physiology/ dairying: methods/ female/ floors and floorcoverings: standards/ housing, animal/ posture/ random allocation/ video recording/ water

Abstract: Cows prefer to spend more time lying down in free stalls with more bedding, but no research to date has addressed the effects of bedding quality. Bedding in stalls often becomes wet either from exposure to the elements or from feces and urine. The aim of this study was to test the effect of wet bedding on stall preference and use. Four groups of 6 nonlactating Holstein cows were housed in free

stalls bedded daily with approximately 0.1 m of fresh sawdust. Following a 5-d adaptation period, each group of cows was tested sequentially with access to stalls with either dry or wet sawdust bedding (86.4 $\pm$ 2.1 vs. 26.5 $\pm$ 2.1% dry matter), each for 2 d. These no-choice phases were followed by a 2-d free-choice phase during which cows had simultaneous access to stalls containing either wet or dry bedding. Stall usage was assessed by using 24-h video recordings scanned at 10-min intervals, and responses were analyzed by using a mixed model, with group (n = 4) as the observational unit. The minimum and maximum environmental temperatures during the experiment were 3.4 $\pm$ 2.2 and 6.8 $\pm$ 2.5 degrees C, respectively. When cows had access only to stalls with wet bedding, they spent 8.8 $\pm$ 0.8 h/d lying down, which increased to 13.8 $\pm$ 0.8 h/d when stalls with dry bedding were provided. Cows spent more time standing with their front 2 hooves in the stall when provided with wet vs. dry bedding (92 $\pm$ 10 vs. 32 $\pm$ 10 min/d). During the free-choice phase, all cows spent more time lying down in the dry stalls, spending 12.5 $\pm$ 0.3 h/d in the dry stalls vs. 0.9 $\pm$ 0.3 h/d in stalls with wet bedding. In conclusion, dairy cows show a clear preference for a dry lying surface, and they spend much more time standing outside the stall when only wet bedding is available.

This citation is from PubMed.

1031. Effects of bedding type and within-pen location on feedlot runoff.

Olson, E. C. S.; Chanasyk, D. S.; and Miller, J. J.

Transactions of the ASAE 49(4): 905-914. (2006)

NAL Call #: 290.9 Am32T; ISSN: 0001-2351

Descriptors: application rates/ depression storage/ feedlot runoff/ hardwood/ rainfall simulators/ runoff/ runoff coefficient/ runoff volume/ straw/ Canada, Alberta

Abstract: This two-year study examined the effects of two types of bedding materials (straw and wood chips) and two within-pen locations (bedding pack and pen floor) on various feedlot runoff parameters in southern Alberta, Canada, using a rainfall simulator. Bedding type affected antecedent factors and hydrological parameters differently by year. Bedding pack locations absorbed 23.5% to 32.9% more moisture, had about 8 cm greater manure depths, slopes between 2.1% and 5.1% steeper, and surfaces that were 2.6% to 5.7% rougher than pen floor locations. Pen floor locations had clod bulk densities that were 0.83 Mg m³ super(-3) greater than bedding pack locations in 1998. However, the effect of bedding packs on these properties depended on the amount of bedding added, which depended on feedlot conditions. Runoff began sooner from pen floor than from bedding pack locations. Once runoff started, the amount and type of bedding material, length of time since fresh bedding was added, and within-pen location affected the time for specific runoff volumes. For example, in 1998, 6 L of runoff were collected about 3 min faster from wood chips than from straw bedding and about 7 min faster from the pen floor than from the bedding pack. Runoff coefficients increased during the simulation events and occasionally exceeded rainfall application rate depending on whether or not water in depression storage was released. Treatment effects were dependent on year of study, and were inconsistent. Thus, further study is warranted regarding the effects of bedding type on feedlot runoff.

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1032. Effects of Casuarina equisetifolia composted litter and ramial-wood chips on tomato growth and soil properties in Niayes, Senegal.

Soumare, M. D.; Mnkeni, P. N. S.; and Khouma, M. *Biological Agriculture and Horticulture* 20(2): 111-123. (2002)

NAL Call #: S605.5.B5 ; ISSN: 0144-8765

Descriptors: bulk density/ carbon nitrogen ratio/ crop yield/ growth/ litter plant/ mineral uptake/ nitrogen/ nutrient uptake/ phosphorus/ plant nutrition/ potassium/ residual effects/ soil density/ soil organic matter/ soil properties/ tomatoes/ water holding capacity/ wood chips/ organic matter in soil

Abstract: A field experiment was conducted in 1999 to study the effects of ramial chipped wood (RCW) and litter compost (LC) of *C. equisetifolia* on tomato (*Lycopersicon esculentum*) growth and soil properties in Niayes, Senegal. The RCW and LC were applied to a sandy soil at 10, 20 and 40 t ha⁻¹ and compared with a control and recommended fertilizer mixture. Soil and plant samples were taken at 45 days of tomato growth and at harvest time for analysis. Residual effects of the materials were evaluated by establishing a second tomato crop on the same plots. Application of RCW depressed tomato growth and yield during the first cropping and this was attributed to RCW inducing intense N immobilization in the soil due its wide C:N ratio. Improvements in growth and yield were observed during the second cropping and ascribed to improved nitrogen release following the extended incubation of the RCW in the soil. To derive short-term benefits from RCW application, it should be applied in combination with experimentally determined amounts of mineral fertilizers. Litter compost improved tomato growth and yield during both croppings owing to increased soil levels and tomato uptake of N, P and K following its incorporation in soil. This was attributed to the narrower C:N ratio of LC, which facilitated its decomposition in the soil. The residual effects of LC were, however, much less, suggesting that LC had limited residual nutrients value. Both RCW and LC increased the soil organic matter content and water holding capacity, and reduced the bulk density of the soil, suggesting that their regular application could result in the long-term improvement of its productivity. This citation is from AGRICOLA.

1033. Effects of crushed wood ash on soil chemistry in young Norway spruce stands.

Arvidsson, H. and Lundkvist, H. *Forest Ecology and Management* 176(1-3): 121-132. (Mar. 2003)

NAL Call #: SD1 .F73; ISSN: 0378-1127 [FECMDW]

Descriptors: Picea abies/ ash/ soil chemistry/ logging/ fuels/ forest soils/ soil fertility/ field experimentation/ soil depth/ cation exchange capacity/ exchangeable calcium/ exchangeable magnesium/ exchangeable potassium/ soil pH/ application rate/ Sweden/ slash

This citation is from AGRICOLA.

1034. Effects of different growing media on greenhouse lettuce grown in soilless culture.

Turhan, E. and Sevgican, A.

Acta Horticulturae 491: 405-408. (1999)

NAL Call #: 80 Ac82; ISSN: 0567-7572

Descriptors: bark/ growing media/ lettuces/ organic fertilizers/ perlite/ pine bark/ pines/ pumice/ sawdust/ seedlings/ soilless culture/ vegetables/ potting composts/ rooting media/ vegetable crops

Abstract: The effects of 8 different growing media on lettuce (cv. Bounty) production were investigated. The media used were perlite, pumice, fine sawdust, ground pine (*Pinus brutia*) bark and mixtures of these materials (1:1). The perlite and pumice were previously used for production of one cucumber crop. The sawdust and ground pine bark were not composted. Seedlings with 3-4 leaves were transplanted into 4-litre pots filled with these substrates on 20 December 1995 and watered with a complete nutrient solution. All the lettuces were harvested on 8 March 1996. Parameters measured were average crop weight, leaf numbers (total, consumable and non-consumable) and proportion of heading. The best results were obtained with pumice medium fertilized with organic manure. Reproduced with permission from the CAB Abstracts database.

1035. Effects of different soil media on the growth of Dracaena dermensis var. Janet Craigie cuttings.

Wazir, M. G.; Noor ul Amin; Ishtiaq, M.; Aziz, A.; and Khan, I. A.

Sarhad Journal of Agriculture(Pakistan) 19(1): 31-34. (2003)

NAL Call #: RA565.S365 S322.P32S37; ISSN: 1016-4383.

Notes: 2 tables, 9 ref. Summary (En). Citation notes: PK (Pakistan).

Descriptors: soil media/ Dracaena dermensis/ sawdust

Abstract: Effects of different soil media on the growth of *Dracaena dermensis* var. Janet Craigie cuttings were studied at the Ornamental Nursery, Horticulture Department, NWFP Agricultural University, Peshawar. Direct cuttings of were planted in 6 inch clay pots containing different soil mixture such as silt sawdust, leaf mould and garden Data showed that soil media of silt + garden soil + leaf mould + sawdust gave maximum number of leaves (62.5) thickness of stem (3.0 cm) number of roots (19.8) and root weight per plant (9.1 g) while minimum number of leaves (55.0), stem thickness (2.4 cm). number of roots (12.3) and root weight (5.0 g) were noted in silt + sawdust. Soil media of silt + sawdust gave maximum days to sprouting (40.5 day) while minimum days to sprouting were noted in Silt + Garden Soil (35.6 days). Maximum length of stem (27.3 cm) and length of roots per plant (41.8 cm) were measured in garden soil while minimum length of stern (19.6 cm) was measured in silt + sawdust and minimum root length (34.8 cm) in silt + garden Soil + leaf mould + sawdust.

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1036. The effects of different traditional sources of nutrients on the infestation of pepper fruits by the pepper fruitfly, Atherigona orientalis (Schiner), in Nigeria.

Ogbalu, O. K.

Journal of Agronomy and Crop Science 182(1): 65-71. (1999); ISSN: 09312250 [ZAPFA].

Notes: doi: 10.1046/j.1439-037X.1999.00287.x.

Descriptors: *Atherigona orientalis*/ infestation/ Nigeria/ pepper fruits/ sources of nutrients/ tradition/ chemical fertilizer/ compost/ manure/ nigeria/ nutrient/ plant disease control/ plant residue/ plant variety/ wood ash/ crop pest/ nutrient/ pest control/ vegetable/ nigeria/ *atherigona orientalis*/ *capsicum annum*/ *capsicum frutescens*
Abstract: Experiments were conducted in 1995 and 1996 to determine the effects of different sources of nutrients on the infestation of fruits of five pepper varieties by *Atherigona orientalis* (Schiner). Different sources of nutrients -chicken droppings, plant residues (compost manure), wood ash and NPK (chemical fertilizer) - were used in the planting of each of the five pepper varieties [Nsukka yellow, Atarugu, and Sweet pepper, all of *Capsicum annum*; Bird's eye chilli and Local medium red (Ogoni pepper) both of *C. frutescens*]. In 1995 plantings, pepper plots of Nsukka yellow and Atarugu varieties that received chicken droppings as source of nutrients suffered the highest percentage fruit damage of 90.7% and 80.8 %, respectively. Pepper plots of Nsukka yellow, Atarugu, Sweet pepper and Local medium red grown in 1996 and treated with chicken droppings suffered the highest percentage fruit damage of 93.7%, 56.6% and 52.2%, respectively. Plots of the Bird's eye chilli variety received minimal or no fruit damage in all. Pepper fruits in the control plots also did not undergo *A. orientalis* attack. Chicken droppings offered the lowest Relative Protection (RP) values to most pepper varieties in 1995 and 1996. NPK chemical fertilizer offered the highest percentage RP values in 1995 and wood ash offered the highest RP in 1996 to most pepper varieties. Also, wood ash in both 1995 and 1996 offered a relatively high percentage RP to most pepper varieties. Compost manure offered a moderate percentage RP in both years.

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1037. Effects of dosage and types of organic composts in the production of lettuce in two soils under protected environment.

Boas, R. L. V.; Passos, J. C.; Fernandes, D. M.; Bull, L. T.; Cezar, V. R. S.; and Goto, R.

Horticultura Brasileira 22(1): 28-34. (2004)

NAL Call #: SB320.43 .B7H67; ISSN: 0102-0536.

Notes: Efeito de doses e tipos de compostos organicos na producao de alface em dois solos sob ambiente protegido.

Descriptors: absorption/ application rates/ bark/ bean straw/ beans/ boron/ calcium/ characteristics/ composts/ copper/ crop yield/ Inceptisols/ iron/ lettuces/ magnesium/ mineral uptake/ nitrogen/ nutrient uptake/ Oxisols/ plant nutrition/ potassium/ sawdust/ straw/ zinc/ soil types genetics

Abstract: The effects of 3 levels (60, 120, and 240 g/vase) of 3 different organic composts (Eucalyptus bark, wood sawdust, and bean straw), applied to 2 soil types (Oxisol (Dark Red Larisol; LE, sandy phase), and Inceptisol (AQ)) on production and nutrient uptake by lettuce grown in plastic vases each with 4 litres of soil in a plastic tunnel. The composts were mixed with fowl manure. The bean straw compost increased the fresh weight of the aerial part and the amount of N, K, Ca, Mg, B, Cu, Fe, S, and Zn in the plants. The best results were obtained in LE in relation to AQ.

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1038. Effects of fermented sawdust feeds and powdered fish oil in diet on the shelf -life of pork.

Lee, J. I.; Chung, M. S.; Hwangbo, J.; Park, B. Y.; Park, T. S.; Kim, J. H.; Sung, P. N.; and Park, G. B.

Korean Journal of Animal Science 40(1): 69-78. (1998)

Descriptors: byproducts/ carcass quality/ diets/ fish oils/ meat quality/ pigmeat/ sawdust/ storage/ trees/ wood residues/ woody plants/ hogs/ pork/ South Korea/ swine
Abstract: The effect of feeding fermented sawdust and powdered sardine oil on the quality of pork was studied. Pigs were randomly assigned to one of 4 diets, control (normal feed), T1 (normal feed and fermented sawdust 30%), T2 (normal feed and 10% sardine powder oil), T3 (normal feed, 30% fermented sawdust, 10% sardine powder oil and 30% limiting amino acids) from 30 to 110 kg liveweight. Samples were stored at 0+or-1 degrees C. Thiobarbituric acid reaction substance (TBARS) values in all treatments increased with storage period (P<0.05). T1 had a lower TBARS value than the other treatments until the 8th day; there were no significant differences among treatments on the 15th day. There were no significant differences in volatile basic N (VBN) between treatments with storage periods. The peroxide value of all treatments decreased with duration of storage (P<0.05), but increased again after the 8th day, that of T1 being significantly lower than the others on the 15th day. TBARS values of all treatments increased with storage (P<0.05), but were not significantly different to each other. There were no significant differences among VBN of treatments with storage periods. Peroxide values of all treatments decreased with storage period (P<0.05), but increased again after the 8th day, while that of T1 was significantly lower than the others on the 15th day.

This citation is from AGRICOLA.

1039. Effects of fertigation on blueberry plants.

Treder, W.; Krzewinska, D.; and Borowik, M.

Zeszyty Naukowe Instytutu Sadownictwa i Kwiaciarnictwa w Skierniewicach 15: 35-45. (2007)

NAL Call #: SB319.3.P7 Z47; ISSN: 1234-0855.

Notes: Original title: Wpyw sposobu nawozenia borowkina wzrost i plonowanie.

Descriptors: application methods/ blueberries/ broadcasting/ crop yield/ fertigation/ fruits/ furrows/ irrigation/ sawdust/ yield components/ fertirrigation/ watering

Abstract: The aim of the experiments conducted in 2004-2005 in the Experimental Orchard in Dabrowice was to compare two methods of nutrient application: fertigation using complete (NPK) fertilizer and traditional broadcast fertilization. The research was carried out on the blueberry cultivar 'Bluecrop', planted in 2000, spaced out at 3x1 m. The plants were cultivated on mineral soil or in furrows filled with a mixture of mineral soil and sawdust. The results showed that the blueberry plants grown in a mixture of mineral soil and sawdust grew better and gave twice as high a yield as the bushes grown in mineral soil. Moreover, their growth was positively influenced by liquid fertilization applied during plant vegetation. Fertigation was more effective than broadcast fertilization. A nitrogen dose of 16.7 kg/ha (N) applied by fertigation resulted in a yield

similar to that obtained with 50 kg/ha (N) in broadcast fertilization. Fertigation also increased the average fruit weight.

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1040. Effects of hardwood sawdust in potting media containing biosolids compost on plant growth, fertilizer needs, and nitrogen leaching.

Bugbee, G. J.

Communications in Soil Science and Plant Analysis 30(5-6): 689-698. (1999)

NAL Call #: S590.C63; ISSN: 0010-3624 [CSOSA2]

Descriptors: Coreopsis grandiflora/ Rudbeckia hirta/ growing media/ sawdust/ nutrient requirements/ nitrogen/ leaching/ nitrates/ carbon nitrogen ratio/ perlite/ slow release fertilizers/ NPK fertilizers/ ammonium nitrogen/ nitrate nitrogen/ stems/ leaves/ flowers/ dry matter partitioning/ fertilizer requirements/ application rate/ fertilizer requirement determination/ growth/ refuse compost

Abstract: Biosolids compost is used in media to grow potted plants. Nitrogen (N) in media leachate may contribute to nitrate (NO₃-N) contamination of surface or ground water. Addition of sawdust to potting media containing biosolids compost will increase the carbon to nitrogen ratio and could prevent N leaching without adversely affecting plant growth. A control medium containing 0% sawdust (v/v), 30% perlite, 50% municipal biosolids compost, and 20% sand was modified to contain either 10, 20, or 30% (v/v) fresh hardwood sawdust. The sawdust replaced either 1/3, 2/3, or all of the perlite in the control medium. Slow release fertilizer, slow plus quick release fertilizer, or no fertilizer was added to each of the four media to determine how the sawdust affected fertilizer needs. Coreopsis (Coreopsis grandiflora L.) and Rudbeckia (Rudbeckia hirta L. 'Goldstrum') were grown in pots for five months. Leachate was tested for NO₃-N and ammonium N (NH₄-N). Increasing amounts of sawdust produced no differences in growth of Coreopsis and few differences in the growth of Rudbeckia. The addition of slow or slow plus quick release fertilizer had little effect on the growth of Coreopsis and a greater effect on the growth of Rudbeckia. Sawdust and fertilizer had no effect on the leaching of N. Nitrogen leached primarily as NH₄-N during the first four weeks of the experiment.

This citation is from AGRICOLA.

1041. Effects of humic substances derived from organic waste enhancement on the growth and mineral nutrition of maize.

Eyheraguibel, B.; Silvestre, J.; and Morard, P.

Bioresource Technology 99(10): 4206-12. (July 2008)

NAL Call #: TD930.A32; ISSN: 0960-8524

Descriptors: agriculture: methods/ biodegradation, environmental/ biomass/ biotechnology: methods/ carbon: chemistry/ fertilizers/ humic substances/ hydrogen ion concentration/ hydroponics/ organic chemicals: chemistry/ plant leaves: metabolism/ plant roots: metabolism/ plant shoots: metabolism/ plants/ Zea mays: chemistry

Abstract: A physico-chemical process has been developed to transform and enhance lignocellulosic waste in liquid humic extracts: humic-like substances (HLS). The aim of this study was to determine the effects of HLS on plant physiology in order to consider their agricultural use as organic fertilizers. The effects of HLS were evaluated on

maize seed germination, and their impact on growth, development and mineral nutrition was studied on maize plants cultivated under hydroponic conditions. The experimental results showed that HLS do not increase the percentage and rate of germination but enhance the root elongation of seeds thus treated. Positive effects were also observed on the whole plant growth as well as on root, shoot and leaf biomass. These effects can be related to the high water and mineral consumption of plants undergoing this treatment. The high water efficiency indicated that such plants produce more biomass than non-treated plants for the same consumption of the nutrient solution. Furthermore, the use of HLS induced a flowering precocity and modified root development suggesting a possible interaction of HLS with developmental processes. Considering the beneficial effect of HLS on different stages of plant growth, their use may present various scientific and economic advantages. The physico-chemical transformation of sawdust is an interesting way of enhancing organic waste materials.

This citation is from PubMed.

1042. Effects of humic substances from composted or chemically decomposed poplar sawdust on mineral nutrition of ryegrass.

Bidegain, R. A.; Kaemmerer, M.; Guiesse, M.; Hafidi, M.; Rey, F.; Morard, P.; and Revel, J. C.

Journal of Agricultural Science 134(3): 259-267. (May 2000); ISSN: 0021-8596 [JASAB]

Descriptors: Lolium multiflorum/ crop yield/ composts/ Populus deltoides/ sawdust/ blood/ oxidation/ biodegradation/ humic acids/ metabolites/ nutrient uptake/ phosphorus/ copper/ manganese/ nitrogen / roots/ flour/ growth/ mineral nutrition

Abstract: Two organic fertilizers were prepared from the same initial mixture of poplar sawdust, blood and flour either by composting in a reactor or by chemical oxidation. Both processes resulted in loss of c. 30% of the organic matter. Composting required 90 days in comparison to only a few hours with chemical oxidation. Extraction of the organic residues with 1 N KOH gave solutions containing 24.6 and 15.1 g/l of humic substances respectively. These humic solutions were applied to pot-grown Lolium multiflorum Lam. At 4 and 10 mg carbon per pot to assess the short-term uptake of macro and microelements by the plants. When the plants were short of phosphorus, the humic substances from the chemically decomposed sawdust supplied at 10 mg C per pot improved total P uptake and yield. Humic substances also increased copper and manganese uptake, and by enhancing root development, also improved nitrogen uptake and biomass yield.

This citation is from AGRICOLA.

1043. Effects of integrated treatments against rice sheath blight severity, disease incidence and yield parameters.

Surulirajan, M. and Janki Kandhari

Annals of Plant Protection Sciences 11(2): 284-288. (2003)

NAL Call #: SB950.A1A46; ISSN: 0971-3573

Descriptors: biological control/ biological control agents/ carbendazim/ chemical control/ crop yield/ cultural control/ farmyard manure/ fungal antagonists/ fungal diseases/ fungicides/ integrated control/ plant disease control/ plant diseases/ plant pathogenic fungi/ plant pathogens/ rice/ rice

straw/ sawdust/ seed weight/ soil amendments/ straw/ yield components/ biocontrol agents/ biological control organisms/ carbendazol/ FYM/ Hyphomycetes/ integrated plant protection/ MBC/ medamine/ paddy/ phytopathogens

Abstract: The control of sheath blight (caused by *Rhizoctonia solani*) in rice (cv. Pusa Basmati-1) by the application of *Trichoderma viride*, carbendazim and soil amendments, singly or in combination, was evaluated in a pot experiment. A highly virulent isolate of *R. solani* (RS 4500) was incorporated into the soil at 15 days before transplanting. Farmyard manure (FYM) and sawdust (1.0%) were applied to soil at 30 days before transplanting. Carbendazim 50 WP (0.1%) was sprayed at 65-, 85 or 105-day intervals. Three days after the application of carbendazim 50 WP, the spore suspension of *T. viride* (Tv 3235) was sprayed. Disease severity was evaluated at maximum tillering and panicle initiation stages, and just before harvesting. Among the treatments, the application of *T. viride* + carbendazim 50 WP + FYM + sawdust resulted in the lowest disease incidence at all stages, as well as in the highest grain and straw yields. The treatments had no significant effect on 1000-grain yield. Reproduced with permission from the CAB Abstracts database.

1044. Effects of litter substrate and genotype on layers' use of litter, exterior appearance, and heterophil:lymphocyte ratios in furnished cages.

Wall, H.; Tauson, R.; and Elwinger, K.

Poultry Science 87(12): 2458-65. (Dec. 2008); ISSN: 0032-5791

Descriptors: animals/ chickens: genetics/ female/ floors and floorcoverings/ genotype/ grooming/ housing, animal/ lymphocytes: physiology/ stress, physiological

Abstract: Effects of sand versus sawdust as a litter bath substrate in furnished cages for laying hens were studied. The study used 112 Hy-Line White (HYW) and 140 Hy-Line Brown (HYB) layers housed in 18 furnished cages with 14 hens in each cage, generating 4 or 5 replicates per combination of genotype and litter substrate. Traits studied were mortality, feather cover, hygiene of hens, pecking wounds, heterophil/lymphocyte ratios, and hens' use of litter baths. Hens' litter bath use was measured by direct observations and by use of the passive integrated transponder technique. The latter technique allowed for recording of an individual hen's visits to litter baths during the 420-d study. There were no indications of differences between sand and sawdust as litter substrates in mortality rates, exterior appearance, or heterophil/lymphocyte ratios. Litter baths with sand or sawdust were occupied to the same extent but dustbathing behaviors were more frequently seen in baths with sawdust. Hens of both lines visited the litter bath to the same extent but HYB performed more dustbathing. There was large variation in the number of days that individual hens visited litter baths; in fact, 30% of the hens never entered litter baths, whereas some hens visited baths almost every day. The HYB hens had inferior feather cover compared with HYW, indicating that feather pecking occurred more frequently in cages with brown hens. The HYW hens had lower body weight, longer claws, and more comb wounds than HYB. In conclusion, sawdust seems to be an acceptable alternative to sand as a litter substrate in furnished cages. This citation is from PubMed.

1045. Effects of mulching on fruit yield, accumulated plant growth and fungal attack in cultivated lingonberry, cv. Sanna, *Vaccinium vitis-idaea* L.

Gustavsson, B. A.

Gartenbauwissenschaft 64(2): 65-69. (1999); ISSN: 0016-478X

Descriptors: bark/ crop yield/ frost/ fruit crops/ gravel/ growth/ mulches/ mulching/ peat/ pine bark/ plant development/ plant residues/ plastic film/ sawdust/ small fruits/ soil pH/ symptoms/ mulching materials

Abstract: The effect of mulching (black plastic foil, peat moss, pine needle litter, sawdust, chopped pine bark, gravel or bare soil (control)) on the growth and yield of *V. vitis-idaea* cv. Sanna, grown on a sandy mineral soil, was investigated during 1995-97 in Sweden. Symptoms of an unidentified fungus as well as accumulated plant growth were determined in the last year of the trial. Soil pH was measured prior to and after the trial. Plastic foil and peat mulch promoted fruit yield, whereas pine needle litter mulch had a negative influence. In a year with deep and delayed winter frost, the organic mulch materials resulted in decreased yield, whereas plants mulched with plastic foil and gravel were unaffected. Accumulated plant growth was positively influenced by peat mulch. Pine needle litter had a significant positive effect when compared with sawdust which gave the poorest growth of all treatments. Gravel mulched- and control-plants exhibited the most severe fungal symptoms; the healthiest plants were those mulched with pine needle litter. Soil pH did not decrease during the cultivation period in chopped pine bark treatment, but decreased in all other treatments, especially in peat moss and pine needle litter treatments, from the initial 5.6 to 4.6 and 4.7, respectively.

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1046. Effects of nitrogen-fixing shrubs in Washington and Coastal California.

Haubensak, K. A.; D'Antonio, C. M.; and Alexander, J.

Weed Technology 18(Suppl): 1475-1479. (2004); ISSN: 0890-037X

Descriptors: burning/ grasslands/ invasion/ nitrogen/ nitrogen fixation/ nutrient availability/ sawdust/ flaming

Abstract: Open grasslands in California and Washington are being invaded by two closely related European shrubs, French broom and Scotch broom, that are considered among the most invasive and damaging of wildland species in those habitats. In this study, we present evidence of their effects on soil nitrogen (N) and the implications for restoration. Using natural abundance ^{15}N signatures of leaves, we show that N fixation by brooms varies across sites and may depend on a suite of site-specific factors. Nonetheless, in sites in both California and Washington, we observe up to a two-fold increase in soil N availability, as assayed in the laboratory. Across a range of sites, we determined that burning decreases total soil N by nearly 40%. We found burning to have the simultaneous effect of decreasing the broom seedbank by 68% after one burn. In a separate experiment, we removed broom and added sawdust to the soil to test whether a N-immobilization effect would help slower growing native perennial grasses in competition with European annual grasses. We found that although sawdust effectively decreased N availability after a

2-yr application period, we could not effectively target which group of species would benefit most.
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1047. The effects of organic and mineral soil media on the quality of *Pterygota alata* Roxb-seedlings.

Hendromono

Buletin Penelitian Hutan 617: 55-64. (1998); ISSN: 1410-0649.

Notes: Original title: Pengaruh media organik dan tanah mineral terhadap mutu bibit *Pterygota alata* Roxb.

Descriptors: coir/ crop quality/ forest nurseries/ growing media/ mineral soils/ organic matter/ Oxisols/ peat/ plant height/ plant morphology/ planting stock/ sand/ sawdust/ seedling growth/ seedlings/ soil types/ soilless culture/ coconut fibre/ nursery plants/ nursery stock/ planting materials/ potting composts/ rooting media

Abstract: An experiment was conducted to prove that organic material have advantages over mineral soil as growing media and to validate the quality index value as an indicator of *Pterygota alata* seedling quality. The seven types of media used (50% Oxisols+50% sand, pure peat, pure coir, pure sawdust, 50% peat+50% coir, 50% peat+50% sawdust, and 50% coir+50% sawdust) were arranged in a completely randomized design with four replicates consisting of 15 plants. The morphological quality and height growth of the seedlings at four and nine months after sowing were better in organic media than in mineral soil medium. The weight of the seedlings grown in the best organic medium was more than twice the weight of the seedlings in mineral soil. The best media for growth and morphological quality of seedlings were pure peat and 50% peat+50% coir by volume. The medium consisting of 50% Oxisols+50% sand by volume was the worst medium for growth and quality of the seedlings. Quality index value could be used as an indicator of *P. alata* seedling quality. The larger the quality index value, the higher is the quality of the seedlings.

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1048. Effects of organic resource quality on soil profile N dynamics and maize yields on sandy soils in Zimbabwe.

Mtambanengwe, F. and Mapfumo, P.

Plant and Soil 281(1/2): 173-191. (2006)

NAL Call #: 450 P696; ISSN: 0032-079X

Descriptors: ammonium nitrogen/ cattle manure/ composts/ crop yield/ immobilization/ leaching/ litter plant/ maize/ maize stover/ nitrate/ nitrate nitrogen/ nitrogen/ nitrogen fertilizers/ nutrient availability/ release/ rooting depth/ sandy soils/ sawdust/ small farms/ soil profiles/ soil types/ sunn hemp/ use efficiency/ ammonia nitrogen/ corn/ fluxes

Abstract: Optimizing the use efficiency of nitrogen (N) derived from different quality organic resources and mineral fertilizers on sandy soils with <100 g clay kg⁻¹ is a major challenge for smallholder farmers in Southern Africa. The dominant sandy soils have a poor capacity to store and supply crop nutrients due to low organic matter contents and inherent infertility. A study was conducted in Zimbabwe to determine the differential N supply effects of different quality and quantities of organic nutrient sources on maize productivity. *Crotalaria juncea* L., *Calliandra calothyrsus* Meissn., cattle manure, maize (*Zea mays* L.) stover and

Pinus patula Schiede & Schltdl. & Cham. sawdust which represented high to low quality materials respectively, were each incorporated into soil at 1.2 and 4 t C ha⁻¹ at Makoholi Experiment Station (rainfall: 450-650 mm yr⁻¹) and tested against a sole mineral N fertilizer and control treatments. In a separate experiment conducted in farmers' fields under different rainfall zones of Zimuto (450-650 mm yr⁻¹), Chinyika (650-750 mm yr⁻¹) and Chikwaka (>750 mm yr⁻¹), commonly available organic materials, including manure and composted miombo leaf litter, applied in varying amounts by farmers were evaluated. Nitrogen release patterns were consistent with differences in resource quality. At 3 weeks after incorporation into soil at the onset of the rains, *C. juncea* and *C. calothyrsus* had released as high as 24% and 13% of added N respectively, compared with no more than 5-6% for the rest of the amended treatments. Most of the N released was lost through leaching as evidenced by progressive movement of NO₃--N bulges beyond maize rooting depth following major rainfall events. Maize yields were significantly related to the size of profile mineral N fluxes, with the best linear relationship (R²=0.86) obtained with N available in the top 30 cm of soil at maize flowering. High grain yields of ~3 t ha⁻¹ were only achieved with *C. juncea* applied at 4 t C ha⁻¹, which also had highest NO₃--N leaching losses. Conversely, the same application rate increased N immobilization by 30% and 42% under maize stover and sawdust, respectively, relative to the control. Results from farmers' fields showed that organic resources traditionally used on smallholder farms are invariably of low quality relative to *C. juncea* and *C. calothyrsus*. However, they exhibited shorter N immobilization effects than was shown for maize stover and sawdust at Makoholi, suggesting that pre-application treatments, such as composting, employed by farmers enhance seasonal N benefits from these materials. Maize yields increased linearly with total N added in these resources in combination with N fertilizer, justifying the high organic matter loading strategy (e.g. >20 t ha⁻¹ for manure, fresh litter and composted litter) used by farmers who often achieve high crop yields on such coarse sandy soils in Zimbabwe.

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1049. Effects of organized soil cultivation on yield and quality of tomato in greenhouse.

Zhang ZhiBin and He ChaoXing

Acta Horticulturae 691(1): 305-311. (2005)

NAL Call #: 80 Ac82; ISSN: 0567-7572

Descriptors: ascorbic acid/ crop quality/ crop yield/ crude protein / cultivation/ fruits/ lycopene/ maize/ maize straw/ manures/ peat/ plant disorders/ plant residues/ protected cultivation/ reducing sugars/ sawdust/ soilless culture/ straw/ substrates/ tomatoes/ vermiculite/ wheat/ wheat straw/ yield components/ corn/ cultivation under glass or plastic/ vitamin C

Abstract: A greenhouse experiment was conducted to determine the effects of different organized soil mixtures on the yield and quality of tomato cv. Zhongza No.9. The treatments comprised: 25% manure + 75% wheat straw (T₁); 25% manure + 75% sawdust (T₂); 25% manure + 75% maize stalk (T₃); 25% manure + 75% mushroom residue (T₄); 25% manure + 50% maize stalk + 25% wheat straw (T₅); 25% manure + 50% maize stalk + 25% sawdust (T₆); 25% manure + 50% maize stalk + 25% peat (T₇); 25%

manure + 50% maize stalk + 25% mushroom residue (T₈); 25% manure + 50% maize stalk + 25% vermiculite (T₉); and 37.5% manure + 50% maize stalk + 12.5% wheat straw ash (T₁). The highest number of fruits per plant (26.3), yield per plant (3.81 kg) and contents of reducing sugar (4.55%), crude protein (0.95%), ascorbic acid (16.9 mg/100 g) and soluble solids (6.4%) were obtained with T₂. T₉ gave the highest average fruit weight (146 g) and lowest ratio of blossom end rot incidence (2.0%), while T₈ gave the highest lycopene content (48.5 mg/100 g). Comparative data on the changes of physical properties of different substrates from sowing to harvest are also tabulated. Reproduced with permission from the CAB Abstracts database.

1050. Effects of phosphorus and nitrogen manipulations on tallgrass prairie restoration.

Kincaid, P.; Smith, V. H.; Foster, B. L.; and Madden, V. L. *Proceedings Rocky Mountain Research Station, USDA Forest Service RMRS P 24*: 364-369. (2002)

Descriptors: ammonium nitrate/ application rates/ establishment/ grasslands/ nature conservation/ nitrogen/ nitrogen fertilizers/ nutrient availability/ phosphorus/ phosphorus fertilizers/ prairie soils/ prairies/ sawdust/ soil fertility/ soil types/ superphosphate/ phosphate fertilizers/ United States of America

Abstract: A study was initiated in spring 1996 to determine the effects of experimental N and P manipulations on the establishment success of two native bunchgrass species (*Andropogon gerardii* and *Sorghastrum nutans*) within replanted tallgrass prairie plots located near Lawrence, Kansas, USA. The N availability treatments included 2 levels of N depletion, 31.25 and 62.50 g m⁻² year⁻¹, which were accomplished using surface soil additions of mixed hardwood and softwood sawdust from a local sawmill; a set of controls, which received neither sawdust nor N additions; and N enrichment levels, which received 6 different supply rates of surface-applied commercial 34-0-0 ammonium nitrate fertilizer (1.0, 2.0, 3.4, 5.4, 7.5 and 9.5 g m⁻² year⁻¹). To increase the degree of N-limitation in half of the experimental units, 3 plots from each of the 9 N availability treatments were randomly selected in spring 1997. Since 1997, these 3 plots have also received an additional 11.25 g m⁻² year⁻¹ of surface-applied commercial 0-0-18 superphosphate fertilizer. Results strongly suggest that soil P can mediate the effects of variations in soil N supply on the abundance of the 2 native prairie grasses. Reproduced with permission from the CAB Abstracts database.

1051. Effects of soil amendment with sawdust and rice husks on the growth and incidence of seedling blight of *Tamarindus indica* Linn.

Muhammad, S.; Abubakar, A.; Magaji, M. D.; and Amusa, T.

Journal of Sustainable Agriculture and the Environment 3(1): 39-44. (2001); ISSN: 1119-8152

Descriptors: cultural control/ fungal diseases/ leaves/ plant disease control/ plant diseases/ plant height/ plant pathogenic fungi/ plant pathogens/ rice husks/ sawdust/ seedling growth/ seedlings/ soil amendments/ tamarinds/ Coelomycetes/ Hyphomycetes/ phytopathogens/ rice hulls

Abstract: Soil in pots were pasteurized and infected with cultures of *Macrophomina phaseolina* and *Rhizoctonia solani*. The soil was impregnated with sawdust and rice

husk, respectively. The amended soils in pots were allowed to stand for 5, 10, 15 and 20 days before sowing the seeds of *T. indica*. The incidence of seedling blight diseases was less in seedlings raised in soils with sawdust and rice husk amendments. The increase in the number of days between amendment application and planting also influenced the reduction in the incidence of seedling blight. The number of compound leaves and plant height were significant in seedlings produced from seeds sown at 20 days after the application of soil amendment. Sawdust was more effective in the reduction of the incidence of seedling blight of *T. indica*.

This citation is from AGRICOLA.

1052. The effects of soil amendments with sawdust and rice husks on the incidence of seedling blight caused by *Fusarium solani* and *Rhizoctonia solani* and the growth of *Parkia biglobosa*.

Muhammad, S.; Amusa, N. A.; Suberu, H. A.; Abubakar, A.; and Magaji, M. D.

Moor Journal of Agricultural Research 2(1): 40-46. (2001); ISSN: 1595-4153

Descriptors: fungal diseases/ growth/ leaves/ plant diseases/ plant height/ plant pathogenic fungi/ plant pathogens/ rice husks/ sawdust/ seedlings/ seeds/ soil amendments/ yield components/ Hyphomycetes/ phytopathogens/ rice hulls

Abstract: Soil in pots, was sterilized and infected with cultures of *Fusarium solani* and *Rhizoctonia solani*. The soil was impregnated with sawdust and rice husk respectively. The amended soil in pots was allowed to stand for 0, 5, 10, 15, and 20 days before planting seeds of *P. biglobosa*. The incidence of seedling blight diseases was less in seedlings raised in soils with sawdust and that of rice husk amendments respectively, allowing the soil in pots to stay for some days after the amendment, before planting also influenced the reduction in the incidence of the seedling blight. The number of compound leaves and plant height were significant in seedlings whose seeds were sown after 20 days of soil amendment. Sawdust amendment however, was found to be more effective in reducing the incidence of seedling blight of *P. biglobosa*.

This citation is from AGRICOLA.

1053. Effects of strains and medium compositions on yield and cell toxic activities of fruit bodies in sawdust-based cultivation of *Yamabushitake* (*Hericium erinaceum*).

Tsujii, H.; Suenari, M.; and Masuno, K.

Bulletin of the Shinshu University Alpine Field Center 1: 73-79. (2003)

Descriptors: antineoplastic properties/ cell cultures/ crop yield/ cultivation/ cytotoxicity/ HeLa cells/ maize cobs/ medicinal fungi/ neoplasms/ pharmacology/ strain differences/ substrates/ wheat bran/ Basidiomycetes/ cancers/ Hericiaceae/ Hericiales/ *Hericium*/ *Hericium erinaceum*

Abstract: A study was conducted to compare the cultivation period, yield and cell toxic activity of 6 strains of *Yamabushitake* (*H. erinaceum* [*H. erinaceus*]) in sawdust-based cultivation. Six strains, maintained in the Nagano Forestry Centre, were used: 4 from Japan, one from Taiwan and one from China. Cell toxicity was determined by adding hot water extracts of fruit bodies to growing HeLa cells. All the 6 strains had cytotoxic activity. Two strains, Y5

and Y6, had the ability to form mature fruit bodies in a short period of cultivation and higher yield than the other 4 strains. On the other hand, the extracts from Y1 and Y2 exhibited the highest cell toxicity potential. The effects of using different maize cob meal levels and supplements were also investigated. Addition of maize cob meal as substrate to sawdust media decreased fruit body yield, shortened the cultivation period and increased cytotoxic activity. Addition of wheat bran as a supplement to the sawdust media improved cytotoxic activity but decreased fruit body yield. The results indicate that mature fruit body with high cytotoxic activity can be produced if Japanese strains such as Y1 and Y2 are cultivated with maize cob meal as a substrate and wheat bran as a supplement to sawdust media.

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1054. Effects of straw, sawdust and sand bedding on dairy manure composting.

Michel Jr., F. C.; Keener, H. M.; Rigot, J.; Wilkinson, T.; and Pecchia, J.

In: Asae Annual International Meeting 2004. Ottawa, ON; pp. 4669-4682; 2004.

Descriptors: ammonia loss/ composting/ dairy/ manure/ nitrogen loss/ sawdust/ straw/ windrow/ ammonia/ manures/ nitrogen/ sawdust/ straw/ ammonia loss/ dairy/ nitrogen loss/ windrow/ composting/ ammonia / composting/ manure/ nitrogen/ saw dust/ straw

Abstract: Composting is an increasingly popular manure management tool for dairies. However, there is little information on the effects of common amendment and bedding types (straw, sawdust and sand) on windrow size, mass, volume, dry matter, and nitrogen losses during composting. In this study, straw, sawdust and sand bedded dairy manures were amended with either sawdust or straw and composted on multiple occasions. Results showed that starting windrow volumes for straw amended composts were 2.1 to 2.6 times greater than for sawdust windrows. Straw amended composts had lower initial bulk densities and temperatures, higher free air space values (75-93%), and near ambient interstitial oxygen concentrations during composting as compared to sawdust amended composts. Sand bedding resulted in greater compost densities, less weight loss and >50% more final compost on a per cow basis. All sawdust-amended composts self-heated to >55°C within 10 days. Sawdust composts without sand maintained these levels for more than 60 days meeting pathogen reduction guidelines. However, none of the straw-amended or sand bedded sawdust amended composts met the guidelines. All of the composts were stable after 100 days and exhibited manure volume and weight reductions relative to the initial manure. Initial compost C:N ratios ranged from 25:1 to 50:1 and the manure nitrogen lost during composting ranged from 2% to 38%. There was a negative correlation between initial compost C:N ratio and nitrogen loss ($R^2=0.59$). An initial C:N ratio of greater than 40 resulted in nitrogen losses less than 10% during dairy manure composting with all three bedding types.

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1055. The effects of substrates prepared by tea waste and disinfection methods on the yield and quality of *Pleurotus sajor-caju* .

Dogan, H. and Peksen, A.

Ondokuz Mays Universitesi, Ziraat Fakultesi Dergisi 18(1): 39-48. (2003); ISSN: 1300-2988.

Notes: Original title: Cay atklarından hazırlanan yetistirme ortamları ve dezenfeksiyon yöntemlerinin *Pleurotus sajor-caju* 'nın verim ve kalitesine etkisi.

Descriptors: agricultural byproducts/ chemical control/ climatic seasons/ crop yield/ disinfection/ edible fungi/ methyl bromide/ pasteurization/ sawdust/ straw/ substrates/ summer/ tea/ wheat/ wheat bran/ wheat straw/ winter/ wood residues/ bromomethane/ Lentinaceae/ pasteurizing / Poriales

Abstract: Studies were conducted during the summer and winter growing seasons to determine the possible use of East Black Sea tea factory wastes as growth substrates for the cultivation of *Pleurotus sajor-caju*. The most suitable disinfection method (autoclave, pasteurization, and methyl bromide) for the substrates was also determined. The substrates were tea wastes, wheat straw, sawdust, and wheat bran. The highest total mushroom yield (175.29 g/1 kg substrate) was obtained from tea waste:wheat bran:wheat straw (1:1:2) substrate disinfected by autoclave in the winter season. Tea waste:wheat bran (1:3) and tea waste:wheat straw (2:2) substrates disinfected by autoclave gave the highest mushroom yield (156.29 and 154.43 g/1 kg substrate, respectively) in the summer season. Reproduced with permission from the CAB Abstracts database.

1056. Effects of the type and application season of animal manure on herbage productivity and utilization efficiency of animal manure in mixed grassland.

Yook WanBang; Choi KiChun; and Ryu GeunChang

Journal of the Korean Society of Grassland Science 24(1): 71-80. (2004)

NAL Call #: SB202.K6H352; ISSN: 1013-9354

Descriptors: animal manures/ application date/ application methods/ autumn/ biomass production/ cattle manure/ cattle slurry/ nitrogen/ nitrogen content/ nutritive value/ pig manure/ sawdust/ soil fertility/ soil organic matter/ split dressings/ spring/ use efficiency/ fall/ nutritional value/ organic matter in soil/ quality for nutrition/ split applications

Abstract: A study was conducted to investigate the effects of the type and season of animal manure (AM) application on herbage productivity and nitrogen use efficiency in a mixed grassland. The treatments consist of: cattle feedlot manure (CFM), swine manure fermented with sawdust (SMFWS) and cattle slurry (CS) and application in autumn or spring as single dressing and 50:50 split dressing. The herbage productivity and nutritive value were hardly influenced by the type and season of AM application. The nitrogen use efficiency of CFM and CS was lower than that of SMFWS. Soil organic matter (OM) content was not significantly affected by the type and season of AM application. The highest OM content was observed in CFM and lowest with CS. The soil nitrogen content was not significantly affected by the type and season of AM application.

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1057. Effects of three types of free-stall surfaces on preferences and stall usage by dairy cows.

Tucker, C. B.; Weary, D. M.; and Fraser, D.

Journal of Dairy Science 86(2): 521-9. (Feb. 2003)

NAL Call #: 44.8 J822 ; ISSN: 0022-0302

Descriptors: animals/ behavior, animal/ cattle: physiology/ female/ housing, animal

Abstract: One important criterion in choosing appropriate housing systems for dairy cattle is that the freestall provides a comfortable surface for the cow. This paper describes two experiments testing the effects of commonly used lying surfaces on stall preference and stall usage by Holstein cows. In both experiments, 12 cows were housed individually in separate pens. Each pen contained three free stalls with a different surface: deep-bedded sawdust, deep-bedded sand, and a geotextile mattress covered with 2 to 3 cm of sawdust. The animals were restricted to each surface in turn, in a random order for either 2 (Experiment 1) or 3 d (Experiment 2). Both before and after this restriction phase, the animals were allowed access to all three surfaces, and preference was determined, based on lying times. Of the 12 cows used in Experiment 1, 10 preferred sawdust before and nine after the restriction phase. During the restriction phase, average lying times and number of lying events during the restriction phase were significantly lower for the sand-bedded stalls ($P < 0.05$), and standing times were higher on mattresses ($P < 0.05$), compared with sawdust. Although these cows had some experience with all three surfaces during the experiment, they had been housed in sawdust-bedded stalls during their previous lactation. Cows used in Experiment 2 had spent their previous lactation in sand bedded stalls. In this experiment, about half the cows preferred sand and half sawdust, after the restriction phase. During the restriction phase of experiment, lying times and number of lying events were lower, and standing times were higher when the animals were restricted to the mattresses compared to either sand or sawdust ($P < 0.05$). These results indicate that (1) free stall surface can affect both stall preferences and stall usage, and (2) mattresses are less preferred.

This citation is from PubMed.

1058. Effects of types and application levels of swine manure on herbage productivity, improvement of soil fertility and environmental pollution in mixed grassland.

Yook, W. B.

Journal of the Korean Society of Grassland Science 23(3): 193-202. (2003)

NAL Call #: SB202.K6H352; ISSN: 1013-9354

Descriptors: application rates/ clay loam soils/ dry matter/ grass sward/ grasslands/ herbage/ leaching/ nitrate/ nitrogen/ nutritive value/ organic matter/ pig manure/ pig slurry/ pollution/ productivity/ sawdust/ silty soils/ soil fertility/ soil types/ urea fertilizers/ environmental pollution/ nutritional value/ quality for nutrition/ South Korea

Abstract: This study was conducted to investigate the effects of the type and application level of swine manure on herbage productivity, efficiency of nitrogen utilization and environmental pollution due to leaching of nitrogen compounds in mixed grasslands. The field experiment was carried out on established grassland sward growing on silt clay loam soil in Korea Republic. Main plots were applied with different types of swine manure: swine manure

fermented with sawdust (SMFWS), swine manure fermented without sawdust (SMF), swine slurry (SS) and mineral fertilizer (urea). In the subplots swine manure were applied at 100, 200 and 400 kg N/ha. The highest values of herbage productivity, nutritive value and nitrogen yields were observed in plots with mineral fertilizer, followed by SS and the lowest values were in SMFWS. The dry matter (DM) yield of plots with mineral fertilizer was 100%, while the DM percents of SMFWS, SMFS and SS were 90.6, 80.9 and 76.8%, respectively. Organic matter (OM) contents of the soils were increased by the applications of swine manure. OM contents were high in plots with SMFS and lowest in plots mineral fertilizer. The amounts of nitrate leaching by types and application levels of swine manure were highest during the end of August and early September and ranged from 10 to 25 ppm.

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1059. Effects of vermicompost as substrate amendment on the growth of papaya (*Carica papaya* L.).

Acevedo, I. C. and Pire, R.

Interciencia 29(5): 274-279 and 231. (2004); ISSN: 03781844.

Notes: Original title: Efectos del lombricompost como enmienda de un sustrato para el crecimiento del lechoso (Carica papaya L.). Language of original document: Spanish.

Descriptors: biodiversity/ ecosystems/ fertilizers/ plants (botany)/ sand/ sawdust/ substrates/ volatile organic compounds/ cattle manure/ crop fertilizers/ vermicomposts/ crops/ bos taurus/ Carica/ Carica papaya

Abstract: Among crop fertilizer practices with low impact on ecosystems, the use of organic materials such as vermicompost has been proposed. The object of this research was to evaluate the effect of the addition of a vermicompost, obtained from cattle manure and coffee pulp, to substrates for the growth of papaya plants. Two experiments were conducted under nursery and field conditions for 60 and 120 days, respectively. In the first one vermicompost was applied alone, while in the second it was applied along with a nitrogen fertilizer. The vermicompost was added in proportions of 0, 5, 10, 15, 20 and 25% to a substrate made of rice hulls, coconut sawdust and thin sand (1:1:1). The nitrogen fertilizer was applied at decreasing ratios in order to keep a constant amount of this element. Both experiments were conducted under a randomized design with 6 treatments, 8 plants per plot and 3 replicates per experiment. The vegetative growth of the plants was evaluated through leaf area, plant height, stem thickness and total dry weight. The largest growth was found with the highest ratios of vermicompost without fertilizer addition, while when nitrogen was added, intermediate ratios were more efficient. The results show the benefits of vermicompost as a substrate amendment for vegetative growth of papaya plants under nursery and field conditions.

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1060. Effects of wood-ash addition on soil solution chemistry and soil N dynamics at a Picea abies (L.) Karst. site in southwest Sweden.

Hogbom, Lars; Series: Report / SkogForsk, 1103-6648 ; Report (Stiftelsen skogsbrukets forskningsinstitut) 4. (2001).

Notes: Includes bibliographical references (p. 19-20)

NAL Call #: SD211 .R47 2001 no.4

Descriptors: wood ash / soil-solution chemistry/ soil-N dynamics/ Picea abies/ Sweden

This citation is from AGRICOLA.

1061. Efficacy of organic soil amendments on the population of Meloidogyne incognita on okra in South Western Nigeria.

Nwanguma, E. I. and Fawole, B. I.

Nigerian Journal of Horticultural Sciences 9: 89-95. (2004); ISSN: 1118-2733

Descriptors: application rates/ crop residues/ cultural control/ decomposition/ nematode control/ okras/ organic amendments/ organic wastes/ pest control/ plant parasitic nematodes/ plant pests/ population density/ poultry manure/ sawdust/ soil amendments/ eelworms/ poultry litter/ Secernentea/ Tylenchida

Abstract: The efficacy of organic soil amendments on the populations of Meloidogyne incognita on okra were investigated in two field trials. Organic wastes comprising fresh poultry mature, crowding, fruits peelings and sawdust were each ploughed 15 cm into the soil at the rates of 0,4, 8 and 16 t/ha, respectively, most significant suppressive effect on soil and root nematode populations. The populations observed in sawdust-amended soil was the lowest. An inverse relationship was observed between nematode populations and rates of each manure type and decomposition period. Similar trends of results were observed in the effects of manure type x manure type x decomposition period interactions on the tested parameters. However, 8 t/ha of poultry in manure (PM) with 6 weeks decomposition period (PM x 8 t/ha x 6 wk) interaction recorded the most outstanding effect other interactions.

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1062. Efficiency of Trichoderma viride Pers: Fr. with wheat bran/sawdust on damping-off of tomato seedlings caused by Pythium indicum Bal.

Neelamegam, R.

Advances in Plant Sciences. 2006; 19(2): 381-386 19(2): 381-386. (2006)

NAL Call #: QK1.A38; ISSN: 0970-3586

Descriptors: biological control/ biological control agents/ biomass production/ cultural control/ dry matter accumulation/ fungal antagonists/ fungal diseases/ integrated control/ plant disease control/ plant diseases/ plant pathogenic fungi/ plant pathogens/ sawdust/ seed germination/ seedling growth/ seedlings/ tomatoes/ vigour/ biocontrol agents/ biological control organisms/ Hyphomycetes/ integrated plant protection/ Peronosporomycetes / phytopathogens/ Pythiaceae/ Straminipila/ vigor

Abstract: The integration of T. viride and sawdust (1.0%) was more effective in the reduction of the incidence of damping off (15%) than T. viride (44%) or wheat bran (59%) in P. indicum [P. deliense]-inoculated unsterilized soil. However, wheat bran (0.1%) resulted in the greatest tomato (cv. Co-1) seed germination (100%), seedling growth (17.8 cm), and seedling vigour index (1780) in unsterilized soil treated with P. indicum and

T. viride. Biomass (dry matter) production was greatest (21.3 mg per plant) in P. indicum-inoculated unsterilized soil amended with T. viride and sawdust.

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1063. Elemental composition of bean (Phaseolus vulgaris) and soy bean (Glycine max L.) grown on wood ash amended soil.

Mbaherekire, B. J.; Oryem Origa, H.; Kashambuzi, J.; Mutumba, G. M.; and Nyangababo, J. T.

Bulletin of Environmental Contamination and Toxicology 70(4): 817-823. (Apr. 2003)

NAL Call #: RA1270.P35A1; ISSN: 0007-4861 [BECTA6]

Descriptors: wood ash / soil amendments/ soybeans/ roots/ shoots/ seeds/ biomass/ heavy metals/ chemical constituents of plants/ Uganda/ plant height

This citation is from AGRICOLA.

1064. Emergence and vigor of guava seedlings on different substrates.

Smiderle, O. J. and Minami, K.

Revista Científica Rural 6(1): 38-45. (2001); ISSN: 1413-8263.

Notes: Original title: Emergencia e vigor de plantulas de goiaba em diferentes substratos.

Descriptors: guavas/ porosity/ pretreatment/ sand/ sawdust/ seed treatment/ seedling emergence/ seedlings/ seeds/ soil/ substrates/ vigour/ water holding capacity/ vigor

Abstract: A greenhouse experiment was conducted to evaluate the effects of different substrates on the percentage and speed of emergence and vigour of guava seedlings. Guava seeds were collected from ripe fruits in a commercial orchard in Guapore, Rio Grande do Sul, Brazil. The seed treatments were: (i) soaking in distilled water for 72 h; (ii) no soaking. After each treatment, seeds were sown in polypropylene trays with different substrates (soil, soil + sand and soil + eucalyptus sawdust) and placed in the greenhouse for seedling emergence. Among the substrates, soil + sawdust exhibited the highest porosity and capacity for water retention. The highest percentage of seedling emergence was obtained with soil + sawdust as substrate, while the highest speed of emergence was obtained with soil + sand as substrate. Pre-soaking the seeds anticipates the initiation of seedling emergence. Reproduced with permission from the CAB Abstracts database.

1065. Emissions of ammonia, nitrous oxide, methane, carbon dioxide and water vapor in the raising of weaned pigs on straw-based and sawdust-based deep litters.

Nicks, Baudouin; Laitat, Martine; Vandenheede, Marc; Desiron, Alain; Verhaeghe, Claire; and Canart, Bernard

Animal Research 52(3): 299-308. (2003); ISSN: 1627-3583

Descriptors: emissions/ ammonia/ nitrous oxide/ methane/ carbon dioxide/ water vapor/ weaned pigs/ straw-based

litter/ sawdust-based litter

Abstract: Five successive batches of 40 weaned pigs were raised on deep litter of sawdust or straw without changing the litter in between batches. The quantity of litter dry matter utilized in the two cases was 5 kg per pig. The concentrations of gases were measured 8 times, at about

one-month intervals, for 6 consecutive days and the ventilation flow was recorded continuously. Pig raising on sawdust-based litter differed from that with straw by an emission of 2.6 times less ammonia (0.46 vs. 1.21 g per pig per day), 2.1 times less methane (0.77 vs. 1.58 g per pig per day), 3.9 times more N₂O (1.39 vs. 0.36 g per pig per day), 4% more CO₂ (481 vs. 463 g per pig per day) and 21% more H₂O (1126 vs. 933 g per pig per day). All differences were significant. About 58% of the nitrogen excreted by the pigs was recovered in the gas form and for the two litters, about 79% in the form of N₂.

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1066. Enhancing biological control in orchards by increasing food web biodiversity.

Brown, M. W. and Tworowski, T.

Journal of Fruit and Ornamental Plant Research 14(Supplement 3): 19-27. (2006); ISSN: 1231-0948

Descriptors: apples/ chemical control/ composts/ crop yield/ cultural control/ detritivores/ diuron/ eugenol/ fruits/ herbicides/ insect pests/ integrated control/ mulches/ mulching/ natural enemies/ peaches/ plant pests/ population density/ poultry manure/ predatory arthropods/ sawdust/ soil arthropods/ terbacil/ weed control/ weeds/ DCMU / integrated plant protection/ mulching materials/ poultry litter/ United States of America/ weedicides/ weedkillers

Abstract: The effects of mulch, compost and herbicides on weed and insect communities in apple and peach orchards were studied in Kearneysville, West Virginia, USA, during 1999-2003. In 16-year-old apple orchards, poultry manure compost was applied in areas that had not been treated or treated with pre-emergent herbicides (diuron and terbacil). Pitfall traps were used to sample ground-dwelling arthropods in treated areas. The application of compost significantly increased the abundance of the detritivores and predators. The herbicides increased the abundance of herbivores dominated by migrating first-instar *Eriosoma lanigerum*. The predator-herbivore ratio was highest in plots with compost only (0.85), followed by compost and herbicide (0.32), compost without herbicide (0.32), and herbicide without compost (0.15). Orchards of apple cv. Ace Spur Delicious on M.7 rootstock and peach cv. Redhaven on Lovell rootstock were treated during 2002 with the following: 5% aqueous eugenol in May and June; composted sawdust mulch (8 cm deep) in June and 5% eugenol in May and June; or 0.56 kg paraquat/ha in May, June, July and August. Eugenol gave excellent weed control for one month but reapplication was necessary. Weed cover by the end of the first season was reduced to 54% with eugenol, 8% with composted sawdust mulch + eugenol; and 2% with paraquat. Weed control treatments did not affect fruit yield and weight. The results indicated that mulch + post-emergence eugenol was as effective in weed control as 4 paraquat applications. Reproduced with permission from the CAB Abstracts database.

1067. Environmental and technical aspects of raising fattening pigs and weaned pigs on sawdust-based or straw-based deep litters.

Nicks, B. and Lekeux, P.

Annales De Medecine Veterinaire 149(1 SPEC.): 31-36. (2005); ISSN: 00034118.

Notes: Original title: Aspects environnementaux et

zootechniques de l'élevage de porcs charcutiers et de porcelets sevrés sur litières accumulées de sciure ou de paille. Language of Original Document: French.

Descriptors: *Sus scrofa*

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1068. Environmental results of keeping weaner pigs on a deep litter with sawdust.

Nicks, B.; Laitat, M.; Desiron, A.; Vandenheede, M.; and Canart, B.

Journées de la Recherche Porcine en France 31: 105-109. (1999)

NAL Call #: SF391.I53 ; ISSN: 0767-9874.

Notes: Original title: Bilan environnemental de l'hébergement de porcelets sevrés sur litière accumulée de sciure.

Descriptors: ammonia/ deep litter housing/ dry matter/ evaporation/ growth/ litter/ liveweight/ manures/ particle size/ pig housing/ piglets/ sawdust/ temperature/ hogs/ piggeries/ sties/ swine/ swine housing

Abstract: Six batches of weaner pigs (N=440) were reared successively on a deep litter with sawdust without cleaning between the batches. The average liveweight of the pigs at the beginning and at the end of the post-weaning period was 8.4±or-2.4 and 26.0±or-4.6 kg. The average daily gain was 422±or-98 g. Each piglet needed 12 kg of sawdust and produced 15 kg of manure. The average temperature of the litter at 20 cm depth was 33.8 degrees C. At the end of the experimental period, the dry matter (DM) content of the litter was 49% and the N content 19 g/kg DM. The C/N ratio decreased progressively from 82 to 25. The water evaporation rate was 92% and the N gas-emission rate 75%. The amount of N in the compost was 139 g/piglet. The average NH₃ concentration in the experimental rooms was 8.7±or-5.2 ppm and the dust concentration 270±or-136 particles/ml. 90% of particles were in the size range of 0.3-0.5 micro m. To decrease the dust concentration water was regularly added to the litter at a rate of 0.94 l/kg sawdust.

This citation is from AGRICOLA.

1069. Equipment performance for determining water needs of tomato plants grown in sawdust based substrates and rockwool.

Dorais, M.; Caron, J.; Begin, G.; Gosselin, A.; Gaudreau, L.; and Menard, C.

Acta Horticulturae 691(1): 293-304. (2005)

NAL Call #: 80 Ac82; ISSN: 0567-7572

Descriptors: chlorophyll/ photosynthesis/ plant water relations/ protected cultivation/ rockwool/ sawdust/ soilless culture/ substrates/ tensiometers/ tomatoes/ water requirements/ carbon assimilation/ carbon dioxide fixation/ cultivation under glass or plastic/ mineral wool/ rock wool

Abstract: There might be a benefit in using sawdust for replacing rockwool in terms of reducing substrate costs while maintaining an adequate productivity and root growth. However, recent research showed that water availability and transfers in sawdust were limited, thereby increasing water stress during active plant growth. To lessen this risk, the objective of this study was to characterize the relationship of substrate matric potential with volumetric water content and dielectric (TDR) sensor in a range of soilless substrates moisture that could be observed in greenhouses. In addition, we investigated whether TDR, load cell, tensiometer and canopy temperature could

accurately sense plant water stress and monitor and control irrigation scheduling for tomato plants grown in sawdust-based substrates. Thus, equipments were installed in 3 substrates (1 - rockwool, 2 - pure sawdust, and 3 - 70% sawdust + 30% wood fibres) for the production of greenhouse tomato grown on raised-gutters with supplemental lighting. Under different solar radiation in winter and spring, and different water contents of the growing media, we measured gas exchanges, Chl a fluorescence and leaf water potential. We also measured plant growth and productivity during the whole growing seasons. For sawdust + wood fibre substrate, there were significant correlations between TDR, load cell, and tensiometer. Matric potentials were generally correlated to TDR and load cell of sawdust and rockwool substrates. The canopy temperature was a poor indicator of the matric potential but a good indicator of the substrate water content during spring. Regardless of the growing season, TDR and load cell measurements were correlated to CO_2 assimilation rate and F_v/F_m ratio of plant grown in sawdust based substrates and rockwool. However, relationships between water content measurements, matric potential, and physiological parameters varied with the growing media and season. No significant differences were observed for plant development, leaf area, plant dry weight, carbohydrate partitioning and yield of tomato plants grown under different growing media. Reproduced with permission from the CAB Abstracts database.

1070. Establishment of cattle waste manure composting technique for consideration of crop and soil, 3: Verification of factor that cattle waste compost with sawdust is avoided.

Fukushima, M; Wakisaka, H.; and Kanbe, Y.
Bulletin of the Tochigi Prefectural Livestock Experiment Station (Japan) 22: 29-34 . (Feb. 2007); ISSN: 0288-9536.
Notes: Summary (Ja). Citation notes: JP (Japan).
Descriptors: cattle/ manure/ composting/ crops/ soils/ sawdust

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1071. Evaluation of allelopathic potential of wood chips for weed suppression in horticultural production systems.

Rathinasabapathi, B.; Ferguson, J.; and Gal, M.
HortScience: A Publication of the American Society for Horticultural Science 40(3): 711-713. (June 2005)
NAL Call #: SB1.H6; ISSN: 0018-5345
Descriptors: wood chips/ mulches/ allelopathy/ weed control/ commercial horticulture/ horticulture/ leaves/ *Lactuca sativa*/ lettuce/ vegetable crops/ bioassays/ *Desmodium tortuosum*/ broadleaf weeds

Abstract: Shredded and chipped wood mulches are used for weed suppression in perennial fruit crops, in urban landscapes, and occasionally in vegetable crops. Wood chip mulches with weed-suppressing allelochemicals may be more effective for weed control, especially under sustainable and organic production systems, than mulches without such properties. The objective of this study was to test for the presence of water-soluble allelochemicals in wood chips derived from tree species, often found in wood resource recovery operations in the southeastern US. Presence of allelochemicals in water eluates of woodchips and leaves was evaluated in a lettuce bioassay. Eluates of

wood chips from red maple (*Acer rubrum* L.), swamp chestnut oak (*Quercus michauxii* Nutt.), red cedar (*Juniperus silicicola* L.H. Bailey), neem (*Azadirachta indica* A. Juss.), and magnolia (*Magnolia grandiflora* L.) highly inhibited germinating lettuce seeds, as assessed by inhibition of hypocotyl and radicle growth. The effects of wood chip eluates from these five species were more than that found for eluates from wood chips of black walnut (*Juglans nigra* L.) a species previously identified to have weed-suppressing allelochemicals. Tests on red cedar, red maple, and neem showed that water-soluble allelochemicals were present not only in the wood but also in the leaves. In greenhouse trials, red cedar wood chip mulch significantly inhibited the growth of florida beggarweed (*Desmodium tortuosum* DC.), compared to the gravel-mulched and no-mulch controls. This citation is from AGRICOLA.

1072. Evaluation of compost for use as a soil amendment in corn and soybean production.

Smiciklas, K. D.; Walker, P. M.; and Kelley, T. R.
Compost Science and Utilization 16(3): 183-191. (2008)
NAL Call #: TD796.5.C58 ; ISSN: 1065657X [CSUTE]
Descriptors: applications/ biogeochemistry/ biological materials/ fertilizers/ grain (agricultural product)/ magnesium printing plates/ manures/ nitrogen fertilizers/ organic compounds/ project management/ soils/ urea/ wood products/ application rates/ compost application rates/ compost applications/ dairy cows/ dry matters/ food wastes/ grain yields/ high organic/ high rates/ in fields/ indicator bacterial/ inorganic fertilizers/ organic matters/ research projects/ soil amendments/ soil characteristics/ soybean productions/ wood chips / composting/ compost/ conference proceeding/ crop production/ fertilizer application/ maize / soil amendment/ soybean/ bacterial/ compost/ corn/ fertilizers/ organic matter/ soil conditioners/ soy beans/ bacteria (microorganisms)/ bos/ glycine max/ zea mays

Abstract: The purpose of this research project was to 1) evaluate rate of compost application and 2) to compare compost with uncomposted raw material and inorganic fertilizer N application upon maize and soybean growth and productivity, and upon soil characteristics. During the first three years of the study, the source of uncomposted material and compost was food waste and ground newsprint. During years 4 to 9 of the study, the source of uncomposted material and compost was dairy cow manure and wood chips. Application rates in field site 1 were 0, 11.2, 22.4, 33.6 and 44.8 Mg ha⁻¹ compost, 44.8 Mg ha⁻¹ uncomposted material and 140 kg ha⁻¹ fertilizer N (as urea). Application rates in field site 2 were 0, 22.4, 44.8, 67.2 and 134.4 Mg ha⁻¹ compost, 134.4 Mg ha⁻¹ uncomposted manure and 180 kg ha⁻¹ fertilizer N (dry matter basis). The high rates of compost application significantly raised organic matter levels, and available P and K compared to inorganic fertilizer N. Uncomposted manure and increasing compost application rates significantly increased grain yield, number of kernels per plant and plant weight. Composting significantly reduced pathogen indicator bacteria concentrations. The data of this study suggest that on these high organic matter soils 22.4 Mg ha⁻¹ to 44.8 Mg ha⁻¹ are optimal compost application rates.

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1073. Evaluation of different composts from horticultural crop residues and their uses in greenhouse soilless cropping.

Urrestarazu, M.; Salas, M. C.; Padilla, M. I.; Moreno, J.; Elorrieta, M. A.; and Carrasco, G. A.

Acta Horticulturae 549: 147-152. (2001)

NAL Call #: 80 Ac82; ISSN: 0567-7572

Descriptors: composts / cress/ crop residues/ crop yield/ cucumbers/ growing media/ inoculation/ lettuces/ melons/ peat/ perlite/ sawdust/ seed germination/ seedling growth/ soilless culture/ tomatoes/ wood shavings/ Capparales/ gherkins/ Hyphomycetes/ potting composts/ rooting media
Abstract: A study was conducted to evaluate the possibility of using different composts from horticultural residues under forced ventilation conditions with different levels of inoculation of microorganisms (inoculations each at 15 days from the beginning; one inoculation at the start of composting; and without inoculation, control). All compost treatments which started with a similar volumetric ratio, 2 pepper:1 cucumber:1 runner bean:1 wooden material (sawdust and industrial shavings), were inoculated with *Trichoderma koningii* and *Coriolus versicolor*. Germination assays were performed in cress (*Lepidium sativum*) and lettuce seeds to determine the compost maturity degree and indirectly the presence of phytotoxicity. In the vegetative growth test conducted using melon seedlings, treatments consisted of a mix of each compost and perlite, in a volume ratio of 1 compost:2 perlite, one control treatment with perlite and another replacing the compost component by peat moss (1 peat moss: 2 perlite). The effect on yield was tested using *Lycopersicon esculentum* var. *cerasiforme* under similar conditions as the growth test. Results indicate that to use the composts for seedling production, it would be necessary to correct the pH and reduce salinity by leaching. For crops with longer growing periods, the tendency was reversed due to similar values at the plant rhizosphere as those in standard conditions obtained with a daily pot fertigation. It is concluded that these composts could be used not only for compost amendment but as horticultural and environmentally friendly substrates. They are able to substitute other traditional substances such as peat, at least during one growing period. Reproduced with permission from the CAB Abstracts database.

1074. Evaluation of nitrogen availability of composted poultry and sawdust cattle manures labeled with 15N on paddy field rice.

Uenosono, S.; Nagatomo, M.; Takahashi, S.; Kunieda, E.; and Yamamuro, S.

Japanese Journal of Soil Science and Plant Nutrition 75(3): 313-319. (2004); ISSN: 0029-0610

Descriptors: ammonium sulfate/ carbon nitrogen ratio/ cattle manure/ composts/ mineralization/ nitrogen/ nutrient availability/ nutrient balance/ organic fertilizers/ paddy soils/ poultry manure / rape/ rice/ sawdust/ soil organic matter/ soil types/ swede rape/ ammonium sulphate/ canola/ Capparales/ oilseed rape/ organic matter in soil/ paddy/ poultry litter

Abstract: This study was conducted to investigate the availability and balance of nitrogen from 15N-labelled composted poultry manure and sawdust-cattle manure by 15N tracer technique, and to compare these results to the 15N-labelled rape cake and chemical fertilizer, ammonium

sulfate. In the field experiment, 15N recovery in rice plants from ammonium sulfate, rape cake, composted poultry and sawdust-cattle manure at maturity were 41.7, 28.7, 15.7 and 4.0% respectively. On the other hand, the 15N residual in the top soil (0-15 cm) from the same set were 35, 41, 47 and 91%, respectively. The mineral fertilizer equivalent of composted poultry manure, composted sawdust-cattle manure and rape cake were 40, 10 and 70%, respectively. The span of 15N availability from these manures was from active tillering stage to panicle formation stage. The trend of change of organic 15N recovery derived from 15N labelled matters in a laboratory incubation experiment was similar to that in the field experiment. It is suggested that the laboratory incubation experiment can characterize or predict the pattern of mineralization of organic matters in the actual field conditions.

This citation is from AGRICOLA.

1075. Evaluation of non-chemical treatments in the control of *Meloidogyne incognita* on common bean.

Ibrahim, A. A. M. and Ibrahim, I. K. A.

Pakistan Journal of Nematology 18(1/2): 51-57. (2000)

NAL Call #: QL391.N4P34; ISSN: 0255-7576

Descriptors: animal manures/ carbofuran/ cattle manure/ chemical control/ cultural control/ galls/ guavas/ leaves/ nematicides/ nematode control/ organic amendments/ pest control/ phytotoxicity/ plant parasitic nematodes/ plant pests/ poultry manure/ sawdust/ Botryocladia/ Botryocladia capillaceae/ eelworms/ Ficus microcarpa/ green bean/ poultry litter/ Rhodymeniaceae/ Rhodymeniales/ Secernentea/ snap bean/ Tylenchida/ Ulva/ Ulva fasciata/ Ulvaceae/ Ulvales

Abstract: A greenhouse study was conducted to evaluate the efficacy of 2 marine algae (*Ulva fasciata* and *Botryocladia capillaceae*), leaves of *Eucalyptus* sp., *Ficus retusa* and *Psidium guajava* (guava), manures of cattle, chicken and dove, and sawdust as soil amendments at 2% w/w, compared to carbofuran 10G in controlling the root-knot nematode *M. incognita* infesting common bean (*Phaseolus vulgaris*) cv. Giza 3. All treatments greatly suppressed the disease index (root galling) and nematode reproduction (egg mass production). The highest reduction in root galling (97.4%) and egg mass production (98.9%) was recorded for the treatment with *U. fasciata*. The relative efficacy of *B. capillaceae*, leaves of *P. guajava*, and the cattle and chicken manures was approximately equal to that of carbofuran in reducing the number of egg masses, while *U. fasciata* reduced egg mass production 18-fold compared with carbofuran. Fresh and dry weights of shoot and root systems of common beans were generally increased by carbofuran and all the tested organic amendments. Both *Eucalyptus* sp. and *P. guajava* leaves exhibited low phytotoxicity.

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1076. Evaluation of simplified covering systems in the reduction of gaseous emissions from pig and cattle slurry storage.

Guarino, M.; Navarotto, P.; Sonzogno, A.; Fabbri, C.; and Valli, L.

Rivista di Ingegneria Agraria (Italy) 35(3): 63-70. (Sept. 2004); ISSN: 0304-0593.

Notes: Original title: Valutazione di sistemi di copertura semplificati nella riduzione di emissioni gassose da

stoccaggi di liquami suini e bovini. Summary (En). Citation notes: IT (Italy).

Descriptors: manure slurry/ covering systems/ gaseous emissions/ swine manure/ cattle manure/ storage

Abstract: In Italy it has been estimated that atmospheric emissions from cattle and pig farms regard ammonia, methane and nitrous oxide production. A significant share of these emissions comes out from waste storage and treatment phases because of the decomposition of organic matter present in slurry. The proposed solutions for reducing emissions from storage lagoons have mainly concerned a reduction of the free surface of slurry by constructing very tall structures or by covering the storage lagoons. In this study, we investigated the effectiveness of a number of simplified floating covers at two different thickness (vegetable oil, maize stalks, light weight expanded clay aggregates, wood chips and wheat straw) in reducing ammonia, methane and odour emissions from pig and cattle slurry. Also their floating capacity was tested. Nine stain steel cylinders of 190 x 10E3 cube m with the possibility of a hermetic seal were used to allow monitoring the air in the headspace. For this analysis, the Brueel e Kjaer monitor (mod. 1302) and the olfactometer T07 were used. The results obtained showed good levels of ammonia emission reduction efficiency (66-100%) and odour abatement (52-90%) for all the tested covers at higher thickness. Some of these materials (clay aggregates, wood chips) also showed good capacity for long-term resistance to deterioration and sinking into slurry. Equally valid results were not obtained as far as methane emissions were concerned.

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1077. Evaluation of various potting media and fertilizer levels for commercial nursery production of *Ficus benjamina* L.

Gad, M. M.

Assiut Journal of Agricultural Sciences 34(4): 123-151. (2003); ISSN: 1110-0486

Descriptors: application rates/ branches/ carotenoids/ chemical composition/ chlorophyll/ clay/ growing media/ leaf area/ leaves/ nitrogen content/ nitrogen fertilizers/ NPK fertilizers/ nurseries/ ornamental plants/ ornamental woody plants/ peat/ phosphorus/ phosphorus fertilizers/ plant composition/ plant height/ pot culture/ pot experimentation/ potassium/ potassium fertilizers/ root shoot ratio/ roots/ sand/ sawdust/ soilless culture/ stems/ straw/ traits/ vermiculite/ woody plants/ chemical constituents of plants/ ornamentals/ phosphate fertilizers/ potash fertilizers/ potting composts/ rooting media/ tetraterpenoids

Abstract: A pot experiment was conducted to study the effect of various potting mixtures and NPK fertilizer rates on the growth and quality of *F. benjamina*. The potting mixtures comprised: clay, clay + straw; clay + sawdust; peat moss; peat + clay; peat + vermiculite; peat + sand; vermiculite; vermiculite + straw; vermiculite + sawdust; sand + straw; and sand + sawdust. The NPK treatments comprised 0:0:0, 8:4:2 and 16:8:4 g NPK/pot. Peat moss alone produced the best vegetative and root characteristics compared to the other media. Peat moss increased plant height, stem diameter, number of branches and leaves, fresh weight of leaves, branches and roots, leaf size, total leaf area per plant and shoot:root ratio followed by peat + vermiculite and vermiculite + straw. The addition of either straw or sawdust to clay or sand showed a great reduction

in plant growth. NPK at 16:8:4 g/pot gave the best increase in vegetative and root characteristics. High leaf contents of N, P, K, chlorophylls a and b, and carotenoids were closely correlated with the best growth and quality obtained with the most suitable media combined with high NPK rates. Reproduced with permission from the CAB Abstracts database.

1078. Evaluation of weathered poultry manure, cow dung and sawdust in the management of *Meloidogyne incognita* race 2 in okra.

Adekunle, O. K.

Environment and Ecology 25(2): 322-328. (2007)
NAL Call #: TD172.E5; ISSN: 0970-0420

Descriptors: application rates/ cattle manure/ growth/ nematode control/ okras/ pest control/ plant development/ plant parasitic nematodes / poultry manure/ sawdust/ Adenophorea/ Dorylaimida/ eelworms/ poultry litter/ Secernentea/ Tylenchida

Abstract: Greenhouse and field experiments were conducted in Nigeria to determine the efficacy of weathered poultry manure (14.35% N, 104.35 mg P/kg and 146.64 mg/kg), cow dung (10.75% N, 21.65 mg P/kg and 153.27 mg K/kg) and sawdust (2.84% N, 205.97 mg P/kg and 53.82 mg K/kg) applied singly at 1.5 and 3.0 t/ha on *Meloidogyne incognita* race 2 infesting okra. The application of weathered poultry manure, cow dung and sawdust to nematode-infested soil resulted in increased vegetative growth, reduced root galling increased yield of okra fruit but also an increase in soil populations of 4 genera of plant parasitic nematodes, namely *Meloidogyne incognita*, *Longidorus* spp., *Xiphinema* spp. and *Pratylenchus* spp.

This citation is from AGRICOLA.

1079. Experiment on different formulae and covering soil of *Pleurotus cornucopiae*.

Huang YuShan; Su GuiPing; and Chen MingBao

Edible Fungi of China 20(6): 12-13. (2001); ISSN: 1003-8310

Descriptors: casing/ cottonseed husks/ crop quality/ crop yield/ culture media/ edible fungi/ gypsum/ sawdust/ sugar/ wheat bran/ Lentinaceae/ Porales

Abstract: *P. cornucopiae* was cultured on the following media: (1) 78% sawdust + 20% wheat bran (WB) + 1% brown sugar (BS) + 1% gesso [?gypsum], (2) 50% cottonseed hulls (CH) + 30% sawdust + 18% WB + 1% BS + 1% gesso, (3) 80% CH + 18% WB + 1% BS + 1% gesso, and (4) 20% CH + 60% sawdust + 17% WB + 1% BS + 1% gesso. The media were covered or not with soil. Yields were highest in (1), followed by (4), (3) and (2), but the differences in yield between the media were not significant. Covering with soil increased yield by about 80% compared with no covering, and improved quality (including colour, taste and size).

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1080. Exploring the mechanisms behind elevated microbial activity after wood ash application.

Jokinen, H. K.; Kiikkilä, O.; and Fritze, H.

Soil Biology and Biochemistry 38(8): 2285-2291. (2006)
NAL Call #: S592.7.A1S6; ISSN: 00380717 [SBIOA].

Notes: doi: 10.1016/j.soilbio.2006.02.007.

Descriptors: dgge/ doc/ pH/ thymidine-incorporation/

bacteria/ carbon/ pH effects/ wood/ dgge/ doc/ relative bacterial growth rate (rbgr)/ thymidine-incorporation/ microbiology/ carbon/ dissolved organic carbon/ experimental study/ fertilizer application/ growth rate/ humus/ hydrophobicity/ incubation/ microbial activity/ relative abundance/ soil microorganism/ wood ash/ ash/ bacteria/ carbon/ microbiology/ pH/ wood/ bacteria (microorganisms)

Abstract: Wood ash fertilization increases the pH and concentration of dissolved organic carbon (DOC) in the soil solution and enhances the activity of soil microorganisms. However, it is unknown whether DOC or pH is primarily responsible for the increase in microbial activity. We designed an experiment to separate the effects of DOC and/or pH on soil microbial activity using suspensions of humus extracts and bacteria that had not previously been exposed to wood ash fertilization. After a 3-week incubation, DOC extracts were obtained from control (DOCC) and ash (DOCA) treatments with carbon concentrations of 9.1 and 32.5 mg C l⁻¹, respectively. These extracts were supplied to bacterial suspensions at concentrations of 0 and 5 mg C l⁻¹. We controlled for pH by matching adjustments, i.e. the original pH of the DOCC extract was 4.5 and its adjusted pH was 6.9, whereas the DOCA extract was pH 6.9 originally and pH 4.5 adjusted. The relative bacterial growth rate (RBGR), as measured by 3H-thymidine incorporation, increased in suspensions of 5 mg C l⁻¹ DOC as compared to control suspensions of 0 mg C l⁻¹. At pH 6.9, RBGR was higher for both DOC extracts than at pH 4.5. These results suggest that both DOC and pH influence microbial activity. As the growth rate at pH 6.9 with DOCA was higher than with DOCC, the quality of the DOC extract must also play a role since the carbon concentration was controlled for. The decrease in relative abundance of hydrophobic and hydrophilic acids in DOCA compared to DOCC indicates a quality shift. As measured by DGGE banding patterns, the bacterial community structure changed over the course of the 24-h experiment in the following three trials, all of which received 5 mg C l⁻¹: DOCC at pH 6.9 and DOCA at pH 4.5 and 6.9. These results demonstrate that both the DOC origin (control vs. ash) and the pH influence a subset of the bacterial community. © 2006 Elsevier Ltd. All rights reserved. © 2009 Elsevier B.V. All rights reserved.

1081. Fate of nitrogen derived from 15N-labeled cattle manure compost applied to a paddy field in the cool climate region of Japan.

Nishida, M.; Sumida, H.; and Kato, N.

Soil Science and Plant Nutrition 54(3): 459-466. (2008)

NAL Call #: 56.8 SO38; ISSN: 0038-0768

Descriptors: application rates/ cattle manure/ composts/ growth/ nitrogen/ paddy soils/ rice/ sawdust/ soil types/ uptake/ paddy

Abstract: To estimate the fate of nitrogen (N) derived from cattle manure compost with sawdust (CMC) in a paddy field in the cool climate region of Japan, well-composted 15N-labeled CMC was applied to a microplot field experiment. Throughout the experimental period of three crop seasons, N from CMC was taken up by rice plants without a marked decline. The percentages of N taken up derived from CMC to applied N as CMC (%CNRp) were 2-3% for each year. The N from CMC was taken up by rice plants over the entire growth period by 1-2, 2 and 2-3% as %CNRp at the panicle initiation, heading and maturity stages, respectively.

A significant positive linear correlation was found between the cumulative compost N uptake and the number of days transformed to standard temperature (25 degrees C) over the entire experimental period, including the fallow season. The %CNRp was identical at CMC application rates ranging from 1 to 4 kg m⁻². Using 15N-labeled CMC, the results showed that well-composted CMC was a stable N source for rice plants for at least 3 years, regardless of the CMC application rate (ranging from 1 to 4 kg m⁻²) in the cool climate region of Japan. The distribution of CMC N was 7% in the rice plants accumulated over 3 years, 66-69% in the soil and 24-27% was un-recovered at the end of the third crop season.

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1082. Fate of nitrogen derived from 15N-labeled plant residues and composts in rice-planted paddy soil.

Ueno, H. and Yamamuro, S.

Soil Science and Plant Nutrition 47(4): 747-754. (2001)

NAL Call #: 56.8 SO38; ISSN: 0038-0768

Descriptors: cattle manure/ composts/ denitrification/ immobilization/ maize/ mineralization/ nitrogen/ nutrient uptake/ organic amendments/ paddy soils/ plant nutrition/ plant residues/ pot experimentation/ rice/ rice husks/ rice straw/ sawdust/ soil types/ straw/ corn/ paddy/ rice hulls

Abstract: Pot experiments that lasted for 3 years were conducted to investigate the dynamics of nitrogen derived from plant residues (rice root, hull, straw, maize root and rapeseed pod-wall), and composts (rice straw compost, cattle manure compost and cattle manure sawdust compost), which were labelled with 15N. The rates of nitrogen uptake by rice (=N efficiency), denitrification and immobilization derived from the organic materials incorporated before the first year of cultivation were investigated throughout 3 years of cultivation. At the end of the first year of cultivation, relatively high rates of N efficiency were obtained for rapeseed pod-wall (24.6%), rice straw (19.1%), and rice hull (18.6%), while maize root and cattle manure sawdust compost displayed a noticeably high denitrification rate. Maize root, cattle manure sawdust compost, rice hull, and rapeseed pod-wall exhibited remarkably high N mineralization rates ranging from 60 to 75% of the organic materials N applied. Cumulative rates of N efficiencies from the organic materials applied before the first year of cultivation fitted well to a first-order kinetic model and their asymptotes were compared among the organic materials. The asymptotic rates of N efficiency tended to depend on the rates at the end of the first year of cultivation.

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1083. Fattening pigs on a thin litter of wood grain or sawdust.

Ramonet, Y. and Robin, P.

In: 34emes Journees de la Recherche Porcine, sous l'egide de l'Association Francaise de Zootechnie.Paris, France.); pp. 143-148; 2002.

Notes: Original title: L'engraisement de porcs sur litiere de particules de bois ou de sciure en couche fine.

Descriptors: ammonia/ litter/ nitrogen/ sawdust/ ventilation/ wood dust/ hogs/ swine

Abstract: Balances of water and minerals, and performance of growing pigs were evaluated in a fattening

pig house with litter. The pig house was isolated and mechanically ventilated, the slope of the floor was low. Two batches of 48 pigs were fattened on two thin litters. The thickness and the composition of the litter were 24 cm of sawdust in room 1 and 15 cm of wood grain in room 2. To maintain the litter in an acceptable condition, it was necessary to add sawdust or wood grain in the two rooms. At the end of the growing period, the amount of litter produced in rooms 1 and 2 were 193 and 218 l per pig, respectively. During the breeding period, around 80% of the water excreted by pigs was evaporated. In the rooms 1 and 2, 63.2% and 62.8% of the total nitrogen of the manure was removed as gases, respectively. The estimation of the ammonia flow indicated that most of the lost nitrogen was emitted as ammonia, from which 70% in the last third part of the growing period.

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1084. Fertilizing effects of swine compost fermented with sawdust on mixed pastures.

Shin, J. S.; Cho YoungMu; Lee HyoHo; Yoon SeaHung; Park GeunJe; and Choi KiChun
Journal of the Korean Society of Grassland Science 24(3): 245-252. (2004)

NAL Call #: SB202.K6H352; ISSN: 1013-9354

Descriptors: botanical composition/ calcium/ composts/ crop mixtures/ crop yield/ crude protein/ dry matter/ fermentation/ fertilizers/ legumes/ magnesium/ phosphate/ pig manure/ potassium/ protein content/ sawdust/ soil chemical properties/ weeds/ chemical properties of soil/ South Korea

Abstract: An experiment was conducted in Suwon, Korea Republic, to investigate the effects of different fertilizer application rates of swine compost fermented with sawdust (SCS) and chemical fertilizer (CF) on the yield and soil chemical properties of mixed pastures sown in September 1993. The treatments include: T0-control; T1-CF (standard amount); T2-SCS (standard amount); T3-SCS(75% of standard amount); T4-SCS(50% of standard amount); T5-SCS(75%) + CF(25%); T6-SCS(50%) + CF(50%); and T7-SCS(25%) + CF(75%). The dry matter yields were similar among treatments except in control and T4. The percentage of legumes and weeds in each treatment was increased. The total digestible nutrients, NE and crude protein yields were nearly the same in the SCS fertilized plots compared to those of CF. Phosphate, potassium, magnesium contents and K:(Ca + Mg) except calcium content were generally higher in the SCS fertilized plots compared to those of CF.

This citation is from AGRICOLA.

1085. Field evaluation of compost, sawdust and rice [Oryza sativa] straw biomass on soil physical and hydraulic properties.

Eusufzai, M. K; Maeda, T.; and Fujii, K.
Journal of the Japanese Society of Soil Physics (Japan) 107: 3-16. (Nov. 2007); ISSN: 0387-6012.

Notes: Summaries (En, Ja). Citation Notes: JP (Japan).

Descriptors: compost/ sawdust/ rice/ Oryza sativa/ biomass/ hydraulic properties

Abstract: A field experiment was carried out to investigate the effects of compost, sawdust and rice straw biomass on soil three-phase composition, soil resistance to penetration, bulk density, near-saturated hydraulic conductivity, K (h),

and soil water retention characteristics. The experimental design involved ten split blocks such that the non-amended one plot was considered as control and other nine plots were under each of compost, sawdust and straw treatments at application rates of 0.1, 0.2 and 0.3 cubic m/cubic m of apparent soil volume. Addition of compost, sawdust and straw showed potential for improvement of surface soil physical and hydraulic properties, then its effectiveness was partly dependent on amendment types and application rates. Three-phase composition of all amended soils showed solid-phase reductions and increase of total porosity. Generally, soil resistance and bulk density at all amendment plots were decreased, which was likely due to reduction in soil solid phases. A good correlation between soil resistance and bulk density was also observed. Except for sawdust applied at higher rate, the K(h) generally increased at any level of compost and straw incorporations, and this was attributed to the of reduction in solid phase of amended soils. Soil water content was relatively high at higher suction for compost amended soils, while improvement in soil water retention was limited at lower suction for sawdust, and gradually increased from low to high suction for straw amended soils, respectively.

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1086. A field growing system to reduce sulphur uptake of a crop grown in a moderately high sulphur soil: Preliminary report.

Trolove, S. N. and Reid, J. B.

Agronomy New Zealand 32/33: 51-59. (2002); ISSN: 0110-6589

Descriptors: barley/ barley straw/ crop management/ crop production / crop yield/ cropping systems/ fertigation/ furrow irrigation/ furrows/ growth/ immobilization/ leaching/ nutrient content/ nutrient uptake/ onions/ roots/ sawdust/ silt loam soils/ soil types/ straw/ sulfur/ urea fertilizers/ elemental sulphur/ fertirrigation/ sulphur

Abstract: The nutrient composition of crops affects a range of characteristics, including yield, storage, protein composition, disease resistance, and flavour, e.g. low sulfur (S) onions are milder than high S onions. Vegetable growers have a limited range of options to manage the nutrient uptake of their crops. Uptake of specific nutrients can be increased by applying fertilizer, but there are no commonly practised techniques for reducing uptake of major nutrients. Here, we report the early testing of a new growing system to help control nutrient uptake. In this system, the plants are grown in 'V'-shaped furrows filled with sawdust and supplied with nutrients via drip tape. We compared five treatments for their ability to reduce S uptake in onions. The treatments were: sawdust-filled furrows (Sawdust), sawdust-and-soil-filled furrows (2:1 mix) (S&S), soil-filled furrows (SFF), barley straw (4 t DM ha⁻¹)+urea (40 kg N ha⁻¹) (BS), and soil (Control). All treatments were fertigated with the same amount of water and nutrients. Crop bulb yields were 61, 59, 71, 65 and 69 t FW ha⁻¹ of bed (LSD0.05=7 t FW ha⁻¹) and bulb S concentrations were 0.27, 0.31, 0.60, 0.48 and 0.51% (LSD0.05=0.06%) for the Sawdust, S&S, SFF, BS and Control treatments, respectively. Preliminary analysis suggests that the Sawdust treatment may have reduced S content by both immobilization and by excluding 38% of the roots from the soil.

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1087. Flooring in front of the feed bunk affects feeding behavior and use of freestalls by dairy cows.

Tucker, C. B.; Weary, D. M.; de Passille, A. M.; Campbell, B.; and Rushen, J.

Journal of Dairy Science 89(6): 2065-71. (June 2006)

NAL Call #: 44.8 J822 ; ISSN: 1525-3198

Descriptors: animal welfare/ animals/ behavior, animal/ cattle: physiology/ eating/ female/ floors and floorcoverings/ housing, animal

Abstract: In 2 experiments we assessed how preferences, time budgets, and feeding behavior of dairy cows change in response to flooring surfaces in front of the feed bunk. In Experiment 1, 12 nonlactating dairy cattle were individually housed with access to 2 standing platforms filled with either concrete or sawdust. In Experiment 2, 24 nonlactating dairy cattle were given access to either concrete or Animat rubber flooring in front of the feed bunk. In Experiment 1, cows preferred the sawdust to the concrete flooring. In both experiments, cows provided with a softer floor in front of the feed bunk spent more time standing near the feed bunk without eating (Experiment 1: 67 vs. 40 min/d on sawdust vs. concrete, respectively, SEM = 5.6 min/d; Experiment 2: 176 vs. 115 min/d on Animat vs. concrete, respectively, SEM = 20.5 min/d) compared with when they were kept on concrete. The increased time spent at the feed bunk was due to a combination of more frequent eating and standing bouts, indicating that cows were more willing to move on nonconcrete flooring. Total time spent eating was significantly greater on the softer floor in Experiment 2, but not in Experiment 1 (Exp. 1: 289 vs. 275 min/d on sawdust and concrete, respectively, SEM = 7.3 min/d; Exp. 2: 330 vs. 289 min/d on Animat and concrete, respectively, SEM = 15.4), although feed intake was increased on the sawdust treatment in Experiment 1. Cows spent significantly more time lying in the feed alley when the flooring was rubber (219 vs. 53 min/d on Animat and concrete, SEM = 53.6 min/d), perhaps because the lying area in Experiment 2 was inadequate. In conclusion, cows prefer to stand on softer flooring in front of the feed bunk, and are more willing to move on and spend more time standing in front of the feed bunk when provided with softer flooring. These results indicate that cows find softer flooring surfaces more comfortable to stand on than concrete, and highlight the importance of evaluating the comfort of the entire facility. This citation is from PubMed.

1088. Fruit optimization with wastes used for outdoor cultivation of King Stropharia.

Domondon, D. and Poppe, J.

In: *Science and Cultivation of Edible Fungi. Proceedings of the 15th International Congress on the Science and Cultivation of Edible Fungi.* Maastricht, Netherlands.; pp. 909-918; 2000.

Descriptors: agricultural wastes/ burning/ casing/ colonization/ contamination/ cultural methods/ development/ edible fungi/ fructification/ growing media/ inoculation/ maize/ plant residues/ production possibilities/ pruning/ sawdust/ shade/ shrubs/ size/ straw/ sunflowers/ temperate zones/ tropics/ utilization/ vegetables/ woody plants/ corn/ farm wastes/ flaming/ Hyphomycetes/ potential production/ potting composts/ production potential/ rooting media/ Strophariaceae/ tropical countries / tropical zones/ vegetable crops

Abstract: Since spring 1997, numerous experiments with the King Stropharia, *S. rugoso-annulata*, were started in a

large garden with trees and shrubs near Gent University, Netherlands [Belgium]. The tested agricultural wastes were: chopped straw, grass chaff, sawdust, chopped winter pruning wood, chopped summer pruning wood, sunflower peels, corn cobs, and combinations. Tree shade, fast substrate colonization, the specific casing layer, surrounding herbs and shrubs, partial carton covers, and periodic rain acted as stimulators of fructification. Some attention was devoted to the influence of fruit peels on primordial formation within the casing layer. Between 6 and 8 weeks after inoculation, the first fruiting bodies appeared on the casing layer. The first harvest came on chopped pruning wood followed by straw, sawdust, grass chaff. Highest mean yield was obtained on the chopped winter pruning wood; numerous large carpophores with a maximum weight of 300 g per fruiting body were harvested. Outdoor cultivation of *S. rugoso-annulata* is better than indoor cultivation where contamination with *Trichoderma* sp. is prevalent. Since burning of pruning wood is forbidden in many Western countries and dissuaded in the tropics, this easy outdoor *S. rugoso-annulata* cultivation can be considered very promising for the cool tropical mountain regions and during summer in temperate zones. Reproduced with permission from the CAB Abstracts database.

1089. Fungal communities in fallow soil before and after amending with pine sawdust.

Kwasna, H.; Sierota, Z.; and Bateman, G. L.

Applied Soil Ecology: A Section of Agriculture Ecosystems and Environment 14(2): 177-182. (Apr. 2000); ISSN: 0929-1393

Descriptors: sawdust/ Pinus/ soil fungi/ community ecology/ fallow/ soil pH/ population density/ *Trichoderma harzianum*/ *Penicillium*/ *Mucorales*/ *Gymnoascales*/ biological control agents/ arable soils/ afforestation/ site preparation/ forest plantations/ Poland/ organic amendments/ *pseudogymnascus roseus*/ Internet resource
This citation is from AGRICOLA.

1090. Gaseous emissions from deep-litter pens with straw or sawdust for fattening pigs.

Nicks, B.; Laitat, M.; Farnir, F.; Vandenheede, M.; Desiron, A.; Verhaeghe, C.; and Canart, B.

Animal Science: An International Journal of Fundamental and Applied Research 78(1): 99-107. (Feb. 2004); ISSN: 1357-7298

Descriptors: swine/ swine housing/ litter (bedding)/ straw/ sawdust/ gas emissions/ ammonia/ nitrous oxide/ methane production/ carbon dioxide/ water/ pig manure/ nitrogen content/ air pollution

Abstract: Three successive batches of fattening pigs were raised on a deep litter of straw in one room and of sawdust in another. The quantities of litter used per pig were 40 kg of straw and 81 kg of sawdust. Once a month, the emissions of ammonia, nitrous oxide, methane, carbon dioxide and water vapour were measured continuously for 6 days consecutively. Gaseous emissions from pig raising on sawdust-based litter and straw-based litter were respectively 12.16 and 13.61 g per pig per day for ammonia (NH₃), 4.96 and 7.39 g per pig per day for methane (CH₄), 2.09 and 0.03 g per pig per day for nitrous oxide (N₂O), 3.15 and 2.74 kg per pig per day for water (H₂O) and 1.32 and 1.30 kg per pig per day for carbon dioxide (CO₂). Differences between the emissions of the two litters were

significant for N₂O and H₂O (P < 0.01). The nitrogen content of the manures collected at the end of the experiment was 1.47 kg per pig for the straw-based litter and 1.07 kg per pig for that based on sawdust. Nitrogen emissions were calculated under the assumption that no gases volatilized from the litter or from the animals other than NH₃ and N₂O. With the two litters, about 50% of nitrogen excreted by the pigs was emitted into the atmosphere in the form of N₂.

This citation is from AGRICOLA.

1091. Germination and seedling growth of African pear (*Dacryodes edulis* Don. G. Lam. H. J.) as affected by different planting media.

Agbogidi, O. M.; Enujoke, E. C.; and Eshegbeyi, O. F. *American Journal of Plant Physiology* 2(4): 282-286. (2007); ISSN: 1557-4539

Descriptors: crop residues/ growing media/ medicinal plants/ metabolism/ plant development/ sawdust/ seed germination/ seedling emergence/ seedling growth/ substrates/ drug plants/ medicinal herbs/ officinal plants/ potting composts/ rooting media

Abstract: A study was conducted in 2006 to determine the germination and seedling growth of African pear (*Dacryodes edulis*) as affected by different planting media: top garden soil, sharp sand, sawdust and a mixture of top soil and sawdust in a ratio of 50:50 in the Teaching and Research Farm of the Delta State University, Asaba Campus, Delta State, Nigeria. The experiment was laid out in a Randomized Complete Block Design (RCBD) with four replications. The results showed that seeds planted in sharp sand had the highest germination percentage (93.5%) and were significantly different ($p \leq 0.05$) from those (88.4, 60.7 and 48.0%) sown in the other media (TS/SD, SD and TS) respectively. The results also indicated that the performance of the seedlings in terms of height, number of leaves, leaf area and collar diameter planted in top garden soil was better and differed significantly ($p \leq 0.05$) compared to those in the other growth media. This study has established that the germination and seedling growth of *Dacryodes edulis* are significantly affected by planting media; while sharp sand favoured greater germination percentage, topsoil is recommended for the seedling growth when more nutrients would be required for normal metabolic activities. Reproduced with permission from the CAB Abstracts database.

1092. GHG emissions from manure in a naturally ventilated, freestall dairy barn, comparing sand and sawdust bedding.

Van Vliet, L. J. P.; Patni, N. K.; and Matin, Md. A. In: *Asae Annual International Meeting* 2004. Ottawa, ON; pp. 5963-5974; 2004. Notes: Conference code: 66322.

Descriptors: bedding materials/ carbon dioxide/ dairy barn/ greenhouse gases/ manure/ methane/ nitrous oxide/ carbon dioxide/ greenhouse effect/ manures/ methane/ nitrogen oxides/ sand/ sawdust/ ventilation/ bedding materials/ dairy barn/ emission rates/ sawdust bedding/ gas emissions/ carbon dioxide/ greenhouse gases/ manure/ methane/ nitrogen oxides/ sand/ saw dust/ ventilation

Abstract: Concentrations and emissions rates of greenhouse gases CO₂, CH₄ and N₂O from manure on concrete alley floor were determined in a naturally

ventilated, freestall Holstein dairy cow barn with sand and sawdust bedding, in south coastal British Columbia, Canada. Gas samples for GHG analysis were collected in two separate experiments during the spring and summer using open chambers placed on the alley floor. Laboratory experiments were also conducted with chambers, one testing different proportions of manure mixed with bedding, and the other using manure from the alley floor, with the two bedding materials. GHGs were analyzed using a gas Chromatograph. Results from the barn and laboratory experiments showed significantly higher CO₂ emission rate from manure with sawdust (1,512 mg-1m⁻²hr⁻¹) than from sand (1,272 mg-1 m⁻²hr⁻¹). However, a significantly lower N₂O emission rate was recorded from sawdust (0.05 mg-1m⁻²hr⁻¹) than from sand (0.22 mg-1m⁻²hr⁻¹). Emission rate for CH₄ was similar from both types of bedding. Emission loads from manure on the barn floor followed the same pattern as the emission rates from each type of bedding. Both the emission rates and loads of GHGs in this study pertain mainly to bedding-littered manure on the alley floor, and essentially exclude GHGs released from the rumen and the lungs of the cows. Further studies are needed to include all sources of GHG emissions in dairy barns.

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1093. Growing foliage plants without soil.

Siar, S. V. and Jalotjot, H. C. Jr.

In: *Philippine Journal of Crop Science*. Gen. Santos City, South Cotabato (Philippines).; Vol. 24.; pp. 76; 1999.

Notes: Annual Scientific Conference of the Federation of Crop Science Societies of the Philippines. Summary only. Citation notes: PH (Philippines).

Descriptors: foliage plants/ soil-less media/ propagation

Abstract: For foliage plant growers, it is common to use soil-based planting media to propagate the plants. It can be a mixture of soil and coir dust, widely used by growers in Laguna [Philippines] or soil and ricehull, which is more common in Bulacan [Philippines] and others but with soil as the major component of the medium. However, the use of non-soil planting media is now becoming more popular. Ever heard of pure coir dust as rooting medium in some foliage plants? Or how about sand, sawdust, ricehull and many more. These are some of the many non-soil materials which can be used as alternate to soil-based media commonly used by ornamental growers. Our country is blessed with an abundance of these materials either as waste products or just one of nature's elements left unexploited or used in other means. Tapping these resources for ornamental purposes as planting media will not just reduce our dependence on soil but create added income for people living in area where they are abundant. Also quarantine regulations of countries importing live ornamental plants prohibit importations of plants with soil-based planting media. This makes non-soil media the right materials for plants geared for the export markets.

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1094. Growing media varying in particle size and shape for greenhouse tomato.

Allaire, S.; Caron, J.; Menard, C.; and Dorais, M. *Acta Horticulturae* 644: 307-311. (2004)

NAL Call #: 80 Ac82; ISSN: 0567-7572

Descriptors: bark/ crop yield/ diffusivity/ growing media/ hydraulic conductivity/ non wood forest products/ peat/

physical properties/ protected cultivation/ rockwool/ sawdust/ soilless culture/ substrates/ tomatoes/ water holding capacity/ wood shavings/ cultivation under glass or plastic/ mineral wool/ minor forest products/ non timber forest products/ potting composts/ rock wool/ rooting media
Abstract: Seven different substrates, i.e. rockwool slab, fresh spruce sawdust, spruce wood shaving, 100% composted spruce bark, 100% fine blond peat, 66% of fine blond peat + 33% composted bark and 33% fine blond peat + 66% of composted bark, were compared for the greenhouse production of tomato. Substrates made of peat and bark gave similar yield as rockwool, while sawdust and shaving gave lower average daily yield than rockwool during 2001 and similar yield as rockwool during 2000. Yield was not related to the physical properties (i.e. water retention characteristics, hydraulic conductivity, pore tortuosity and gas diffusivity) although they greatly vary between substrates. The results indicate that if irrigation is adjusted for the physical properties of the substrates, then different recycling organic materials with various particle sizes and shapes can be used for greenhouse tomato production.
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1095. Growth and evolution of *Salix purpurea* L. willow plants cultivated on composts obtained from wood waste.

Wroblewska, H.; Stolarski, M.; and Czajka, M.
Fragmenta Agronomica 29(3): 316-327. (2006); ISSN: 0860-4088.

Notes: Original title: Wzrost i rozwój roślin wierzby *Salix purpurea* L. uprawianej na kompostach sporządzonych z odpadów drzewnych.

Descriptors: application rates/ composting/ composts/ growth/ mineral soils/ nitrates/ nitrogen content/ plant height/ plywood/ shoot cuttings/ soil amendments/ soil pH/ soil salinity/ substrates/ trace elements/ urea formaldehyde/ waste utilization/ waste wood/ wood products/ microelements

Abstract: A comprehensive research on safe composting of industrial and post-use waste of composite wood products and on the utilization of obtained composts for plant growing has been carried out in the Wood Technology Institute for several years. The effect of composts obtained from plywood waste and post-use wood waste on the growth and development of *S. purpurea* seedlings was determined by cultivating willow in pots filled with mineral soil mixed with the composts in various proportions (1:1, 1:3 or 1:9). Three 20-cm long cuttings from *Salix purpurea* "Perinea" shoots were set in each pot. Before the test started, microelement content, pH and salinity of the soil and the substrate were determined. The experiment started at the end of April and was continued till September. Plant condition was evaluated visually and a photographic documentation was made. Plant height was measured and recorded once every 3 weeks. The substrate used for willow cultivation differed mostly in N content. Toxic doses of this element were observed in pure compost from indoor plywood waste, where plywood was glued with urea-formaldehyde resin. To a lesser extent, these N toxic doses were present in composts from post-use wood waste. The strongest evolution and increase in height were observed in of plants set into substrata consisting of soil and compost obtained from industrial exterior plywood waste glued with

phenol-formaldehyde resin. These substrate were characterized by a medium content of N in the form of nitrates. After 18 weeks, *S. purpurea* in every variants of the substrate containing this compost (also in the case of 100% compost) were higher than the plants in the control. Compost from interior plywood waste at a dose of 10% had a positive influence on plant growth. Smaller doses of composts from post-use wood waste also resulted in better growth of the plants compared to those plants in pure mineral soil. Results suggest that *S. purpurea* can be cultivated on soils amended with mature composts obtained from industrial and post-use wood waste, provided that safe doses of composts, determined base on their chemical compositions are used.
 This citation is from AGRICOLA.

1096. Growth, nutrient composition and straw yield of sorghum as affected by land configuration and wood-chips mulch on a sandy loam soil in northeast Nigeria.

Chiroma, A. M.; Alhassan, A. B.; and Yakubu, H.
International Journal of Agriculture and Biology 8(6): 770-773. (2006); ISSN: 1560-8530

Descriptors: chemical composition/ climatic factors/ crop yield/ edaphic factors/ grasslands/ growth/ mulches/ mulching/ nutrient content/ nutrients/ plant composition/ ridging/ sandy loam soils/ soil types/ sown grasslands/ stems/ wood chips/ chemical constituents of plants/ mulching materials/ sown pastures

Abstract: Six land configuration and wood chips mulch treatments were evaluated from 1999-2002 on a sandy loam soil, northeast Nigeria for their effects on growth, leaf nutrient composition and straw yield of sorghum. Treatments evaluated include: flat bed (FB), open ridge (OR), tied ridge (TR), FB + mulch (FBM), OR + mulch (ORM) and TR + mulch (TRM). Early plant growth as measured by leaf number plant⁻¹ and stem diameter were not significantly influenced by treatments in any given year but with advancement in growth, the mulched (FBM, ORM and TRM) treatments showed better growth than their bare (FB, OR and TR) counterparts. Sorghum leaf N, P, K, Ca and Mg contents were all higher in the mulched than in the bare treatments irrespective of tillage method. Averaged across the four experimental years (1999-2002) mean increases in straw yield relative to the FB treatment were 9.6% for OR, 16% for TR, 56% for FBM, 39% for ORM and 41% for TRM. The OR and TR treatments slightly increased straw yield in years with normal rainfall (1999, 2001 and 2002) but decreased straw yield in 2000, the year with poor rainfall distribution. It is concluded that under the edapho-climatic conditions of Maiduguri in northeast Nigeria, substantial improvement in the growth and straw yield of sorghum can be obtained when adequate amounts of wood chips are applied to the surface of either a flat bed or ridge tilled soil with little/no risk of crop failure.
 This citation is from AGRICOLA.

1097. Growth promotion of spinach by fluorescent *Pseudomonas* strains under application of organic materials.

Urashima, Y.; Suga, Y.; and Hori, K.
Soil Science and Plant Nutrition 51(6): 841-847. (2005)
 NAL Call #: 56.8 SO38 ; ISSN: 0038-0768

Descriptors: betaine/ bioluminescence/ composts/ grasslands/ growth/ hippuric acid/ horse dung/ oat straw/ oats/ organic matter/ pampas/ rice/ rice husks/ rice straw/

roots/ sawdust/ soil amendments/ spinach/ straw/ trehalose/ glycinebetaine/ paddy/ rice hulls

Abstract: We investigated whether the colonization of spinach roots by fluorescent *Pseudomonas* strains was promoted by the application of organic materials. Firstly, the bioluminescence (*lux*) gene was introduced into fluorescent *Pseudomonas* strains, and the colonization of on spinach roots by fluorescent *Pseudomonas* strains was observed using a CCD (charge-coupled device) camera. As a result, various organic materials were found to promote the colonization of spinach roots by fluorescent *Pseudomonas* strains. H3-4 strain colonized the roots when oat straw and betaine monohydrate, rice husks, Japanese pampas grass and horse feces compost (with rice straw) were applied. D23-2 strain colonized the roots when hippuric acid sodium salt, Japanese pampas grass, oat straw, horse feces compost (with rice straw) and trehalose dehydrate were applied. H23-1 strain colonized the roots when cattle feces compost (with rice straw), horse feces compost (with sawdust), Japanese pampas grass, betaine monohydrate, oat straw, horse feces compost (with rice straw) and hippuric acid sodium salt were applied. The organic materials (cattle feces compost (with rice straw), horse feces compost (with sawdust), Japanese pampas grass, betaine monohydrate or horse feces compost (with rice straw)) and fluorescent *Pseudomonas* (HS23 strain) were applied to soil, and spinach was cultivated. The growth of spinach was promoted when fluorescent *Pseudomonas* strains and organic materials except for Japanese pampas grass were applied. Since the growth of spinach was not promoted when only the organic materials were applied, this growth-promoting effect was considered to be due to the fluorescent *Pseudomonas* strains that colonized the roots more readily when the organic materials were applied. In conclusion, the growth-promoting effect of fluorescent *Pseudomonas* strains was demonstrated in soil culture by the application of fluorescent *Pseudomonas* strains and organic materials, which promoted root colonization by fluorescent *Pseudomonas* strains.

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1098. Growth, yielding and fruit firmness of two highbush blueberry cultivars cultivated on three different organic substrates.

Ochmian, I.; Grajkowski, J.; Ostrowska, K.; and Mikiciuk, G. *Zeszyty Naukowe Instytutu Sadownictwa i Kwiaciarnictwa w Skierniewicach* 15: 47-54. (2007)

NAL Call #: SB319.3.P7 Z47; ISSN: 1234-0855.

Notes: Original title: Wzrost, plonowanie oraz jedrność owoców dwóch odmian borówki wysokiej (*Vaccinium corymbosum* L.) uprawianej w trzech typach podłoża organicznych.

Descriptors: crop yield/ firmness/ growing media/ husks/ peat/ sawdust/ seedling growth/ substrates/ hulls/ potting composts/ rooting media

Abstract: The experiment was carried out in 2003-2005 at the Experimental Fruit-Growing Station of the Szczecin University of Agriculture in order to study possibilities of highbush blueberry cultivation on a compact soil of alkaline reaction. Three different organic substrates were used: peat, cocoa husks, and sawdust. The experiment was performed on 'Sierra' and 'Patriot' cultivars. Measurements

were also carried out of the length and quantity of annual shoots, and of yield size and its characteristics. As a result, it was found that of the three substrates tested peat and sawdust had the best influence on the growth of both cultivars. The blueberry plants started yielding on all three substrates already in the second year after being planted. Yields from the bushes growing on peat and sawdust were similar, whereas on cocoa husks they were reduced by over 50%. 'Patriot' bushes produced yields considerably higher than 'Sierra' bushes. It was also found that the substrates had an influence on fruit firmness. Fruits produced on peat were less firm than those produced on sawdust or cocoa husks.

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1099. Heavy metal speciation in compost derived from the different animal manures.

Ko, H. J.; Choi, H. L.; and Kim, K. Y.

Journal of Animal Science and Technology 46(2): 273-282. (2004); ISSN: 1598-9429

Descriptors: animal manures/ arsenic/ bulking agents/ cadmium/ cattle manure/ chemical speciation/ chromium/ composting/ composts/ copper/ heavy metals/ lead/ nickel/ pig manure/ poultry manure/ rice husks/ sawdust/ zinc/ poultry litter/ rice hulls

Abstract: Composting animal manure is one of feasible treatments that reserves some portion of nutrients of manure. Although the application of compost to arable land has many advantages, the repeated cultivation of the agriculture land will accumulate the level of heavy metals in the soil which is potentially harmful to people and animals. Therefore it is important to know the characteristics concentration and species of heavy metals in a variety of chemical forms than just total content of the metal. Because the metals in different forms have different mobilities and bioavailabilities. The aim of this study was to examine the total content and the chemical forms of the heavy metals; Cr, Ni, Cu, Zn, As, Cd and Pb in the animal manure composted with sawdust or rice hull as a bulking agent. A total of 75 compost samples were collected throughout the country and classified into the three groups in accordance with the characteristics of raw materials: swine manure, poultry manure, and mixed (swine+poultry+cattle) manure. The compost samples were analysed for total metal content and fractionated by sequential chemical extractions to estimate the quantities of metals: exchangeable, adsorbed, organically bound, carbonate and residual. The results showed that the heavy metal concentrations in all compost samples were lower than the maximum acceptable limits by the Korea Compost Quality Standards. The concentrations of heavy metals in the swine manure compost were higher than those of both the poultry and the mixed manure compost except for Cr. Zn and Cu concentrations of three different compost ranged from 157 to 839 mg Zn/kg DM (dry matter) and from 47 to 458 mg Cu/kg DM, depending on the composition of animal manures. The predominant forms for extracted metals were Cr, Ni, Zn, As and Pb, residual; Cu, organic; and Cd, carbonate. The results suggested that the legal standards for composts should be reexamined to revise the criteria on the total metal content as well as metal speciation.

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1100. Hock lesions and free-stall design.

Weary, D. M. and Taszkun, I.

Journal of Dairy Science 83(4): 697-702. (Apr. 2000)

NAL Call #: 44.8 J822; ISSN: 0022-0302

Descriptors: animals/ cattle/ cattle diseases/ dust/ female/ hindlimb/ housing, animal/ lactation/ rubber/ silicon dioxide/ skin diseases: etiology: veterinary/ soil/ wood

Abstract: We compared the prevalence and severity of skin lesions on the hocks of lactating dairy cows in southern British Columbia, comparing 20 farms using three common bedding surfaces: sawdust, sand, and geotextile mattresses. Skin lesions were scored at five positions on the hock. For each position we noted if the lesion showed inflammatory attributes, and then assigned a severity score. Of the 1752 lactating cows scored, 1267 cows (73%) had at least one hock lesion. Of those cows with lesions, 87% had lesions on both legs, 76% had lesions on more than one location on the hock, and 78% had a lesion of at least moderate severity (i.e., evidence of skin breakage or an area of hair loss >10 cm²). Lesions were most prevalent on farms that used geotextile mattresses (91% of cows) and least common on farms that used sand (24% of cows). Moreover, lesions on cows from farms using mattresses were more numerous and more severe than those on cows from sand-bedded farms. The prevalence and severity of lesions on farms using sawdust was intermediate. Lesions also varied in relation to location on the hock. For farms using geotextile mattresses, lesions were more common and more severe on the lateral surfaces of both the tuber calcis and the tarsal joint. On farms using sawdust, lesions were common on the dorsal surface of the tuber calcis and the lateral surfaces of both the tuber calcis and the tarsal joint. Lesions were rare on all five positions for cows from sand-bedded farms. Among the 10 farms sampled using sawdust, we found a significant negative relationship between the length of the stall and severity of lesions. For cows with lesions, the number and severity of lesions increased with age.

This citation is from PubMed.

1101. Housing of calves in pens on a deep litter of softwood sawdust.

Szyndler, J. and Kaczor, A.

Annals of Animal Science Supplement 1: 137-140. (2002);

ISSN: 1642-3402

Descriptors: animal behaviour/ animal housing/ behaviour/ body weight/ calves/ litter/ pens/ sawdust/ animal behavior/ behavior

Abstract: The effects of deep litter of softwood sawdust on housing conditions of calves in pens were investigated. Calves were housed under 4 bedding systems: deep litter of sawdust, deep litter of sawdust supplemented with Stalosan F, deep litter of 50% sawdust and 50% straw (by volume), and shallow straw litter. Behavioural studies revealed no negative effects of litter of softwood sawdust on the behaviour of calves. Cleanliness of animals kept on litter of sawdust was similar or slightly better compared to straw litter housing. The type of floor had no effect on weight gains of the calves. Based on the studies and measurements made, it is concluded that softwood sawdust is useful as a bedding material for calves.

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1102. Immobilization of soil nitrogen as a possible method for the restoration of sandy grassland.

Torok, K.; Szili Kovacs, T.; Halassy, M.; Toth, T.; Hayek, Z.; Paschke, M. W.; and Wardell, L. J.

Applied Vegetation Science 3(1): 7-14. (2000)

Descriptors: abandoned land/ altitude/ cellulose/ chemical composition/ decomposition/ grasslands/ immobilization/ nitrogen/ old fields/ organic matter/ polysaccharides/ productivity/ revegetation/ sandy soils/ sawdust/ soil/ soil amendments/ soil fertility/ soil organic matter/ soil water/ starch/ sucrose/ complex carbohydrates/ organic matter in soil/ saccharose/ soil moisture

Abstract: Experiments were designed to test the applicability of nitrogen immobilization as a means of accelerating the recovery of an endemic open sandy grassland (*Festucetum vaginatae danubiale*) on old fields in the Great Hungarian Plain. Effects of various carbon sources (sucrose, starch, cellulose and sawdust) and their combinations in different quantities were studied in laboratory microcosms. Carbon addition decreased nitrogen availability in all cases, the rate and timing of change being dependent on the type of carbon source applied. The combination of 2 g each of sucrose and polysaccharides (starch, cellulose, sawdust) per kg soil was found to be the most effective, as sucrose decreased available nitrogen content of soil intensively and the polysaccharides maintained the immobilized nitrogen for a longer period. In a follow-up experiment, sucrose and sawdust were selected for field application to test their effectiveness in immobilizing N and accelerating restoration. The field experiment was established to test the importance of abiotic site differences in the immobilization of soil nitrogen. Selected sites were located along an altitude, moisture and productivity gradient. Soil organic matter, microbial biomass-C and decomposition rate varied between sites depending on altitude. At two sites with lower soil moisture and organic matter levels carbon addition increased microbial activity and nitrogen immobilization significantly.

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1103. Impact of crop residues on soil organic matter content and the production of late jute seed.

Alim, M. A.; Alam, M. M.; Khandker, S.; Ahmed, S. A.; Haque, A.; and Akhter, N.

OnLine Journal of Biological Sciences (Pakistan) 1(12): 1124-1126. (Dec. 2001); ISSN: 1608-4127.

Notes: 5 tables, 24 ref. Summary (En). Citation Notes: PK (Pakistan).

Descriptors: crop residues/ soil organic matter/ jute seeds/ sawdust/ straw

Abstract: An investigation was undertaken to evaluate the impact of different crop residues on late jute seed yield and organic matter content of soil. The plant height, number of branch/plant, number of pod/plant, number of seeds/pod and seed yield/plant were significantly increased with different crop residues. The performance in seed yield were dry jute leaves (89.30%) greater than lentil straw (87.77%) wheat straw (43.28%) greater than compost (35.35%) greater than rice straw (32.740%) greater than saw-dust (16.91 %) over the control. The resources increased the soil organic matter content in soil by 24.59, 22.92, 26.22, 19.67, 29.51 and 30.33% respectively over the control indicating the

enrichment of soil health. In correlation studies it was observed that the jute seed yield parameters, the seed yield was highly correlated with plant height, number of branches/plant and number of pods/plant.

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1104. Impact of high-volume wood-fired boiler ash amendment on soil properties and nutrients.

Chirenje, T. and Ma, L. Q.

Communications in Soil Science and Plant Analysis 33(1-2): 1-17. (2002)

NAL Call #: S590.C63; ISSN: 0010-3624 [CSOSA2]

Descriptors: wood ash / sandy soils/ spodic horizons/ soil pH/ electrical conductivity/ soil water content/ bulk density/ soil fertility/ trace elements/ nutrient availability/ saturated hydraulic conductivity/ water holding capacity / application rate/ Florida/ macronutrients/ subsurface application/ surface treatment/ boilers

Abstract: Forest application of boiler ash is fast becoming a popular alternative to landfilling. Boiler ash is a good source of calcium (Ca), magnesium (Mg), potassium (K), phosphorus (P), manganese (Mn), and zinc (Zn), but it may potentially increase soil pH and electrical conductivity. A monitoring study was conducted to determine the changes in soil properties and the availability and leachability of nutrients following the application of large quantities of boiler ash in a sandy soil (with a spodic horizon). Two application rates (900 and 1800 Mg ha⁻¹) and two application methods (surface and subsurface) were used in a three-hectare area, which was divided into 15 subplots. Soil samples from different depths were collected over a period of 21 months. Soil pH increased from 5.6 to above 9 and the electrical conductivity increased by up to 2 orders in all plots compared to the controls. The high alkalinity from the ash in the 1800 Mg ha⁻¹ rate depleted the spodic layer, and this was more pronounced in the subsurface treatments. Plant-available water was doubled to 12% in the 1800 Mg ha⁻¹ treatment and soil bulk density was reduced from 1500 kg m⁻³ to 1200-1360 kg m⁻³. Total and plant available macronutrients (Ca, Mg, K, and P) and micronutrients [iron (Fe), Mn, copper (Cu), and Zn] increased substantially after ash application. Based on our study, it is highly recommended that ash application rates be lowered to agronomic rates, e.g., approximately 10 Mg ha⁻¹, based on liming equivalence, to maximize the beneficial effects of boiler ash on soil.

This citation is from AGRICOLA.

1105. Impact of sawdust and wood shavings in bedding on pig tuberculous lesions in lymph nodes, and IS1245 RFLP analysis of Mycobacterium avium subsp. hominissuis of serotypes 6 and 8 isolated from pigs and environment.

Matlova, L.; Dvorska, L.; Palecek, K.; Maurenc, L.; Bartos, M.; and Pavlik, I.

Veterinary Microbiology 102(3-4): 227-236. (Sept. 2004); ISSN: 0378-1135

Descriptors: litter (bedding)/ sawdust/ wood shavings/ tuberculosis/ Mycobacterium avium/ animal pathogenic bacteria/ lymph nodes/ isolation/ restriction fragment length polymorphism/ serotypes/ swine/ lesions (animal)/ genotype/ Mycobacterium fortuitum/ bacterial contamination/ disease transmission/ livestock production/ Czech Republic/ Mycobacterium avium hominissuis

Abstract: Among 25,027 slaughter pigs raised in two farms,

tuberculous lesions were detected in the lymph nodes of 898 (3.6%) of them. Tuberculous lesions were most commonly found in the mesenteric (601; 2.4%) and head (451; 1.8%) lymph nodes. Mycobacteria were isolated from 49 of 120 randomly selected mesenteric, head and bronchial lymph nodes with diagnosed tuberculosis originating from both farms. Forty six Mycobacterium avium subsp. hominissuis, one M. chelonae and two M. fortuitum isolates were found in the lymph nodes of pigs. No statistically significant difference was detected between farms A and B for isolation rates of mycobacteria from the lymph nodes of pigs and their species composition. To investigate the source of the pigs' infections, culture examinations of 117 samples from the external environment were performed. Mycobacteria were isolated from 25 samples from the external environment (21.4%). Mycobacterial isolates were also detected in eleven (91.7%) and two (16.7%) of 12 used sawdust and 12 of non-used (fresh) sawdust samples, respectively. None of 12 wood shavings was culture-positive. Twelve of 13 sawdust isolates were classified as M. a. hominissuis of serotypes 6 and 8 and genotype IS901- and IS1245+; the remaining isolate was classified as species M. fortuitum. Other conditionally pathogenic mycobacteria were only isolated from 12 of the remaining 81 samples from the external environment (excluding bedding). A total of eight isolates (two pig and six sawdust samples originating from farms A and B) were examined by IS1245 restriction fragment length polymorphism (IS1245 RFLP) analysis. These isolates produced five distinct IS1245 RFLP types with more than 20 bands. Based on identical IS1245 RFLP types of one pig isolate and two isolates of used sawdust from farm A, we have concluded that contaminated sawdust was the source of mycobacterial infection for pigs in our study.

This citation is from AGRICOLA.

1106. The impact of the addition of Eucalyptus grandis wood chips on nitrogen availability in plantation soils.

Bird, T. L. and Scholes, M. C.

Southern African Forestry Journal 196: 9-14. (2003); ISSN: 0038-2167

Descriptors: clear felling/ forest plantations/ immobilization/ logging/ mineralization/ multipurpose trees/ nitrogen fertilizers/ nutrient availability/ soil fertility/ soil types/ trees/ wood chips/ wood residues/ woody plants/ clearcutting/ timber extraction/ timber harvesting

Abstract: The impact of plantation residues, as a result of clear felling, on nutrient availability in plantation systems, as well as the difficulties during subsequent planting and harvesting, should be considered in the development of plantation management strategies. The aim of this experiment was to determine if the addition of stump wood chips would result in the immobilization of nitrogen. Soil from two plantations, one of the Kranskop soil form (0.57% nitrogen) and one of the Hutton soil form (0.23% nitrogen), were analysed in a laboratory experiment for changes in nitrogen availability. Soils were amended with wood chips and varying amounts of nitrogen fertilizer. Inorganic nitrogen was measured after 14, 60 and 90 days of aerobic incubation. Net mineralization rates, regardless of treatment or soil, ranged between -24.98 and +2.53 micro g nitrogen/g soil/day, over the 3-month incubation period. Immobilization of nitrogen was found to occur in those treatments that received the highest nitrogen additions.

Addition of wood chips on their own did not alter the nitrogen availability patterns. However, it was observed that wood chips, together with high levels of additional nitrogen, resulted in an extended period of release of nitrogen in these plantation soils.

This citation is from AGRICOLA.

1107. Impacts of ground vegetation management strategies in a kiwifruit orchard on the composition and functioning of the soil biota.

Wardle, D. A.; Yeates, G. W.; Bonner, K. I.; Nicholson, K. S.; and Watson, R. N.

Soil Biology and Biochemistry 33(7/8): 893-905. (2001)

NAL Call #: S592.7.A1S6; ISSN: 0038-0717

Descriptors: agricultural land/ biota/ decomposition/ ground vegetation/ herbicides/ kiwifruits/ microbial activities/ mulches/ orchards/ pastures/ sawdust/ soil amendments/ soil biology/ soil fauna/ soil flora/ soil management/ vegetation management/ Eucnemidae/ farmland/ grazing lands/ mulching materials/ nematodes/ weedicides/ weedkillers

Abstract: Replicated field plots were established in a New Zealand kiwifruit (*Actinidia deliciosa*) orchard of each of five ground vegetation management treatments, i.e., maintenance of pasture, planting of a dwarf fescue (*Festuca rubra*) mulch, sawdust application, cultivation and repeated use of herbicides, and the responses of components of the soil biota to these treatments monitored over a 5-year period. Those treatments involving enhancement of basal resources inputs (pasture, fescue, sawdust) consistently supported higher levels of microbial biomass and activity than did the others. These effects were not consistently propagated through higher trophic levels of the decomposer food web. The response of decomposer food web components to treatments was considered to be due to the complex interplay of top-down and bottom-up forces in soil food webs. Ordination analysis revealed that the sawdust and cultivated plots supported different species assemblages to the pasture and fescue plots. Further treatments supporting greater basal resource inputs tended to result in a higher diversity of nematodes; on average the Shannon-Weiner diversity index for the 0-5 cm depth layer was 2.80 and 2.64 for the fescue and pasture treatments, and only 2.32 and 2.45 for the cultivation and herbicide treatments. Populations of *Collembola* were also generally enhanced in plots with greater basal resource inputs. Litterbag decomposition rates was utilized as a measure of the performance of ecosystem functioning carried out by the soil biota, and it was shown that surface litter decomposition rates were generally greatest in those treatments supporting greater levels of basal resource inputs and microbial biomass (i.e., greatest for the mulched and fescue plots, least for the herbicides and cultivated plots), but were generally independent of higher trophic levels..

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1108. In-situ conservation of residual soil moisture through tillage and mulch for maize (*Zea mays*) in tropical Bay Islands.

Pramanik, S. C.

Indian Journal of Agricultural Sciences 69(4): 254-257. (1999)

NAL Call #: 22 AG83I; ISSN: 0019-5022

Descriptors: coir/ cultivation/ maize/ minimum tillage/ mulches/ rice/ rice husks/ rice straw/ sawdust/ straw/ water use/ coconut fibre/ corn/ minimum tillage systems/ mulching materials/ paddy/ rice hulls

Abstract: In a field experiment during the dry seasons (December-April) of 1994/95 and 1995/96 at Port Blair, Andaman and Nicobar Islands, India, maize cv. Co 1 was grown with conventional or minimum tillage and mulching with rice straw, sawdust, coir dust or rice husks. The tillage treatments had no significant effect on growth, yield or water use. Mulching significantly increased yield and water use, with rice husks giving the poorest results. The yield increase was due to better crop growth parameters, improvement in moisture stress indices, efficient root development, conservation of more residual soil moisture in the crop root zone and higher water use efficiency. Reproduced with permission from the CAB Abstracts database.

1109. Increased occurrence of acute mastitis caused by *Klebsiella* spp. in a dairy with sawdust bedding.

Peinhopf, W. and Deutz, A.

Praktische Tierarzt 86(6): 420-425. (2005); ISSN: 0032-681X.

Notes: Original title: Gehauftes Auftreten von Akutmastitiden durch *Klebsiella* spp. in einer Milchviehherde mit Sagemehl Einstreu.

Descriptors: ampicillin/ bovine mastitis/ case reports/ clinical aspects/ cows/ dairy cows/ drug resistance / enrofloxacin/ gentamicin/ litter/ oxytetracycline/ sawdust/ sulfonamides/ trimethoprim/ cefaperazone/ clinical picture/ sulphonamides/ terramycin

Abstract: The increased occurrence of acute mastitis in a Holstein-Friesian dairy caused by *Klebsiella* spp. is described in a case report. Besides acute clinical mastitis (72%), subacute (28%) cases of *Klebsiella* mastitis were also observed. The bacteriological examination of the sawdust bedding on this farm showed *Klebsiella* spp. in 3 out of 7 samples, while no *Klebsiella* spp. could be detected in several straw bedding samples from other dairies. Furthermore *Listeria monocytogenes* was detected only in sawdust bedding (3 out of 7 samples). Both, the bacteriological findings and the anamnesis, led to the assumption that a galactogen infection, caused by sawdust bedding, was responsible for this outbreak. Some *Klebsiella* strains detected were resistant to Ampicillin (100%), Terramycin (26%) and Gentamicin (5%), while all of them were sensitive to Cefaperazon, Enrofloxacin and Sulfonamide/Trimethoprim.

This citation is from AGRICOLA.

1110. Industrial wood ash as a soil amendment for crop production.

Meyers, N. L. and Kopecky, M. J. 81(4): 123-130. (1998); ISSN: 07341415 [TAJOD]

Descriptors: biomass/ coal ash/ cultivation/ environmental protection/ fertilizers/ greenhouse effect/ land fill/ soil conditioners/ wood/ alfalfa/ crop production/ indicator crops/ soil amendment/ wood ash/ waste utilization

Abstract: Wood ash - produced as a by-product of energy generation by wood-products industries - has potential for use as a liming and nutrient source for crop production. We conducted greenhouse and field studies to evaluate the effects of landspreading industrial wood ash on the yield and elemental composition of forage crops and on soil

nutrient levels. Greenhouse studies evaluated ash rates up to the equivalent of 40 tons/acre (90 Mg ha⁻¹) using alfalfa (*Medicago sativa* L) and barley (*Hordeum vulgare*) as indicator crops. A limed and fertilized control (dosages based on soil tests) was included for comparison. In field trials, wood ash was applied to alfalfa at rates up to 20 tons/acre (45 Mg ha⁻¹) at two locations in Price County, WI. Biomass yields generally increased with ash application up to 20 tons/acre and decreased at applications exceeding this level. Wood-ash application usually produced yields greater than those obtained with the limed and fertilized control treatment. No undesirable elements accumulated in forage tissue at ash application rates up to 20 tons/acre. These results suggest that land application of wood ash is an environmentally safe alternative to landfilling and may replace conventional limestone and fertilizer for forage crop production. Application: Greenhouse and field tests evaluating the effects of landspreading wood ash as a crop fertilizer.

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1111. Influence of *Cognettia sphagnetorum* (Enchytraeidae) on birch growth and microbial activity, composition and biomass in soil with or without wood ash.

Liiri, M.; Setälä, H.; Haimi, J.; Pennanen, T.; and Fritze, H. *Biology and Fertility of Soils* 34(3): 185-195. (Sept. 2001) NAL Call #: QH84.8.B46; ISSN: 0178-2762

Descriptors: *Betula pendula*/ *Enchytraeidae*/ microbial activity/ soil microorganisms/ microorganisms/ biomass/ species diversity/ ash/ soil amendments/ seedlings/ degradation/ drought/ water stress/ soil fauna/ population density/ population dynamics/ nitrogen content/ leaves/ roots/ shoots/ disturbed soils/ Finland/ ratios/ growth

Abstract: In this laboratory study using microcosms with seedlings of silver birch (*Betula pendula*), we explored whether *Cognettia sphagnetorum* (Enchytraeidae) can retain its important role of accelerating decomposition processes in soils and stimulating primary production under disturbance. We established systems with or without wood ash amendment (first-order disturbance) in the soil, either in the presence or absence of *C. sphagnetorum*. To test whether the systems treated with wood ash are more sensitive to an additional disturbance than the ash-free systems, the microcosms were later on disturbed by drought. To determine the influence of two disturbances on the enchytraeids and populations of other fauna, and the possible changes in the system functioning, measurements were made of the growth of birch seedlings, foliar N concentration, composition and biomass of soil microbial communities and leaching of N and dissolved organic carbon from the microcosms. Both wood ash application and drought exerted a clear negative influence on the populations of *C. sphagnetorum*. However, populations of this species were very resilient and recovered rapidly after drought in the ash-free soils. In the ash-free soils *C. sphagnetorum* tended to improve birch growth, increased the N content of the birch leaves, and decreased the root to shoot ratio. However, in the ash-treated soils enchytraeids had negative effects on these parameters. *C. sphagnetorum* impacted on neither N and C leaching nor soil microbes, whereas wood ash decreased microbial biomasses and changed their community structure (as determined by phospholipid fatty acids method and denaturing gel electrophoresis) and substrate utilisation

potential (Biolog method). It was concluded that *C. sphagnetorum* can retain its influential role under varying environmental conditions, but that the stimulating or retarding effects of this species on system functioning can be context dependent.

This citation is from AGRICOLA.

1112. Influence of different nutrient sources on nodulation, growth and yield of chickpea.

Dhanveer Singh; Ram, H; Singh, A K; Maurya, B R; and Jagdish Prasad

Indian Journal of Fertilisers 4(2): 59-60, 69. (2008); ISSN: 0973-1822

Descriptors: bulk density/ chickpeas/ chlorophyll/ composts/ crop yield/ iron/ leaves/ manganese/ nodules/ plant height/ pods/ protein/ sawdust/ sludges/ soil pH/ yield components/ Mn

Abstract: In a pot experiment conducted during November to February 2006 in Varanasi, Uttar Pradesh, India with chickpea as test crop, the application of 10 tonnes pressmud/ha-1 with days after planting (DAP) at 100 kg ha-1 significantly increased plant height, nodule and pod numbers/pot, leaf-chlorophyll, grain-protein and grain yield over control and found to be superior than other treatments comprising of pressmud/sawdust/compost/sludge at 5 or 10 tonnes ha-1 with DAP at 100 kg ha-1, whereas sawdust treatments decreased pH and bulk density of post-harvest soil. Despite increase in nodule-Fe and Mn by sludge application, it did not reflect on yield parameters of chickpea.

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1113. The influence of intercropping and saw dust mulching on carrot yield and entomofauna.

Luik, A.; Heidemaa, M.; Viidalepp, V.; and Estonian Agricultural University, Tartu Estonia

Transactions of the Estonian Agricultural University (Estonia). Agronomy 208: 115-120. (2000); ISSN: 1406-4049.

Notes: Original title: Segaviljeluse ja saepurumultchi moju porgandi saagile ning entomofaunale. 1 table; 4 ill., 6 ref. Summary (En). Citation notes: EE (Estonia).

Descriptors: intercropping/ sawdust/ mulching/ carrots/ yield/ entomofauna

Abstract: Intercropping of carrots with garden beans (in rows with a 40 cm distance) and mulching with fresh saw dust significantly disoriented pests and decreased the damage of carrots by *Trioza viridula* and *Psila rosae*. Garden beans and saw dust separately did not have significant influence on these pests. Under synergism of garden beans and saw dust the part of undamaged carrots in crop was significantly increased. 19 species of carabids were found in carrot beds. *Amara fulva*, *A. bifrons*, *Harpalus rufipes*, *H. affinis* and *Calathus erratus* were most numerous.

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1114. The influence of mineral fertilization with mixtures of waste activated sludges with bark and sawdusts on the yield and chemical composition of ryegrass (*Lolium multiflorum* Lam.).

Kalembasa, S. and Symanowicz, B.

Folia Universitatis Agriculturae Stetinensis, Agricultura 77: 129-134. (1999).

Notes: Original title: Wpyw nawozenia mineralnego, mieszanin osadow posciekowych z kora i trocinami na plonowanie i skad chemiczny Lolium multiflorum Lam.

Descriptors: bark/ chemical composition/ fertilizers/ NPK fertilizers/ sawdust/ sewage sludge/ wastes

Abstract: Pot experiments were conducted to compare the effects of farmyard manure, sewage sludge, and sludge mixed with sawdust or coniferous tree bark, on L. multiflorum. Treatments were applied with or without mineral NPK fertilizers. Dry matter yields and plant NPK contents are tabulated.

This citation is from AGRICOLA.

1115. Influence of moisture conditions on the production and growth of black currant.

Strautina, S. and Kampuss, K.

In: Proceedings of the International Conference Fruit Production and Fruit Breeding, Tartu, Estonia.; pp. 173-176; 2000.

Descriptors: black currants/ crop yield/ drought/ fertigation/ irrigation/ mulching/ sawdust/ Cunoniales/ fertirrigation/ watering

Abstract: Black currants are among the most economically important small fruit crops in Latvia. To obtain high berry yields, it is necessary to secure optimal growth conditions for this crop. One of the demands is sufficient moisture supply. In a trial established in spring 1997 with cultivars Titania and Zagadka, three growing methods were tested: (1) without additional moisture regulation (control variant); (2) sawdust mulch; (3) drip irrigation combined with fertigation. In a prolonged drought, fertigation proved to be the best moisture supply method, providing the plants with optimal amounts of water and nutrients. It was found in the trial that during a long dry period, sawdust mulch has a negative influence on black currant growth and yield. Reproduced with permission from the CAB Abstracts database.

1116. Influence of mulch on erva-mate productivity.

Lourenco, R. S.; Medrado, M. J. S.; Nietsche, K. ; and Sabatke Filho, F. E.

Boletim de Pesquisa Florestal 43(113-122)(2001); ISSN: 1517-6371.

Notes: Original title: Influencia da cobertura morta na produtividade da erva-mate.

Descriptors: fertilizers/ intercropping/ mate/ mulches/ productivity/ sawdust/ wood chips/ wood residues/ mulching materials

Abstract: A field experiment was conducted in Sao Mateus do Sul, Brazil to determine the efficiency of using two types of mulch, intercrop (grass) and fertilizer application in achieving erva-mate [*Ilex paraguariensis*] productivity. The treatments used in the experiments were: (T1) no mulch, no fertilizer; (T2) fertilizer application without mulch; (T3) application of chips without fertilizers; (T4) application of chips+fertilizer; (T5) application of sawdust without fertilizer, (T6) application of sawdust+fertilizer; (T7) intercrop grass without fertilizer; and (T8) intercrop grass+fertilizer. Results showed that the addition of chips as mulch improved the productivity of erva-mate up to four years. Reproduced with permission from the CAB Abstracts database.

1117. Influence of mulch on soil temperature, nutrient concentration, yield components and tuber yield of sweet potato (*Ipomoea batatas*).

Ossom, E. M.; Pace, P. F.; Rhykerd, R. L.; and Rhykerd, C. L.

Indian Journal of Agricultural Sciences 73(1): 57-59. (2003)
NAL Call #: 22 AG831; ISSN: 0019-5022

Descriptors: coffee/ coffee pulp/ copper/ crop yield/ dry matter/ grass clippings/ husks/ iron/ leaves/ magnesium/ manganese/ mineral content/ mulches/ nutrient content/ plant nutrition/ potassium/ sawdust/ soil temperature/ sweet potatoes/ tubers/ weed utilization/ weeds/ yield components/ zinc/ hulls/ Mn/ mulching materials

Abstract: A field experiment was conducted in Kabiufa, Papua New Guinea from September 1999 to February 2000 to study the effects of 4 organic materials on soil temperature, and nutrient concentration and tuber yield of sweet potato (I. batatas cv. Wan Mun). The organic materials used as mulch were coffee (*Coffea arabica*) husk, coffee pulp, sawdust and thatch grass (*Imperata cylindrica*). Grass mulch resulted in the lowest soil temperatures. Significant temperature differences ($P=0.05$) were observed at 5-cm, 10-cm and 15-cm depths. Coffee husk mulch resulted in the highest K (2.04%), Mg (0.11%), Fe (180.26 ppm), Mn (33.02 ppm), Cu (9.88 ppm) and Zn (16.52 ppm) concentrations in the tubers. Sawdust mulch resulted in a higher but not statistically significant dry matter yield of tuber at 16 weeks after planting, whereas the grass mulch gave the lowest dry matter yield. Reproduced with permission from the CAB Abstracts database.

1118. The influence of mulching on nutrition and yield of 'Northblue' blueberry.

Karp, K.; Noormets, M.; Paal, T.; and Starast, M.

Acta Horticulturae 715: 301-305. (Aug. 2006)
NAL Call #: 80 Ac82

Descriptors: peat mulch/ pHKCl/ plastic mulch/ sawdust mulch/ vaccinium corymbosum x vaccinium angustifolium/ vaccinium/ vaccinium angustifolium/ vaccinium corymbosum

Abstract: Research to optimize blueberry cultivation in Estonia started in the Department of Horticulture at Estonian Agricultural University. The first experiments were established with different cultivation technologies in 1997. The purpose of the present experiment is to ascertain the influence of different mulches on the nutrition and yield of fruit bearing plants. The data were collected the 5th and 6th year after planting. The cultivation treatments were a control without mulch, sawdust mulch, peat mulch, plastic mulch, and soil amended with peat and covered with peat or plastic mulch. The initial pH of the experimental area was pHKCl 5.9; this changed over the years significantly to a pH more suitable for blueberry in treatments where peat was used as mulch or as an amendment. In treatments where peat was used, the soil acidity in the upper soil layers was pH 4.3 to 5. The soil pH was 5.4 only in treatments where soil was amended with peat and plastic mulch was used. In deeper layers (10 to 15 cm) the pH was 5.8 to 6.1. Mulching treatment significantly influenced nutrient content of leaves. Chlorophyll meter readings were significantly lower in the leaves of control plants compared to the plants growing on different mulches (381 and 498, 542 SPAD

units respectively). The average yield (2001, 2002) was 20 to 402 g/plant. Treatment and year had a significant effect on yield. The lowest yield was obtained in control plants (without mulch) and the highest was in plants where soil was amended with peat and a plastic mulch was used.
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1119. Influence of organic amendments on nematode fauna and microflora of chickpea rhizosphere.

Gopal Pandey; Pandey, R. K.; and Hemlata Pant
Indian Journal of Pulses Research 18(2): 263-264. (2005); ISSN: 0970-6380

Descriptors: chickpeas/ composts/ fauna/ flax/ growth/ Indian mustard/ linseed/ microbial flora/ neem seed cake/ non wood forest products/ oilseed cakes/ organic amendments/ plant development/ plant parasitic nematodes/ plant pests/ rhizosphere/ rhizosphere fungi/ root nodules/ sawdust/ soil organic matter/ Capparales/ eelworms/ microflora/ minor forest products/ neem/ neem seed oilmeal/ non timber forest products/ oil cakes/ organic matter in soil/ Secernentea/ Tylenchida

Abstract: A study was conducted in Uttar Pradesh, India, to assess the effects of organic amendments on nematode fauna and microflora of chickpea rhizosphere. Treatments comprised: mustard cake, mahua cake, neem cake, linseed cake, composts, sawdust and a control. Results showed that organic amendments significantly increased growth parameters of chickpea. Higher growth of plants was recorded in neem cake-amended soil. The organic amendments significantly reduced the root-knot (*Meloidogyne incognita*) infection, with neem cake recording the maximum reduction. The *Rhizobium* and *Azotobacter* populations increased significantly with neem cake treatment. The number of root nodules was also higher in neem cake-amended soil in both experiments. Organic matter and oil cakes increased population of total fungi in the rhizosphere. Maximum increase in fungal number was noted in neem cake-amended soil. The soil nematode population around the roots of treated plants were decreased.

Reproduced with permission from the CAB Abstracts database.

1120. Influence of organic amendments on the exchangeable aluminium of an Oxisol.

Castillo, A. E.; Carbonell, R. M.; and Vazquez, S.
Ciencia del Suelo 17(1): 58-59. (1999); ISSN: 0326-3169.

Notes: Original title: Influencia de enmiendas organicas sobre el aluminio de cambio de un oxisol.

Descriptors: acidity/ aluminium/ Ferralsols/ manures/ organic amendments/ Oxisols/ pines/ sawdust/ soil/ soil solution/ soil toxicity/ stems/ tobacco/ toxicity/ aluminum/ toxic soils

Abstract: A greenhouse experiment was conducted to assess the effects of organic amendments on the aluminium toxicity of an Oxisol. Two rates (4.6 and 13.9 g kg⁻¹) of farmyard manure, pine tree sawdust and tobacco stems were applied to pots containing the plough-layer of the studied soil. An unamended treatment was also incorporated as control. pH, acidity and exchangeable aluminium were determined in composite samples after 60, 90 and 120 days. Results showed that organic

amendments decreased aluminium in the soil solution from 2.95 cmol kg⁻¹ in the control to 0.572 cmol Al kg⁻¹ in the treatment with the highest rate of tobacco stems.
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1121. The influence of organic fertilizers on the humus content and composition in deflated chestnut soils.

Egorova, R. A. and Chimitdorzhieva, G. D.
Agrokhimiya 2: 27-30. (2000); ISSN: 0002-1881

Descriptors: application/ bark/ cattle dung/ chestnut soils/ composts/ fractionation/ humic acids/ manures/ sawdust/ soil/ humic substances

Abstract: The effects on humus of manure, compost, straw, dung + sawdust, and bark compost at application rates ranging from 0 to 40 t/ha were studied in an experiment in Buryatia, Russia, from 1990 to 1992. It was shown that dung + sawdust and bark compost increased the content of humic acid fraction 1, and also a tendency to increase humic acid fraction 2. Applications of straw compost led to an increase in humic acid fraction 2. Changes in humic substance groups were non-significant.

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1122. Influence of precipitated calcium carbonate (CaCO₃) on shiitake (*Lentinula edodes*) yield and mushroom size.

Royse, D. J. and Sanchez Vazquez, J. E.
Bioresource Technology 90(2): 225-228. (2003)
NAL Call #: TD930.A32 ; ISSN: 0960-8524

Descriptors: calcium carbonate/ crop yield/ edible fungi/ growing media/ millets/ rye/ sawdust/ size/ soilless culture/ substrates/ weight/ wheat bran/ northern red oak/ potting composts/ rooting media/ Tricholomataceae

Abstract: Synthetic substrate consisting of oak sawdust (50%), white millet (28%), winter rye (11%) and soft red wheat bran (11%) was non-supplemented or supplemented with 0.2%, 0.4% or 0.6% (dry weight basis) precipitated calcium carbonate (CaCO₃). Shiitake (*Lentinula edodes*) was grown in two crops to determine the effect of three CaCO₃ levels on mushroom yield and size. Yields and biological efficiencies (averages for two crops) from substrates non-supplemented with CaCO₃ were lower by 14.1%, 18.4% and 24.9% compared to treatments supplemented with 0.2%, 0.4% and 0.6% CaCO₃, respectively. Mushroom size (weight) was larger with non-supplemented substrate (16.8 g) compared to substrate supplemented with 0.6% CaCO₃ (15.1 g). However, mushroom production was more consistent from crop to crop when 0.6% CaCO₃ was added to substrate.

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1123. Influence of sawdust ash on soil chemical properties and cowpea performance in Southwest Nigeria.

Awodun, M. A.
International Journal of Soil Science 2(1): 78-81. (2007); ISSN: 1816-4978

Descriptors: acid soils/ ash/ calcium/ chemical composition/ cowpeas/ crop yield/ magnesium/ nitrogen/

nutrient content/ phosphorus/ plant composition/ potassium/ sawdust/ soil chemical properties/ soil organic matter/ soil pH/ soil types/ black eyed peas/ chemical constituents of plants/ chemical properties of soil/ organic matter in soil/ southern peas

Abstract: Field trials were carried out at two locations in fairly acidic soils in Southwest Nigeria to test effect of sawdust ash on soil chemical properties, leaf nutrient content and yield of cowpea (*Vigna unguiculata* Walps). Sawdust ash applied at 2, 4, 6, 8 and 10 t ha⁻¹ significantly increased soil organic matter, pH, N, P, K, Ca and Mg contents relative to 0 t ha⁻¹ sawdust ash. The 4, 6, 8 and 10 t ha⁻¹ sawdust ash increased pod weight and grain yield. The mean increases in grain yield across locations were 17, 63 and 68%, respectively. This citation is from AGRICOLA.

1124. Influence of seedbed mulching and shading on the germination and early development of rosewood (*Aniba rosaeodora*) seedlings .

Marques, A. da S. J.; Varela, V. P.; and Melo, Z. L. de O. *Acta Amazonica* 29(2): 303-312. (1999); ISSN: 0044-5967.

Notes: Original title: Influencia da cobertura e do sombreamento do canteiro na germinacao e desenvolvimento inicial de plantas de pau rosa (*Aniba rosaeodora*).

Descriptors: clay minerals/ diameter/ forest nurseries/ forests/ growth/ height/ leaf area/ leaves/ mulches/ mulching/ nature reserves/ rice/ rice straw/ roots/ sawdust/ seed germination/ seedling emergence/ seedlings/ shade/ shading/ shoots/ straw/ tropical rain forests/ vermiculite/ mulching materials/ paddy

Abstract: An experiment was carried out in the nursery at Adolph Ducke Forest Reserve, Manaus, Amazonas, Brazil, to compare three types of mulching materials (rice straw, sawdust and vermiculite) often used in forest nurseries and to test four shade levels on germination, emergence and development of rosewood (*Aniba rosaeodora*) seedlings. The shade levels (30, 50 and 70%) were obtained by using black polyolefine screens and 0% shading intensity was obtained under full open sky. The types of mulch and interaction between shading levels and mulching did not influence seed germination and emergence speed index. The shade levels did not influence seed germination, but significantly effected emergence speed index. The mulches did not influence seedling growth in height, diameter and shoot, root and total dry weight, but the leaf area of the seedlings obtained with vermiculite mulch was greater than that obtained with sawdust. Better results in height growth and shoot, root and total dry weight were observed in seedlings grown under 30 and 50% shade. The interactions between 30% shade and vermiculite mulching and 50% shade and rice straw provided the best height growth and total dry weight, respectively.

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1125. Influence of sowing techniques and pesticide application on the emergence and the establishment of bean plants (*Phaseolus vulgaris* L.).

Valenciano, J. B.; Casquero, P. A.; and Boto, J. A. *Agronomie* 24(2): 113-118. (2004); ISSN: 0249-5627

Descriptors: application methods/ crop establishment/ cultivars/ pesticides/ sawdust/ seedling emergence/

sowing/ vermiculite/ cultivated varieties/ green bean/ seed sowing/ snap bean

Abstract: The emergence and the establishment of beans are affected by bean seed fly attacks, soil fungi and crust formation. Experiments were conducted during 1998 and 1999 in Leon, Spain to evaluate the effects of the following treatments: bean cultivars (Rinon de Leon and Canela) as main plots; the pesticide application system (untreated, treatment of seed before sowing and treatment of seed during sowing) as subplots; and sowing technique (sowing in raised beds, sowing in flat land without adding substratum, sowing in flat land + adding sawdust and sowing in flat land + adding vermiculite) as sub-subplots. Sowing in flat land + addition of substrate to the sowing line resulted in the acceleration of the common bean emergence and the improvement of its establishment. Application of pesticides to the sowing line accelerated bean emergence. Highly significant interaction between environment and sowing technique was obtained for all parameters studied.

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1126. Influence of substrate formulation and autoclave treatment on *Lentinula edodes* production.

Kilpatrick, M.; Murray, D. J.; and Ward, F.

In: Science and Cultivation of Edible Fungi. Proceedings of the 15th International Congress on the Science and Cultivation of Edible Fungi. Maastricht, Netherlands.; pp. 803-810; 2000.

Descriptors: bark/ casing/ crop yield/ development/ edible fungi/ fructification/ grain/ growing media/ growth/ limestone/ microbial contamination/ mushrooms/ pathogens/ production/ sawdust / size/ spawning/ straw/ vegetables/ wheat/ wheat straw/ northern red oak/ potting composts/ rooting media/ Tricholomataceae/ vegetable crops

Abstract: *Lentinula* substrates were prepared from various lignocellulosic materials: red oak sawdust, composted spruce bark, composted spent mushroom substrate and wheat straw, supplemented with varying proportions of wheat grain, wheat bran and limestone. Yields (fresh weight/per unit fresh weight substrate) were highest from oak and oak/spruce bark combinations. Increasing grain supplementation (10-37% DW) of wood-based substrates raised productivity by an average 85%. In contrast, straw-based substrates showed a negative response with grain supplementation. When supplemented substrates were subjected to heat treatments of 2 or 3 autoclave cycles (121 degrees C for 1 h at 15 psi), there were no significant differences in level of pathogen infection or total yield. The more intensive regime reduced the number of fruiting bodies harvested by ~35%; the average weight per fruiting body increased by a similar amount. In a comparison of surface, core and mixed spawning techniques, surface spawning was a viable technique that could reduce post-autoclave contamination.

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1127. Influence of substrate wood chip particle size on shiitake (*Lentinula edodes*) yield.

Royse, D. J. and Sanchez-Vazquez, J. E.

Bioresour. Technology 76(3): 229-33. (Feb. 2001)
NAL Call #: TD930.A32 ; ISSN: 0960-8524

Descriptors: crops, agricultural: growth & development/ fertilizers/ food industry: economics: methods/ particle size/ shiitake mushrooms: growth & development/ wood

Abstract: Wood chips from four commercial hardwood sawmills were screened with 10 US standard sieves (4-0.21 mm) to assess particle size distributions. 96-98% of wood chips were < 4 mm while 95-99% of particles were > 0.21 mm. The majority (mean = 64.5%) of wood chips passed through US standard sieve size 14 (< 1.4 mm). Shiitake (*Lentinula edodes*) was grown in three crops to determine the effect of four particle size classes (1 = 2.8-4 mm; 2 = 1.7-2.8 mm; 3 = 0.85-1.7 mm; 4 = < 0.85 mm) on mushroom yield. Yields from substrates prepared with wood chips from class 4 (< 0.85 mm) were lower by 27.7%, 12.4% and 2% (mean = 14.9%) for Crops I, II, and III, respectively, when compared to controls. Profiling of wood chips may help growers optimize their production media and reduce production costs. This citation is from PubMed.

1128. Influence of the substrate components on the crop yield of shiitake (*Lentinus edodes* (Berk) Singer).

Kalberer, P.

Gartenbauwissenschaft 63(1): 15-19. (1998); ISSN: 0016-478X

Descriptors: calcium/ crop yield/ cultural methods/ growing media/ maize/ nitrogen/ plant residues/ sawdust/ soyabeans/ urea/ vegetables/ wheat/ corn/ potting composts/ rooting media/ soybeans/ *Tricholomataceae*/ vegetable crops

Abstract: Substrates for growing *L. edodes* [*Lentinula edodes*] contain mainly hardwood sawdust (75-80%) supplemented with other components. The effect of substrate composition on the yield of *L. edodes* was investigated. Under optimum growing conditions, the basic formulation gave a good yield in a short harvesting period; the standard deviation of yield was small. Yields from substrates containing whole maize meal as a supplement were more uniform than those from substrates containing wheat bran. Substrates with 20% whole maize meal gave higher yields than substrates with only 10%. For highest yields, the substrate should contain 20% maize meal, an additional N source (1% urea or 4% extracted soyabean meal) and 2% calcium carbonate.

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1129. Influence of urea and ammonium chloride on crop yield and fruit body size of shiitake (*Lentinula edodes*).

Kalberer, P. P.

In: *Science and Cultivation of Edible Fungi Proceedings of the 15th International Congress on the Science and Cultivation of Edible Fungi*. Maastricht, Netherlands.; pp. 361-366; 2000.

Descriptors: corn flour/ cultural methods/ deformation/ edible fungi/ fertilizers/ fructification/ growing media/ growth/ maize/ nitrogen fertilizers/ plant residues/ quality/ sawdust/ size/ spawn/ urea/ vegetables/ corn/ cornflour/ maize flour/ potting composts/ rooting media/ *Tricholomataceae*/ vegetable crops

Abstract: The supplementation of a sawdust-corn flour substrate with urea or ammonium chloride increased the crop yield of *L. edodes*. From supplemented substrates heavier fruiting bodies were harvested. The duration of the

incubation influenced the crop yield and the size of the fruiting bodies. The supplements slowed down the spawn run and prolonged the incubation. Urea added to the substrate caused the failure of some primordia to develop and the deformation of some fruiting bodies. Reproduced with permission from the CAB Abstracts database.

1130. Influence of various potting media on growth and nutrient uptake efficiency of *Scindapsus aureus*.

Iftikhar Ahmad and Qasim, M.

International Journal of Agriculture and Biology 5(4): 594-597. (2003); ISSN: 1560-8530

Descriptors: chemical composition/ farmyard manure/ growing media/ manures/ nutrient uptake/ organic amendments/ plant composition/ plant nutrition/ potting/ sand/ sawdust/ silt/ substrates/ use efficiency/ chemical constituents of plants/ FYM/ potting composts/ rooting media

Abstract: The effects of various potting media were studied to determine growth response and nutrient uptake efficiency of *S. aureus* [*Epipremnum pinnatum*]. Soil amendments were made by using farmyard manure, leaf mould and poultry manure as main sources and by making different combinations with sand, silt and sawdust. Potting media in different combinations were better than the sole factor of the soil itself because different combinations of potting media produced more growth and vigour of the plants and improved total available N and P. Moreover, correlation coefficients indicated positive relationship among various growth responses and soil and plant NPK contents except leaf P which exhibited a negative relationship.

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1131. Influence of wood ash-based soil amendments on weed occurrence and diversity in a humid tropical environment.

Smith, M. A. K.; Ojeniyi, S. O.; and Oladejo, B. T.

Journal of Sustainable Agriculture and the Environment 3(2): 270-275. (2001); ISSN: 1119-8152

Descriptors: broadleaves/ dry matter/ forests/ humid zones/ maize/ occurrence/ rain forests/ soil amendments/ species diversity/ trees/ wood ash/ woody plants/ corn/ *Mitracarpus villosus*

Abstract: The weed species occurrence, diversity and dry matter accumulation at 6 weeks after applying ash-based soil amendments to early season maize (*Zea mays* var. DMR-ESR-Y) in the rainforest ecozone of southwestern Nigeria were evaluated. The weed flora was dominated by Poaceae (30.7%) and annual broadleaves (53.8%). Soil amendment resulted in a complex admixture of weed species particularly *Euphorbia heterophylla* (EHETE), *Setaria* spp. (SETAR), *Mitracarpus villosus* (MITVI) and *Digitaria horizontalis* (DIGHO). Weed densities were highest (107.2 plants/m²) and lowest (67.6 plants/m²) in 8 tonnes/ha wood ash (WA) and 12 WA, respectively. F3+4WA (150 kg/ha NPK 23-13-13+4 tonnes/ha wood ash) carried the most diverse weed flora (D=3.84) while the least variable weed flora occurred in F2+2WA (250 kg/ha NPK+2 tonnes/ha wood ash). In contrast, weeds were equally most widespread in F3+4WA and 8WA (8 tonnes/ha) and least in the untreated control (CON). Weeds occurring in 8WA, F2+2WA and F4+6WA (100 kg/ha NPK+6t/ha wood ash)

accumulated comparable dry weights and these were significantly more than in CON and F1 (300 kg/ha NPK), 12WA (12 tonnes/ha wood ash) and F3+4WA. The implications of these on soil fertility improvement strategies and associated weed management problems, are discussed.

This citation is from AGRICOLA.

1132. Influence of wood chip particle size used in substrate on biological efficiency and post-soak log weights of shiitake.

Royse, D J and Sanchez Vazquez, J E.

In: Science and Cultivation of Edible Fungi. Proceedings of the 15th International Congress on the Science and Cultivation of Edible Fungi. Maastricht, Netherlands.; pp. 367-373; 2000.

Descriptors: crop yield/ cultural methods/ edible fungi/ growing media/ logs/ sawdust/ size/ utilization/ vegetables/ wood chips/ potting composts/ rooting media/ Tricholomataceae/ vegetable crops

Abstract: Wood chips from 7 commercial sawdust sources were profiled by sieving materials through 10 US standard sieve sizes (4-0.21 mm). The majority (mean=70.7%) of wood chips passed through US standard sieve size 16 (<1.18 mm). Sawdust of particle size 0.5-0.85 mm accounted for the single largest particle size class (mean=32.2%). The next single largest class had a particle size distribution of 0.85-1.18 mm (mean=17.8%). Shiitake [*Lentinula edodes*] was grown in 3 crops to determine the effect of 4 particle size classes (1 = 2.8-4 mm; 2 = 1.7-2.8 mm; 3 = 0.85-1.7 mm; and 4 = <0.85 mm) on yield. In addition, logs from 2 crops were weighed after each soak (3) to determine the effect of particle size on water up-take. Yield from substrate prepared with wood chip particle size class 4 (extra fine; <0.85 mm) was significantly less than yields from the other particle size classes and the controls. Yield from particle size class 3 (0.85-1.7 mm) was highest among the 4 classes. Water uptake was greater in synthetic logs made with extra fine wood chips (<0.85 mm). Profiling of wood chips at the source may help growers optimize their production media and reduce production costs. Reproduced with permission from the CAB Abstracts database.

1133. Initiation and growth of shoots of *Gongronema latifolia* benth stem cuttings in different rooting media.

Agbo, C. U. and Omaliko, C. M.

African Journal of Biotechnology 5(5): 425-428. (2006)

NAL Call #: TP248.13 .A37; ISSN: 16845315 .

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Language of Original Document: English.

Descriptors: *Gongronema latifolia*/ propagation/ rooting media/ stem cuttings/ Nigeria/ nonhuman/ plant/ plant growth/ plant leaf/ plant root/ plant stem/ sawdust/ season/ soil/ spice/ stem cutting/ vegetable/ vegetation/ *Gongronema*

Abstract: Vegetative propagation of *Gongronema latifolia* Benth commonly used as a forest leafy vegetable and spice, was studied in three rooting media (sawdust, ricehull and soil) under two seasons in Nsukka. The study showed that *G. latifolia* could be effectively propagated by stem cuttings. There was significant reduction in number of days to shoot initiation and growth in sawdust medium in the wet season. Sawdust and soil gave a better performance of the

cuttings in opening of apical buds, initiation of shoots, percentage of rooted cuttings, number of vines, vine length and number of opposite leaves on vines in both seasons. Even though, both media performed similarly in most of the attributes, sawdust medium will be preferred to soil because it is readily available and affordable. Effective and high percentage rooting of *G. latifolia* stem cuttings, which will provide excellent conservation of a selected clone derived from virgin forest and hybridization, could be achieved in sawdust medium during the dry season. © 2006 Academic Journals.

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1134. Integrated crop management strategies for plantain production and control of black leaf streak (black Sigatoka) disease in the Democratic Republic of Congo.

Ngongo, P. M. K.

Infomusa 11(1): 3-6. (2002); ISSN: 1023-0076

Descriptors: cover crops/ cowpeas/ crop residues/ crop yield/ cultural control/ flowering date/ fungal diseases / harvesting date/ integrated control/ mulches / mulching/ nitrogen fertilizers/ phosphorus fertilizers/ plant disease control/ plant diseases/ plant height/ plant pathogenic fungi/ plant pathogens/ potassium fertilizers/ rice husks/ sawdust/ wood residues/ black eyed peas/ harvest date/ integrated plant protection/ mulching materials/ *Mycosphaerellaceae*/ phosphate fertilizers/ phytopathogens/ potash fertilizers/ rice hulls/ southern peas

Abstract: A field experiment was conducted in western Congo in 1998 to compare the field performance and yield of plantain (*Musa AAB* cv. Yumba) under different practices of soil fertility and disease management, viz. application of crop residues as mulches (wood sawdust or rice husk), cover crop (*Vigna unguiculata*) and fertilizers (300 kg N, 60 kg P₂O, 550 kg K₂O). The development and severity of black Sigatoka disease (caused by *Mycosphaerella fijiensis*) were studied. Growth (plant height, plant girth, number of emerged leaves, days to flowering, days to harvest and height of the tallest sucker) and yield parameters (number of hands per bunch, number of fruits per bunch, bunch weight and yield) were evaluated. Soil analysis showed that rice husk was the best in improving soil fertility level. The severity of black Sigatoka on plantain was much lower in the mulched plantain than in the non-mulched plantain. Rice husk was the best in slowing disease development. Crop residues also improved plant girth and lowered the number of leaves. Plants mulched with rice husk flowered earlier and had a longer fruit-filling period than those other treatments. Plantain mulched with rice husk was harvested 16 days earlier than plantain mulched with sawdust. It also showed better suckering and tallest suckers. Mulching improved the number of hands and fruits per bunch than the non-mulched plantains. Plantains mulched with rice husk outyielded the controlled plants, plants treated with cover crop and plants applied with NPK fertilizer by 46, 37 and 26%, respectively. Reproduced with permission from the CAB Abstracts database.

1135. Integrated management of rice sheath blight under field condition.

Surulirajan, M. and Janki Kandhari

Indian Phytopathology 58(4): 431-436. (2005)

NAL Call #: 464.8 IN2 ; ISSN: 0367-973X

Descriptors: biological control/ biological control agents/ carbendazim/ chemical control/ crop yield/ cultural control/ farmyard manure/ fungal diseases/ fungicides/ integrated control/ plant disease control/ plant diseases/ plant pathogenic fungi/ plant pathogens/ rice/ rice straw/ sawdust/ seed weight/ straw/ biocontrol agents/ biological control organisms/ carbendazol/ FYM/ Hyphomycetes/ integrated plant protection/ MBC/ medamine/ New Delhi/ paddy/ phytopathogens

Abstract: A study was conducted in Delhi, India, to assess the disease severity, percent disease incidence (PDI) and yield parameters (grain yield, straw yield and 1000-grain weight) against sheath blight (*Rhizoctonia solani*) of rice through different combinations of treatments in the field in 1999-2000 and 2000-01. Treatments comprised: *Trichoderma viride* 3235 (Tv3235) spore suspension spray; 0.1% carbendazim; 1% farmyard manure (FYM); 1% sawdust; Tv3235 + carbendazim; Tv3235 + FYM; Tv3235 + sawdust; carbendazim + FYM; carbendazim + sawdust; FYM + sawdust; Tv3235 + carbendazim + FYM; Tv3235 + carbendazim + sawdust; Tv3235 + FYM + sawdust; carbendazim + FYM + sawdust; Tv3235 + carbendazim + FYM + sawdust; and an untreated control. Among all the treatments, Tv3235 + carbendazim + FYM + sawdust showed the maximum reduction in sheath blight severity, PDI and the highest grain yield over the control. Reproduced with permission from the CAB Abstracts database.

1136. Integration of fungal antagonist and organic amendments for the control of rice sheath blight.

Khan, A. A. and Sinha, A. P.

Indian Phytopathology 59(3): 363-365. (2006)

NAL Call #: 464.8 IN2 ; ISSN: 0367-973X

Descriptors: biological control/ biological control agents/ crop yield/ cultural control/ farmyard manure/ fungal antagonists/ green manures/ integrated control/ neem seed cake/ non wood forest products/ organic amendments/ plant disease control/ plant pathogenic fungi/ plant pathogens/ rice/ sawdust/ straw/ wheat/ wheat straw/ biocontrol agents/ biological control organisms/ FYM/ Hyphomycetes/ integrated plant protection/ minor forest products/ neem seed oilmeal/ non timber forest products/ paddy/ phytopathogens

Abstract: A study was conducted to evaluate the effect of the integration of organic amendments (FYM, wheat straw, dhaincha [*Sesbania aculeata*], sawdust and neem cake) and fungal antagonist (*Trichoderma harzianum* (TH)) on rice sheath blight caused by *Rhizoctonia solani*. All treatments significantly reduced disease severity/incidence and increased grain yield and 1000-grain weight compared with the untreated control. FYM+TH, followed by neem cake+TH and dhaincha+TH, were the most effective treatments.

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1137. Investigation of chemical change on swine fecal composting added sawdust.

Maeda, K. and Okuhata, S.

Bulletin of the Wakayama Research Center of Agriculture, Forestry and Fisheries (Japan) 2: 149-154. (2001); ISSN: 1345-5028.

Notes: 3 tables; 12 fig.; 10 ref. Summary (Ja). Citation notes: JP (Japan).

Descriptors: chemical change/ swine manure/ composting/ sawdust

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1138. Investigations on quantity and physical-chemical quality of wood ash in improving the feeding values of poor quality roughage feeds for ruminants.

Kimambo, A. E.; Aboud, A. A.; Laswai, G. H.; Mtakwa, P.; Nkenwa, D.; Anthony, N.; and Mtamakaya, J. D.

In: Proceedings of the Joint 17th Scientific Conference of the Tanzania Society for Animal Production and the 20th Scientific Conference of the Tanzania Veterinary Association. AICC Arusha, Tanzania.; pp. 170-182; 2002.

Descriptors: alkalinity/ ashing/ charcoal/ chemical composition/ combustion/ digestibility/ dry matter/ feed additives/ hardwoods/ nutritive value/ pH/ physicochemical properties/ roughage/ ruminant feeding/ softwoods/ wood/ wood ash/ wood residues/ hydrogen ion concentration/ neutral detergent fibre/ nutritional value/ potential of hydrogen/ quality for nutrition

This citation is from AGRICOLA.

1139. Irrigation, sawdust mulch, and Enhance® biocide affects soft rot incidence, and flower and tuber production of calla.

Wright, P. J. and Burge, G. K.

New Zealand Journal of Crop and Horticultural Science 28(3): 225-231. (2000)

NAL Call #: SB99.N45N45; ISSN: 01140671

Descriptors: agronomic methods/ calla/ *Erwinia carotovora*/ irrigation/ mulch/ soft rot/ *Zantedeschia* spp / flowering/ irrigation/ morbidity/ plant growth/ plant yield/ soft rot/ *Zantedeschia*

Abstract: The incidence and severity of soft rot, flower grades, and tuber yields of calla (*Zantedeschia* spp.) plants were affected by the quantity of water received during the growing season, sawdust mulch, and Enhance® biocide applications to tubers before planting. Incidence of plants with soft rot symptoms increased at a relatively constant rate during the season reaching an average for all treatments of 61% at the end of flowering. Irrigated plus mulched callas had 15% less soft rot than the irrigation without mulch or the mulch without irrigation treatments. Yield of tubers was 90% greater from irrigated plants. Dipping tubers in Enhance® before planting slightly reduced the severity of rotting in harvested tubers from non-irrigated plants. The total number of flowers was not affected by irrigation but was slightly reduced by sawdust mulch. However, the number of long stemmed flowers was increased 41% by irrigation, to over 1.5 per tuber.

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1140. Land management effects on biogeochemical functioning of salt-affected paddy soils.

Quantin, C.; Grunberger, O.; Suvannang, N.; and Bourdon, E.

Pedosphere 18(2): 183-194. (2008)

NAL Call #: S590 .P43; ISSN: 1002-0160

Descriptors: cattle manure/ crop yield/ electrical conductivity/ flooding/ iron/ land management/ manganese/ organic amendments/ oxides/ paddy soils/ pig manure/ poultry manure/ redox potential/ redox reactions/ reduction/ rice/ saline soils/ sawdust/ soil chemistry/ soil management/ soil pH/ soil salinity/ soil solution/ soil types/ water management/ flooded

conditions/ Mn/ oxidation reduction potential/ oxidation reduction reactions/ paddy/ poultry litter/ water resource management

Abstract: Most lowlands in Northeast Thailand (Isaan region) are cultivated with rice and large areas are affected by salinity, which drastically limits rice production. A field experiment was conducted during the 2003 rainy season (July-November) to explore the interactions between salinity and land management in two fields representative of two farming practices: an intensively managed plot with organic inputs (buffalo, poultry and pig manure mixed with sawdust) and efficient water management, and one without organic matter addition. Field measurements, including pH, Eh, electrical conductivity (EC), and soil solution chemistry, were performed at three depths, with a particular focus on Fe dynamics, inside and outside saline patches. High reducing conditions appeared after flooding particularly in plots receiving organic matter and reduction processes leading to oxide reduction and to the release of Fe and, to a lesser extent, Mn to the soil solution. Oxide reduction led to the consumption of H⁺ and the more the Fe reduction was, the higher the pH was, up to 6.5. Formation of hydroxy-green rust were likely to be at the origin of the pH stabilization. In the absence of organic amendments, high salinity prevented the establishment of the reduction processes and pH value remained around 4. Even under high reduction conditions, the Fe concentrations in the soil solution were below commonly observed toxic values and the amended plot had better rice production yield. Reproduced with permission from the CAB Abstracts database.

1141. Leaching of As and Cr in wood-ash-amended soil columns.

Chirenje, T.; Rivero, C.; and Ma, L. Q.

Soil and Sediment Contamination 11(3): 359-375. (2002)
NAL Call #: TD878 .J68

Descriptors: arsenic/ chromium/ leaching/ wood ash/ soil amendments/ spodic horizons/ humic acids/ fulvic acids/ soil pollution/ risk

This citation is from AGRICOLA.

1142. Leaching of nitrogen derived from cattle manure sawdust compost and coated fertilizer applied to vegetables grown in upland Andosol.

Ohashi, T. and Matano, O.

Japanese Journal of Soil Science and Plant Nutrition 74(5): 631-635. (2003); ISSN: 0029-0610

Descriptors: Andosols / cattle manure/ composts/ denitrification/ leaching/ lysimeters/ nitrate/ nitrogen/ nitrogen fertilizers/ sawdust/ soil types/ tracer techniques/ upland soils/ vegetables/ volatilization/ hill soils/ vegetable crops

Abstract: A lysimeter study in combination with 15N-tracer method was carried out for 3 years and 9 months to investigate the fate of nitrogen derived from cattle manure sawdust compost and coated fertilizer which were applied to vegetables grown in upland Andosol. Of total amount of input nitrogen derived from cattle manure sawdust compost, 1.15% was leached as nitrate, 12.8% was taken up by plants, 68.1% remained in soil, and 18.0% was unaccounted - for which was estimated to be the result of denitrification and volatilization. Of total amount of input

nitrogen derived from coated fertilizer, 2.55% was leached as nitrate, 65.3% was taken up by plants, 16.2% remained in soil, and 15.9% was unaccounted - for which was estimated to be the result of denitrification and volatilization. This citation is from AGRICOLA.

1143. Lingonberry establishment on soils amended with fish waste and wood chips.

Talbot, V. L.; Holloway, P. S.; and Matheke, G. E. M.

Acta Horticulturae 574: 305-308. (2002)

NAL Call #: 80 Ac82; ISSN: 0567-7572

Descriptors: fish scrap/ growth/ mineral soils/ nitrogen/ organic fertilizers/ phosphorus/ potassium/ rhizomes/ silt loam soils/ soil amendments/ soil pH/ soil types/ wood chips/ fish waste/ United States of America

Abstract: Year old lingonberries (*Vaccinium vitis-idaea* subsp. *vitis-idaea*) were planted in Rabideau silt loam soils (Trapper Creek, Alaska) amended with five combinations of cannery fish waste (90% salmon, 10% halibut) as an organic fertilizer and wood chips recovered from rotting windrows of tree slash as a soil amendment. Control consisted of mineral soils. Treatments included fish waste only, 2:1 (v:v) fish waste:wood chips, 1:1 (v:v) fish waste:wood chips, 1:2 (v:v) fish waste:wood chips and wood chips only. Total volume of an amendment applied singly or a combination of amendments was 150 l.m⁻². Each amendment was tilled into the plots, and planting occurred six weeks later. Plants were grown for one full season following the planting season to study establishment and vegetative growth on this organic mix. All treatments with fish waste showed the greatest overall plant growth. The treatment with fish waste only produced the greatest number and dry weight of stems and leaves (average 45 stems, 680 leaves, 8 g per plant) of all treatments. Rhizome production varied widely among plants (0-13 rhizomes per plant) and did not differ among treatments. Vegetative growth was inhibited by addition of wood chips alone. Soil tests during the first growing season showed 2118-2749 micro g.g⁻¹ total available N, 255-281 micro g.g⁻¹ P and 787-880 micro g.g⁻¹ K for fish-amended soils, 106 micro g.g⁻¹ N, 25 micro g.g⁻¹ P and 235 micro g.g⁻¹ K for the control and 20 micro g.g⁻¹ N, 27 micro g.g⁻¹ P and 428 micro g.g⁻¹ K for the wood chip plots without fish. Lingonberries that normally require low nutrient levels grew best at the highest nutrient levels and showed no adverse effects from the fish waste. Wood chips did not provide any benefit for the establishment of lingonberries on mineral soils during the first year.

This citation is from AGRICOLA.

1144. Litter characteristics and performance of broilers reared under different stocking densities and litter types.

Oliveira, M. C.; Bento, E. A.; Carvalho, F. I.; and Rodrigues, S. M. M.

Ars Veterinaria 21(3): 303-310. (2005); ISSN: 0102-6380.

Notes: Original title: Características da cama e desempenho de frangos de corte criados em diferentes densidades populacionais e tipos de cama.

Descriptors: ammonia/ body weight/ broilers/ feed intake/ litter/ liveweight gain/ meat production/ moisture/ pH/ poultry/ sawdust/ stocking density/ stocking rate/ wood shavings/ chickens/ density of stocking/ domesticated birds/ hydrogen ion concentration/ liveweight gains/ potential of hydrogen

Abstract: This experiment was carried out to evaluate the litter characteristics and performance of broilers reared under different stocking densities and litter types. 450 chicks were distributed in an entirely randomized design and 2x2 factorial arrangement (2 stocking densities - 10 and 14 birds/m² and 2 litter types - wood shavings and sawdust), with 4 treatments and 5 replications. At the end of the experiment, the body weight, liveweight gain, feed consumption, feed:gain ratio, meat/area production and viability were determined. Litter samples were collected for moisture, pH and volatilized ammonia analysis. The feed consumption decreased ($P < 0.01$), the feed:gain ratio improved ($P < 0.02$) and the total meat production increased ($P < 0.01$) with increasing stocking density. In relation to the poultry litter, the final pH was not influenced by the stocking density and/or litter type. However, the moisture content and volatilized ammonia of the sawdust were higher ($P < 0.03$) than that of the wood shavings (40.37% and 78.88 ppm and 32.68% and 37.91 ppm to sawdust and wood shavings, respectively). It was concluded that the highest evaluated density and use of wood shavings could be adopted under both stocking densities as well as the sawdust under the density of 10 birds/m². Reproduced with permission from the CAB Abstracts database.

1145. Living conditions and body weight gains of fattening pigs kept on different litters.

Kaczor, A. and Szyndler, J.

Roczniki Naukowe Zootechniki 26(4): 365-376. (1999); ISSN: 0137-1657

Descriptors: animal behaviour/ animal health/ animal housing/ animal welfare/ behaviour/ deep litter housing/ finishing/ floors/ hygiene/ liveweight gain/ living conditions/ pens/ pig housing/ sawdust/ stocking density/ stocking rate/ straw/ supplements/ animal behavior/ animal rights/ behavior/ density of stocking/ fattening/ flooring/ hogs/ liveweight gains/ piggeries/ sties/ swine/ swine housing
Abstract: The aim of the study was to determine the effect of various types of deep litter from coniferous tree sawdust on living conditions of pigs in standard pens approximately 10 m² in area including behaviour, hygiene, daily weight gains, and concentration of harmful gas admixtures in the fattening house. The studies were conducted on litter from coniferous tree sawdust without supplements, with Stalosan F, and with straw (50% of sawdust to 50% of straw in terms of volume). It was concluded that resting conditions of pigs were better on deep litter from sawdust than on shallow litter from straw. The best hygiene of animals was ensured by deep sawdust litter with Stalosan F or with straw. The concentration of harmful gas admixtures (NH₃ and CO₂) did not exceed the permitted level. The type of litter had no effect on daily weight gains of pigs, and stocking density was found to have greater influence. Management of pigs on deep sawdust litter in standard pens approximately 10 m² in area and with a stocking density of 6-7 animals (i.e. 1.4-1.2 m²/pig) ensured proper living conditions. It is concluded that deep litter from coniferous tree sawdust is usefulness for managing pigs in standard pens up to 10 m² in area. Reproduced with permission from the CAB Abstracts database.

1146. Maintenance and hysteresis of soil-root interface water potential of cherry-plum in response to soil dehydration and rehydration.

Xu HuiLian; Caron, J.; Bernier, P. Y.; Umemura, H.; Gauthier, L.; and Gosselin, A.

Journal of the Japanese Society for Horticultural Science 68(2): 228-235. (1999); ISSN: 0013-7626

Descriptors: bark/ composts/ dehydration/ growing media/ hydraulic conductivity/ hysteresis/ matric potential/ ornamental plants/ ornamental woody plants/ peat/ plant water relations/ responses/ sawdust/ soil water/ transpiration/ water potential/ water stress/ woody plants/ xylem / xylem water potential/ ornamentals/ potting composts/ Prunus cistena/ rooting media/ soil moisture
Abstract: For Prunuscistena plants grown in 3 artificial soil mixes and subjected to soil dehydration and rehydration, the soil-root interface water potential ($\Psi_{s,r}$) was estimated using an equation of Ohm's analog, and the maintenance and hysteresis of $\Psi_{s,r}$ as well as xylem water potential ($\Psi_{i,x}$) and transpiration rate (E_A), were examined. The soil mixes were composted bark, peat and sand (Mix 1), peat, bark, sand and compost (Mix 2), and peat, sawdust and sand (Mix 3). When water was withheld and the soil matric potential ($\Psi_{i,m}$) was lowered, plants grown in Mix 2 maintained higher $\Psi_{s,r}$ as well as higher $\Psi_{i,x}$. However, when the soil mix was rehydrated, $\Psi_{s,r}$ was always lower during the re-wetting than during the drying cycles. The relationship between $\Psi_{i,m}$ and $\Psi_{s,r}$ showed a strong hysteresis-like behavior. Hysteresis was greatest in Mix 2 and least in Mix 3. Hysteresis of $\Psi_{i,x}$ or E_A showed a similar trend to that of $\Psi_{s,r}$. The differences among soil mixes in hysteresis of $\Psi_{s,r}$ might be related to the unsaturated hydraulic conductivity of substrates. Reproduced with permission from the CAB Abstracts database.

1147. The management of bedding litter and mastitis.

Escobal, I.; Martinez, L.; and Esnal, A.

Albeitar 65: 20-21. (2003).

Notes: Original title: El manejo de las camas y las mamitis.

Descriptors: bark/ cattle housing/ cows/ dairy cows/ litter/ mastitis/ sawdust/ straw/ cattle sheds

Abstract: An account is given of the type of litter used, its cleanliness and the frequency of changing it on the count of bacteria causing mastitis in dairy cows. Other factors considered were housing density, cow feeding, cleanliness of pens, humidity and the storage of litter. Data are tabulated for the bacterial count of straw, Peruvian bark shavings, wood shavings and sawdust bedding materials (0 and 24 h after use). It was concluded that although bedding consisting of straw and Peruvian bark shavings had a higher bacterial count than that from wood shavings and sawdust, efficient management of litter is more important than the type of litter used.

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1148. Manioc peel and charcoal: A potential organic amendment for sustainable soil fertility in the tropics.

Topoliantz, S.; Ponge, J. F.; and Ballof, S.

Biology and Fertility of Soils 41(1): 15-21. (2005)

NAL Call #: QH84.8.B46; ISSN: 0178-2762

Descriptors: calcium/ carbon nitrogen ratio/ cassava/ cassava peel/ charcoal/ crop production/ crop yield/ exchangeable aluminium/ growth/ magnesium/ mulches/ nutrient availability/ nutrient content/ organic amendments/ organic farming/ Oxisols/ phosphorus/ sawdust/ shifting cultivation/ soil acidity/ soil fertility/ soil types/ sustainability/ tropical soils/ tropics/ bush fallowing/ eco agriculture/ ecological agriculture/ exchangeable aluminum/ manioc/ mulching materials/ organic culture/ slash and burn/ swidden agriculture/ tapioca plant/ tropical countries/ tropical zones

Abstract: In tropical areas, where crop production is limited by low soil quality, the development of techniques improving soil fertility without damage to the environment is a priority. In French Guiana, we used subsistence farmer plots on poor acidic soils to test the effect of different organic amendments, bitter manioc peel (M), sawdust (Sw) and charcoal (Ch), on soil nutrient content, earthworm abundance and yard-long bean (*Vigna unguiculata sesquipedalis*) production. The peregrine *Pontoscolex corethrurus* was the only earthworm species found. Pod production and plant growth were lowest in unamended soil. The application of a mixture of manioc peel and charcoal (M+Ch) improved legume production compared with other organic mixtures. It combined the favourable effects of manioc peel and charcoal. Manioc peel improved soil fertility through its low C:N ratio and its high P content, while charcoal decreased soil acidity and exchangeable Al and increased Ca and Mg availability, thus alleviating the possible toxic effects of Al on plant growth. The M+Ch treatment was favourable to *P. corethrurus*, the juvenile population of which reached a size comparable to that of the nearby uncultivated soil. The application of a mixture of manioc peel and charcoal, by improving crop production and soil fertility and enhancing earthworm activity, could be a potentially efficient organic manure for legume production in tropical areas where manioc is cultivated under slash-and-burn shifting agriculture.

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1149. Manipulating bedding materials and PLT™ to reduce NH₃ emissions from broiler manure.

Tasistro, A. S.; Cabrera, M. L.; Ritz, C. W.; and Kissel, D. E.

Bioresource Technology 99(6): 1952-1960. (2008)

NAL Call #: TD930.A32 ; ISSN: 0960-8524

Descriptors: ammonia/ ammonium/ carbon dioxide/ carbon nitrogen ratio/ emission/ groundnut husks/ litter/ paper/ poultry manure/ sawdust/ straw/ waste utilization/ wheat/ wheat straw/ wood shavings/ groundnut shells/ peanut husks/ peanut shells/ poultry litter

Abstract: We studied the effect of five bedding materials (wood shavings, sawdust, peanut hulls, wheat straw and shredded paper) and PLT™ (a commercial formulation of Na bisulfate) in factorial combinations, on NH₃ emissions from broiler manure. Treatments were incubated for 11 days at 25 degrees C and 98% relative humidity. Ammonia was trapped in 0.1 N H₂SO₄ and measured colorimetrically as NH₄⁺, and CO₂ was monitored with an infrared analyzer. Ammonia and CO₂ emissions were suppressed by PLT™ throughout the study. Wheat straw, wood shavings, and sawdust, with C(total)/N(total) > 50 or C(biodegradable)/N > 20, had low NH₃ emissions. Total NH₃ emissions from peanut hulls and shredded paper were the highest,

probably due to peanut hulls' low C/N ratio and shredded paper's alkaline pH. No significant interactions on NH₃ emissions were detected between PLT™ and bedding materials.

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1150. Manipulating the N release from N-rich crop residues by using organic wastes on soils with different textures.

Chaves, B.; Neve, S. de; Piulats, L. M.; Boeckx, P.; Cleemput, O. van; and Hofman, G.

Soil Use and Management 23(2): 212-219. (2007)

NAL Call #: S590.S68; ISSN: 0266-0032

Descriptors: carbon nitrogen ratio/ cauliflowers/ crop residues/ leeks/ microbial activities/ mineralization/ nitrogen/ organic wastes/ overwintering/ sandy loam soils/ sawdust/ silt loam soils/ sludges/ soil texture/ soil types/ vinasse/ Capparales/ heading broccoli/ microbial biomass

Abstract: The potential to manipulate the N release from vegetable crop residues (cauliflower, leek) by using organic wastes was tested under field conditions on three soil textures during 2 years (silt loam, sandy loam and loamy sand). During the first year, incorporation of green waste compost and sawdust did not significantly increase microbial biomass N and did not lead to a significant N immobilization of crop residue-N. During the second year, straw did increase microbial biomass N and showed a good N immobilization potential in all textures. The largest increase in microbial biomass N and the greatest N immobilization occurred in the loamy sand soil. The texture effect was probably because of better incorporation of the crop residues and immobilizer wastes in the loamy sand soil compared with the other textures. During spring, there was no consistent remineralization of immobilized N after the addition of malting sludge or vinasses in either year. This could be a result of the limited amount of N immobilized and available for remineralization in the first year or an unsuitable composition of the remineralizer wastes.

Reproduced with permission from the CAB Abstracts database.

1151. Manipulating the quantity, quality, and manner of C addition to reduce soil inorganic N and increase C4:C3 grass biomass.

Bleier, J. S. and Jackson, R. D.

Restoration Ecology 15(4): 688-695. (2007)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: biomass production/ carbon/ immobilization/ mineralization/ sawdust/ soil amendments/ soil types/ sugar/ inorganic nitrogen/ restoration ecology/ United States of America

Abstract: Applying C to soils has been proposed as a plant community restoration tactic because it has been shown to immobilize inorganic N, which should confer a competitive advantage to slower growing plants that are often key components of the desired plant community. Disparate experimental and survey results have led to questions about the appropriate quality and quantity of C to apply. We conducted a single-season glasshouse experiment in three soil types to determine how the quality (sugar, sawdust, sugar+sawdust), quantity (1 and 5 kg sugar or sawdust/m²), and mode of application (surface applied or

mixed into soil) of C affected soil inorganic N pools, net mineralization rates, and aboveground biomass of coexisting C3 and C4 plant species. Carbon applied as sawdust mixed into the soil resulted in the highest level of immobilization in the short term (6 weeks), but all combinations and rates of sugar and sawdust application resulted in immobilization over this period. In the long term (24 weeks), most amendments immobilized N and suppressed aboveground biomass of the C3 grass, *Bromus inermis*, but the high rate of sugar resulted in the strongest immobilization and C3 suppression. However, this treatment also maintained the highest soil inorganic N pool at season's end, which calls into question its effectiveness if longer-term benefits are desired. Neither net mineralization rates nor soil inorganic N pools were correlated to the ratio of C4 to C3 plant biomass at season's end indicating that the mechanisms for favorable plant response to C addition are not understood. Reproduced with permission from the CAB Abstracts database.

1152. Mass and nutrient losses during the composting of dairy manure amended with sawdust or straw.

Michel, F. C. Jr; Pecchia, J. A.; Rigot, J.; and Keener, H. M. *Compost Science and Utilization* 12(4): 323-334. (2004)

NAL Call #: TD796.5.C58 ; ISSN: 1065-657X

Descriptors: bulk density/ carbon/ carbon nitrogen ratio/ cattle manure/ composting/ losses/ mass/ nitrogen/ nutrients/ phosphorus/ potassium/ sawdust/ soil amendments/ soil density/ straw/ windrows/ swath

Abstract: Composting has become an increasingly popular manure management method for dairy farmers. However, the design of composting systems for farmers has been hindered by the limited amount of information on the quantities and volumes of compost produced relative to farm size and manure generated, and the impact of amendments on water, dry matter, volume and nitrogen losses during the composting process. Amendment type can affect the free air space, decomposition rate, temperature, C:N ratio and oxygen levels during composting. Amendments also initially increase the amount of material that must be handled. A better understanding of amendment effects should help farmers optimize, and potentially reduce costs associated with composting. In this study, freestall dairy manure (83% moisture) was amended with either hardwood sawdust or straw and composted for 110-155 days in turned windrows in four replicated trials that began on different dates. Initial C:N ratios of the windrows ranged from 25:1 to 50:1 due to variations in the source and N-content of the manure. Results showed that starting windrow volume for straw amended composts was 2.1 to 2.6 times greater than for sawdust amendment. Straw amended composts had low initial bulk densities with high free air space values of 75-93%. This led to lower temperatures and near ambient interstitial oxygen concentrations during composting. While all sawdust-amended composts self-heated to temperatures >55 degrees C within 10 days, maintained these levels for more than 60 days and met EPA and USDA pathogen reduction guidelines, only two of the four straw amended windrows reached 55 degrees C and none met the guidelines. In addition, sawdust amendment resulted in much lower windrow oxygen concentrations (<5%) during the first 60

days. Both types of compost were stable after 100 days as indicated by CO₂ evolution rates <0.5 mg CO₂-C/g VS/d. Both types of amendments also led to extensive manure volume and weight reductions even after the weight of the added amendments were considered. However, moisture management proved critical in attaining reductions in manure weight during composting. Straw amendment resulted in greater volume decreases than sawdust amendment due to greater changes in bulk density and free air space. Through composting, farmers can reduce the volume and weights of material to be hauled by 50 to 80% based on equivalent nitrogen values of the stabilized compost as compared to unamended, uncomposted dairy manure. The initial total manure nitrogen lost during composting ranged from 7% to 38%. P and K losses were from 14 to 39% and from 1 to 38%, respectively. There was a significant negative correlation between C:N ratio and nitrogen loss (R²=0.78) and carbon loss (R²=0.86) during composting. An initial C:N ratio of greater than 40 is recommended to minimize nitrogen loss during dairy manure composting with sawdust or straw amendments. This citation is from AGRICOLA.

1153. Mass multiplication of antagonists and standardization of effective dose for management of web blight of urd and mung bean.

Dubey, S. C. and Patel, B.

Indian Phytopathology 55(3): 338-341. (2002)

NAL Call #: 464.8 IN2 ; ISSN: 0367-973X

Descriptors: application rates/ biological control/ biological control agents/ bran/ cattle dung/ crop yield/ fungal antagonists/ fungal diseases/ green gram/ groundnut husks/ growth/ mass rearing/ mortality/ mung beans/ plant disease control/ plant diseases/ plant height/ plant pathogenic fungi/ plant pathogens/ poultry manure/ rice/ rice straw/ root nodules/ roots/ sawdust/ seed germination/ sporulation/ straw/ substrates/ sugarcane bagasse/ wheat/ wheat bran/ wheat straw/ biocontrol agents/ biological control organisms/ death rate/ groundnut shells/ Hyphomycetes/ mung bean/ paddy/ peanut husks/ peanut shells/ phytopathogens/ poultry litter

Abstract: Ten substrates, based on combinations of wheat bran, pulse bran, sugarcane bagasse, rice straw, wheat straw, cow dung, poultry manure, groundnut shell, and sawdust, were used for the mass multiplication of the fungal antagonists *Trichoderma viride* and *Gliricladium virens*. The substrates were mixed with tap water (3/4; v/v) and were sterilized before being inoculated with one-week-old culture of *T. viride* or *G. virens*. The growth of *G. virens* was most pronounced after 4 days of incubation in substrates with groundnut shell and wheat straw + pulse bran. After 6 days of incubation, sporulation was most intensive with pulse bran + sawdust. Growth was slow in manure-based substrates. Growth was not observed in substrates containing sugarcane bagasse + tap water. *T. viride* sporulation was most pronounced after 4 days of incubation in substrates containing wheat straw + pulse bran and rice straw + pulse bran. After 6 days of incubation, pulse bran + sawdust and groundnut shell resulted in superior sporulation. The effect of both antagonists (multiplied in substrates containing pulse bran + sawdust and inoculated at 0.5, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, or 8.0 g/kg soil 24 h

before sowing) on *Rhizoctonia solani* (inoculated at 5 g/kg soil 48 h before sowing) and on mung bean cv. Sunaina and urd bean (*Vigna mungo*) cv. T-9 (sown at 10 seeds/pot) was also investigated. Both antagonists increased seed germination, plant height, root length, root nodule number, and yield, and reduced plant mortality and disease caused by *R. solani*. The highest rate, however, adversely affected seed germination. The inoculation of both antagonists at 6 g/kg soil appeared to be most appropriate.

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1154. Mathematical model for estimating the water evaporation in a deep-litter and conventional slatted floor housing systems for pigs.

Oliveira, P. A. V. de

Engenharia Agrícola 23(3): 398-406. (2003); ISSN: 0100-6916.

Notes: Original title: Modelo matematico para estimar a evaporacao d'agua contida nos dejetos, em sistemas de criacao de suinos sobre cama de maravalha e piso ripado, nas fases de crescimento e terminacao.

Descriptors: composting/ composts/ deep litter housing/ evaporation/ faeces/ mathematical models/ pig housing/ pig manure/ sawdust/ slatted floors/ urine/ waste management/ feces/ piggeries/ sties/ swine housing

Abstract: The reduction of manure production becomes a crucial problem, especially in regions with intensive pig production because of the risks of water pollution by nitrates and air pollution by ammonia. A study was conducted to precisely quantify the contribution of the litter to the water evaporation in a deep-litter housing system, compared to a conventional housing system with slatted floor. The experiment was realized in 2 cells of 12 pigs each, from 25 to 100 kg of live weight. In the first cell, the pigs were housed on a deep sawdust litter and in the second in a full slatted floor. A methodology for quantification the amount of water evaporated from the cell or stored in the slurry was developed and validated through a mass balance in the cell with slatted floor. In the deep-litter system, most of the water from faeces and urine was evaporated, and water evaporation was negligible in the slatted floor. The amount of slurry was largely reduced and stabilized in the form of a compost in the deep litter system. Reproduced with permission from the CAB Abstracts database.

1155. Matricconditioning improves the quality and protein level of medium vigor hot pepper seed.

Ilyas, S.; Sutariati, G. A. K.; Suwarno, F. C.; and Sudarsono

Seed Technology 24(1): 65-75. (2002); ISSN: 1096-0724

Descriptors: chemical composition/ gibberellic acid/ plant composition/ plant growth regulators/ protein content/ sawdust/ seed germination/ seed quality/ seed treatment/ seeds/ vigour/ chemical constituents of plants/ plant growth substances/ plant hormones/ vigor

Abstract: The objective of this study was to invigorate medium vigor hot pepper [*Capsicum annum*] seed using matricconditioning. In one experiment, medium (80% germination, 2-year-old) vigor seeds of hot pepper were subjected to various invigoration treatments. In the subsequent experiment, medium and high (95% germination, one-year-old) vigor hot pepper seeds were subjected to matricconditioning treatment at 15 degrees C for 6 days using sawdust (210 micro particle size)

moistened with 100 micro M gibberellic acid (GA₃). In the later experiment, the ratio of seed to sawdust to GA₃ solution in the matricconditioning treatment was 1:2:5. Seed quality of matricconditioned medium vigor seed was enhanced over the untreated seed as indicated by a higher percent of germination, improved vigor index, and speed of germination. The total protein isolated from matricconditioned seed was 16% higher than that from untreated. Meanwhile, total protein isolated from high vigor seed was 10% higher than that from medium vigor seed. Qualitative changes in the profiles of total protein isolated from matricconditioned seeds occurred within the 76, 45, 38, 30 and 20 kDa polypeptides. Matricconditioning with sawdust and GA₃ offers an alternative for improving seed quality of hot pepper seeds.

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1156. Method of sawdust-based cultivation of shiitake (*Cortinellus shiitake*) and a cultivation water tank used for the method.

Inoue, Sadayuki; Ayusawa, Sumio; and Eda, Katsumasa

Official Gazette of the United States Patent and Trademark Office Patents 1257(2)(2002); ISSN: 0098-1133

Descriptors: sawdust/ shiitake/ *Cortinellus shiitake*/ cultivation/ water tanks

Abstract: A method of sawdust-based cultivation of Shiitake (*Cortinellus Shiitake*) and a cultivation water tank used for the method in which a top portion of a cultivation bag which includes a cultivation bed (sawdust-based substrate) is cut to expose a top surface of the cultivation bed and water is poured into a gap between the bag and bed; and a cultivation water tank comprises a framework, water tanks arranged in the framework, sawdust-based substrates arranged in the water tank, a latticed frame, water sprinklers, an air blower and illuminators, a pump connected to the water pipe and the exhaust pipe through a pipe, exhaust pipes provided at a drain pipe so that water may not overflow onto the top surface of the sawdust-based substrates which is characterized in that water is circulated to refrain mushrooms from fruiting and growing from the side and bottom faces of the sawdust-based substrates, but to grow only from the top surface of sawdust-based substrates.

© Thomson Reuters

1157. Microbial stabilization of pig slurry solids amended with natural zeolite and/or sawdust.

Vargova, M.; Sasakova, N.; Venglovsky, J.; Ondrasovicova, O.; Vucemilo, M.; and Tofant, A.

Stocarstvo 54(4): 253-260. (2000); ISSN: 0351-0832

Descriptors: animal wastes/ pig slurry/ public health/ waste treatment/ hogs/ livestock wastes/ swine

Abstract: The effects of natural zeolite clinoptilolite on microbial stabilization of the solid fraction of pig slurry supplemented with zeolite and/or sawdust were investigated during a 6-week storage period with turning after 1 and 3 weeks. The solid fraction was obtained by mechanical separation on vibrating sieves in the first stage of aerobic pig slurry treatment. Temperatures recorded in the substrates S1-S4 (S1=control; S2=SF+2% zeolite; S3=SF+2% sawdust; S4=SF+2% zeolite+2% sawdust) showed a significant positive effect of zeolite during the first 3 weeks of storage. Plate counts of psychrophilic, mesophilic and coliform bacteria were also affected by

zeolite and corresponded to temperature. At the end of the experiment, fecal coliform counts were by one order lower in supplemented substrates (S2-S3) compared with the control (S1).
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1158. Movement and environmental load of nitrogen derived from compost in greenhouse culture.

Fujita, N. and Furukawa, Y.

Bulletin of the Nara Prefectural Agricultural Experiment Station 36(21-27)(2005); ISSN: 1345-6393

Descriptors: application rates/ cattle manure/ composts/ crop yield/ nitrate nitrogen/ nitrogen/ nitrogen oxides/ nutrient availability/ nutrient balance/ sawdust/ spinach/ Capparales

Abstract: Cattle compost mixed with sawdust (0, 30 or 120 mg/ha) was used continuously for 5 years for year-round greenhouse-cultured komatsuna [*Brassica campestris*] and spinach. When mature compost was applied at 120 mg/ha, more than 30 mg N/ha derived from the compost was retained in the soil. The same treatment reduced the rate of N₂O derived from the compost, consequently reducing the NO₃-N retained in the soil. The compost at 120 mg/ha reduced the yields of komatsuna and spinach, and adversely affected the soil nutrient balance.
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1159. Mulch induced eco-physiological growth and yield of maize.

Awal, M. A. and Khan, M. A. H.

Pakistan Journal of Biological Sciences (Pakistan) 3(1): 61-64. (Jan. 2000)

NAL Call #: QH301 .P355; ISSN: 1028-8880.

Notes: 1 ill., 3 tables, 18 ref. Summary (En). Citation notes: PK (Pakistan).

Descriptors: mulch/ eco-physiological growth/ yield/ maize
Abstract: Mulching effects of sawdust, ash, rice straw and water hyacinth on growth, dry matter partitioning, earliness, yield attributes and yield of maize were studied. All mulches except sawdust significantly influenced the SLA, CGR, NAR and DM partitioning, but with no apparent effect on RGR. Water hyacinth and rice straw mulches hastened the tasseling, Bilking and maturity time by 6, 8 and 8 days respectively and produced double the amount of biological and economic yield as compared to the control and sawdust, the ash mulch behaved intermediately. Significantly higher harvest index. was also observed under water hyacinth and rice straw mulches.
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1160. Mulching effects on soil physical properties and peanut production.

Khan, A. R.

Italian Journal of Agronomy 6(2): 113-118. (2002); ISSN: 1125-4718

Descriptors: aeration / bulk density/ crop production/ crop yield/ diffusion/ evaporation/ groundnuts/ lateritic soils/ mulches/ mulching/ oxygen/ plant water relations/ polyethylene/ porosity/ rice/ rice husks/ rice straw/ sandy loam soils/ sawdust/ soil physical properties/ soil

temperature/ soil types/ soil water/ straw/ Ultisols/ water use efficiency/ mulching materials/ paddy/ peanuts/ physical properties of soil/ polythene/ rice hulls/ soil moisture

Abstract: A field experiment was conducted on lateritic sandy loam soil (Ultisols) in the coastal belt of Bay of Bengal (Eastern India) to investigate the variable soil surface conditions which can create favourable soil physical conditions and improve the productivity and water use efficiency of groundnuts. The treatments spread on the soil surface were: rice husk (6 t/ha); rice husk incorporated (6 t/ha); paddy straw (6 t/ha); sawdust (6 t/ha); water mulch; clear polyethylene; black polyethylene; and bare (control). Physical properties of soils such as bulk density, aeration porosity, soil temperature and oxygen diffusion rate were studied under these vegetative and plastic mulches. Data showed that relatively higher values of bulk density occurred in bare as compared to mulched plots. Plastic mulches maintained minimum values of bulk density during the two years of experimentation. The radiation interception due to shading and evaporative cooling were responsible for lower soil temperature under vegetative mulches, whereas incident short wave radiation was transmitted through clear polyethylene sheets and absorbed directly by the soil causing higher soil temperature. Minimum depletion of moisture was observed in plastic mulches. Increased pod yield of groundnut and higher water use efficiency were recorded under plastic mulches. Mulched plots were in better position to store and retain moisture for a longer period.

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1161. Mulching-induced alteration of microclimatic parameters on the morpho-physiological attributes in onion (*Allium cepa* L.).

Rahman, M. S. and Khan, M. A. H.

Plant Production Science 4(3): 241-248. (2001); ISSN: 1343-943X

Descriptors: ash/ burnt soils/ dry matter accumulation/ flowering date/ leaf area index/ mulches/ mulching/ onions/ plant height/ rice husks/ roots/ sawdust/ soil temperature/ soil water/ LAI/ mulching materials/ rice hulls/ soil moisture
Abstract: The effects of mulches (rice husk, sawdust, ash and burnt soil) on soil temperature and moisture conservation of soil, and their relationship with morpho-physiological attributes of onion (cv. Faridpuri Bhati) were studied in Bangladesh during 1995 and 1996. All mulches except ash were effective in conserving soil moisture. The sawdust mulch retained the soil moisture most effectively, followed by rice husk and burnt soil. For almost all stages of growth and at any time of the day, ash mulch retained the soil temperature most effectively. Sawdust was least effective in this aspect. Dry matter accumulation, leaf area index (LAI), plant height and root length were significantly influenced by these mulches. Mulching increased the number of scapes, but the effect of the number of scapes on their fresh and dry weights were insignificant. Ash mulch induced early flowering while the other mulches significantly delayed it. Thus, the use of ash as mulch was better compared to the other three mulches. This might be due to

the increased soil temperature under ash mulch. Further work is required to elucidate the fertilizing effect of the mulches.

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1162. Mulching with shredded wood or Miscanthus chips maintains soil moisture and promotes soil fertility as well as vegetative and reproductive growth of young apple trees.

Beeck, C. in der; Pude, R.; and Blanke, M. *Erwerbsobstbau* 48(2): 47-61. (2006); ISSN: 0014-0309.

Notes: Original title: Holzhacksel und Miscanthusmulch erhalten die Bodenfeuchte und fördern die biologische Bodenaktivität sowie vegetatives und generatives Wachstum junger Apfelbäume.

Descriptors: apples/ carbon nitrogen ratio/ growth/ light relations/ microbial activities/ mineral uptake/ mineralization/ mulches/ mulching/ nitrogen/ nutrient uptake/ plant nutrition/ potassium/ soil fertility/ soil water/ wood chips/ mulching materials/ soil moisture

Abstract: Tree rows of a 2-year-old apple (cv. Topaz) orchard in Klein-Altendorf, Bonn, Germany, were mulched with either (a) high (6 cm; 17 t dm/ha), (b) low (3 cm, 7 t dm/ha) shredded stems of Miscanthus in July 2004, or (c) shredded broadleaved tree trunks (5 cm; 29 t dm/ha) in January 2005 to conserve resources and achieve closed systems. An uncovered soil served as the control. The soil covered with any of the three mulches mineralized 7-14 kg less N/ha throughout the growing season resulting in a more balanced N mineralization. The reduction in N supply prevented late vegetative growth and contributed to good fruit colouration. The largest soil respiration was recorded with wooden chips as mulch with a peak of 1.6 CO₂ m⁻² h⁻¹ in June-July, followed by Miscanthus mulch and the uncovered control, which indicates enhanced microbial activity in the summer as a result of medium C/N ratio, warming and better aeration of the wood chips. The organic mulches preserved soil moisture with values of less than 53 centibars and with less fluctuation than in the control. The organic mulches reflected ~10% of incident PAR 1 m above ground, i.e. more light than uncovered soil, all without affecting fruit colouration. The two thicker (5 and 6 cm) organic mulches suppressed weed population by 63-67% relative to the control. The two thicker (5-6 cm) organic mulches improved potassium uptake by the apple leaves with 1.5% K relative to 1.3% K in the control on a leaf dry matter basis, but reduced their calcium and magnesium content. Wood chips as mulch improved the vegetative growth of the apple trees during the growing season, measured as trunk diameter, of 4 mm, followed by 3.6 mm of the high Miscanthus and 2.8 mm in both the low Miscanthus mulch and the control. 8. The organic mulches enlarged apple fruit diameter from 78 mm in the control to 80 mm with a concomitant increase in fruit weight from 180 g in the control to 185-188 g.

This citation is from AGRICOLA.

1163. Mushroom cultivation using smoke-heated softwood sawdust.

Yoshizawa, N.; Itoh, T.; Ohnishi, M.; Ishiguri, F.; Ando, M.; Yokota, S.; Sunagawa, M.; and Idei, T.

Bulletin of the Utsunomiya University Forests 34: 69-79. (1998)

NAL Call #: 99.9 UT72 ; ISSN: 0286-8733

Descriptors: chemical composition/ cultural methods/ edible fungi/ growing media/ heat treatment/ plant extracts/ sawdust/ softwoods/ vegetables/ Basidiomycetes/ Coriolaceae/ Grifola/ Grifola frondosa/ heat processing/ Hypsizygus mamoreus/ Larix leptolepis/ Lentinaceae/ Poriales/ potting composts/ rooting media/ smoke treatment/ Tricholomataceae/ vegetable crops

Abstract: The use of smoke-heated sugi (*Cryptomeria japonica*) and karamatsu (*Larix leptolepis*) sawdust for sawdust-based cultivation of shiitake (*Lentinus edodes* [*Lentinula edodes*]) and hiratake (*Pleurotus ostreatus*) edible fungi was investigated in order to offset the shortage of hardwood sawdust as a cultural substrate. Brief details are also included of more limited tests on the cultivation of 3 other edible fungi (enokitake, *Flammulina velutipes*; maitake, *Grifola frondosa*; bunashimeji, *Hypsizygus mamoreus*). In chemical analyses of sawdust prepared from smoke-heated logs of sugi and karamatsu, the hot-water, 1% sodium hydroxide, and ethanol-benzene extracts were reduced in comparison with non-treated sawdust. This could lead to the promotion of active mycelial growth. In tests with shiitake cultivation using both sugi and karamatsu smoke-heated sawdust, yields of fruiting bodies decreased with increases in mixing ratios of softwood sawdust with beech sawdust (from 100% beech through 3:1, 1:1, 1:3 beech/softwood to 100% softwood). The best mixtures were 3:1 and 1:1 beech/softwood) and smoke treated sugi sawdust gave better shiitake fruiting body yields than non-smoke treated sugi and smoke treated karamatsu. In the sawdust-based cultivation of hiratake using smoke-heated sugi or karamatsu sawdust in the same ratios with beech as above, yields of fruiting bodies were similar in the various media mixes and with smoke-heated or non-heated softwood sawdust. The results suggest that smoke-heated sawdust of both sugi and karamatsu would be useful for the cultivation of shiitake and hiratake mushrooms, and would in addition reduce the cost of mushroom cultivation. Reproduced with permission from the CAB Abstracts database.

1164. Mycobiota of soil amended with sawdust with refer to influence of various carbon sources on polygalacturonases produced by *Aspergillus terreus*.

Barakat, A.; El Shanawany, A. A.; and El Maghraby, Y. H. *African Journal of Mycology and Biotechnology* 11(3): 39-49. (2003); ISSN: 1110-5879

Descriptors: enzyme activity/ enzymes/ polygalacturonase/ sawdust/ soil amendments/ Hyphomycetes/ pectin depolymerase/ pectinase/ Trichocomaceae

Abstract: Ninety-three species and 2 species varieties belonging to 25 genera were isolated from soil amended with sawdust and non amended soil (control). The total counts of fungi and number of genera and species were higher in amended soil with sawdust than the non amended soil. *Aspergillus*, *Emericella* and *Penicillium* were the most prevalent genera recovered from both soil types in all experimental periods. The 90 fungal isolates which were recovered during this work were screened for their capabilities to produce pectinase enzyme and the effect of different carbon sources on the activities of the endo- and exo-polygalacturonases (PG) produced by *A. terreus* were also studied.

This citation is from AGRICOLA.

1165. New results concerning the importance of substrate composition in *Pleurotus* sp. cultivation.

Ficior, D.; Indrea, D.; Apahidean, A. S.; Apahidean, M.; Maniutiu, D.; Ganea, R.; Bobaila, M.; and Paven, I. *Buletinul Universitatii de Stiinte Agricole si Medicina Veterinara Cluj Napoca Seria Horticultura* 61: 45-48. (2004); ISSN: 1454-2382

Descriptors: crop yield/ maize cobs/ sawdust/ straw/ substrates/ wheat/ wheat straw/ Lentinaceae/ Poriales

Abstract: Experiments were carried out during 2000-02 in an old greenhouse to investigate the effect of substrate composition on *Pleurotus* sp. cultivation. The treatments comprised maize cobs, wheat straw, beech sawdust, 50% wheat straw+50% maize cobs, 50% beech sawdust+50% maize cobs, 50% wheat straw+50% beech sawdust, 25% wheat straw+75% maize cobs, 75% wheat straw+25% maize cobs, and 33% maize cobs+33% wheat straw+33% beech sawdust. The materials were shredded into pieces of 1-3 cm (in the first 2 years) or 3-7 cm (in the last year) and then, moistened. The highest average yield (12.66 kg/120 l) was recorded with 25% wheat straw+75% maize cobs and the lowest (2.93 kg/120 l) with beech sawdust. Wheat straw in combination with maize cobs or beech sawdust improved the quality of the substrate. The dimensions of the materials could affect the yield.

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1166. New role of sulfuric acid in production of multicomponent fertilizers from renewable sources.

Górecka, H.; Górecki, H.; Chojnacka, K.; Baranska, M.; Michalak, I.; and Zielinska, A.

American Journal of Agricultural and Biological Science 2(4): 241-247. (2007); ISSN: 15574989

Descriptors: animal bones/ NPK fertilizers/ poultry feather/ renewable sources/ slaughter wastes/ sulfuric acid/ wood ash/ animalia

Abstract: The paper discusses the possibility of using renewable sources: slaughter wastes and wood ashes in the production of NPK fertilizers. The content of macronutrients, micronutrients and toxic elements in these materials was reported. In the present work, poultry feathers were used as fertilizer source of nitrogen, animal bones as the source of phosphorus and wood ash as the source of potassium and micronutrients. Bioavailability of fertilization components was increased by mineralization with sulfuric acid, which transformed keratinous nitrogen of poultry feathers into ammonia nitrogen, hydroxyapatite phosphorus to bioavailable orthophosphate. Also, mineralization of organic content of the materials was achieved. The method of production and the composition of NPKS fertilizer, the content of which was adjusted to the requirements of oil seed rape was provided. The fertilization properties were checked in germination tests. © 2007 Science Publications.

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1167. Nitrogen content of shiitake mushroom (*Lentinus edodes* (Berk.) Sing.) cultivated on sawdust medium and dependence on that in the medium.

Fujihara, S.; Kasuga, A.; Sugahara, T.; Hashimoto, K.; Kiyomizu, Y.; Nakazawa, T.; and Aoyagi, Y.

Journal of the Japanese Society for Food Science and Technology 47(3): 191-196. (2000)

Descriptors: amino acids/ bran/ carbohydrates/ chemical composition/ composition/ edible fungi/ growing media/ maize/ nitrogen/ nucleic acids/ quality/ rice/ rice bran/ sawdust/ soyabeans/ vegetables/ corn/ paddy/ potting composts/ rooting media/ saccharides/ soybeans/ Tricholomataceae/ vegetable crops

Abstract: *L. edodes* [*Lentinula edodes*] was cultivated on sawdust media to which had been added okara (insoluble residue of homogenized soyabean produced as a waste product of tofu manufacture), rice bran or maize bran (5, 10, 15, 25 or 35%). Total N in media and fruiting bodies was determined. Fruiting bodies were analysed for total amino acids, amide-N, free amino acids, nucleic acids and chitin. N contents of fruiting bodies were closely related to those of the growing media. No significant relationship between lentinic acid concentration in fruiting bodies and N content of the medium was observed. The concentration of lentinic acid in fruiting bodies cultivated on media supplemented with rice bran and maize bran was about twice that of fruiting bodies obtained from okara-amended media. High levels of N in sawdust media could decrease carbohydrates in fruiting bodies, thus reducing quality (fruiting bodies too soft to eat).

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1168. Nitrogen transformations during pig manure composting.

Huang, G. F.; Wu, Q. T.; Li, F. B.; and Wong, J. W.

Journal of Environmental Sciences (China) 13(4): 401-5. (Oct. 2001)

NAL Call #: TD187.5.C6J68; ISSN: 1001-0742 .

11723923

Descriptors: animals/ biotransformation/ conservation of natural resources/ germination/ hydrogen-ion concentration/ manure/ nitrogen: chemistry: metabolism/ plant leaves/ refuse/ disposal: methods/ seeds/ swine/ wood

Abstract: Composting is now suggested as one of the environmentally and friendly alternative method for disposal of solid organic wastes, as it leads to minimization, stabilization, and utilization of organic waste. Transformations of nitrogen were investigated in co-composting of pig manure with different amendments, such as sawdust and leaves. Samples were analyzed for pH, total-N, soluble NH₄-N, soluble NO₃-N and soluble organic-N. The total-N increased after 63 days of composting, as well as the soluble NO₃-N and soluble organic-N. Soluble NH₄-N increased significantly and showed peak values at day 7, thereafter decreased sharply and gradually to lower levels. Seed germination index (GI) showed that co-composting of pig manure with sawdust reached maturity after 49 days of composting, while co-composting of pig manure with sawdust and leaves required shorter time for 35 days. Soluble NH₄-N was significantly negatively ($P < 0.05$), while soluble NO₃-N and soluble organic-N were significantly positively ($P < 0.05$), correlated with seed germination index (GI). Addition of leaves in co-composting of pig manure with sawdust had no significant impacts on nitrogen transformations, but it was beneficial for maturity of pig manure compost.

This citation is from PubMed.

1169. Nitrogenous gas emissions during the rearing of pigs on sawdust litter.

Kermarrec, C. and Robin, P.

In: 34emes Journees de la Recherche Porcine, sous l'egide de l'Association Francaise de Zootechnie.Paris, France.); pp. 155-160; 2002.

Notes: Original title: Emissions de gaz azotes en elevage de porcs sur litiere de sciure.

Descriptors: ammonia/ floor pens/ litter/ nitrogen/ nitrogen balance/ nitrous oxide/ sawdust/ slatted floors/ ventilation/ hogs/ swine

Abstract: The early composting of pig slurry in rearing systems based on litter leads to nitrogenous gas emissions. The types of molecules and the amounts emitted depend on both livestock and litter management. Our objectives were firstly to characterise the difference between the fully-slatted floor system (used as a reference system) and the deep litter sawdust system, secondly to explore the variability in emissions depending on the area in the pen (either excretion or sleeping area) and the management system (litter either turned or not turned). The experiments were conducted under controlled conditions, and the gas emission measurements were compared with the mass balance (food, pig, and litter or slurry). The comparison of the slatted floor and litter systems was performed under the same conditions: climate, building, animals and food. The comparison showed that there was a large discrepancy in nitrogen balance that could be attributed to atmospheric nitrogen (N_2) in the deep litter system. The study of the variability in emissions showed that nitrogen losses were negligible when the litter contained high levels of available carbon and when it was porous. This is of interest in the conservation nitrogen. Conversely, the highest nitrogen losses occurred with low carbon availability. In the latter case, ammonia (NH_3) was emitted from the surface where defaecation occurred and nitrous oxide (N_2O) was emitted from deep within the litter. Deep litter emissions of N_2O were highest when litter was turned.

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1170. A note on the effect of bedding materials on the performance of lactating piglets.

Gonzalez, C.; Ortega, J.; Vecchionacce, H.; and Diaz, I.

Cuban Journal of Agricultural Science 33(4): 383-386.

(1999); ISSN: 0864-0408

Descriptors: coffee/ crop residues/ diarrhoea/ farrowing pens/ lactation/ lesions/ litter/ liveweight gain/ mortality/ piglets/ pines/ rice husks/ sawdust/ wood shavings/ death rate/ diarrhea/ hogs/ liveweight gains/ rice hulls/ scouring/ swine

Abstract: The effects of different bedding materials on the survival, liveweight gain and diarrhoea incidence in lactating piglets were evaluated. An experiment was carried out using a completely randomized design with 42 observations distributed in 7 treatments consisting of a control (without bedding) or the use as bedding of pine or common sawdust, pine or common shavings, coffee parchment or rice hulls. The bedding was placed in the farrowing stalls from birth until 15 days of age. There were statistically significant ($P < 0.01$) differences between treatments for articular lesions at the limbs and the volume of bedding used. Articular lesions increased with the abrasiveness of the material used, being higher with common shavings, rice hulls or no bedding. The highest

bedding expenses were for pine sawdust, pine shavings, coffee parchment and rice hulls, and the lowest for common sawdust and common shavings. There was no treatment effect on daily gain, diarrhoea frequency or mortality. It is suggested that there is better performance in the pig litters with bedding than without it.

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1171. Nutrient absorption characteristics of greenhouse tomato cultivated with organic substrates.

Chen ShuangChen; He ChaoXing; Zou ZhiRong; and Zhang ZhiBin

Plant Nutrition and Fertilizer Science 11(3): 369-374.

(2005); ISSN: 1008-505X

Descriptors: crop residues/ farmyard manure/ growing media/ maize stover/ mushroom compost/ nitrogen/ nutrient requirements/ nutrient uptake/ peat/ phosphorus/ plant nutrition/ potassium/ poultry manure/ protected cultivation/ sawdust/ straw/ substrates/ tomatoes/ wheat/ wheat straw/ cultivation under glass or plastic/ dietary standards/ food requirements/ FYM/ nutritional requirements/ potting composts/ poultry litter/ rooting media

Abstract: In a greenhouse experiment, tomato hybrid Zhongza plants were grown on various mixtures of artificial organic substrates prepared with fermented broken-up maize stalk, wheat straw, peat moss, straw ash, sawdust, spent mushroom compost, dung and poultry manure. Different formulae of the substrates resulted in differences in N, P and K uptake per plant, nutrient use efficiency and nutrient allocation to various portions of the plants. The ratio of $N:P_2O_5:K_2O$ for the whole growing season was 1:0.194-0.375:0.903-1.412. Calculated according to the yield data, N, P_2O_5 and K_2O required for the production of 100 kg tomato was 136.7-201.4, 39.9-60.0 and 156.7-235.7 g, respectively. The best organic substrate formula was dried dung:maize stalk:sawdust/spent mushroom compost (1:2:1).

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1172. Nutrient availability in soil amended with pecan wood chips.

Tahboub, M. B.; Lindemann, W. C.; and Murray, L.

HortScience: A Publication of the American Society for Horticultural Science 42(2): 339-343. (Apr. 2007)

NAL Call #: SB1.H6; ISSN: 0018-5345

Descriptors: *Carya illinoensis*/ pecans/ nut crops/ wood chips/ soil amendments/ nutrient availability/ immobilization in soil/ soil fertility/ nitrogen/ phosphorus/ potassium/ silty soils/ clay soils/ application rate/ ammonium sulfate/ carbon nitrogen ratio/ crop residue management/ crop residues/ New Mexico

Abstract: Pecan [*Carya illinoensis* (Wangenh.) K. Koch] pruning wood is usually burned, a practice that creates serious environmental concerns. Chipping and soil incorporation of prunings may be an alternative disposal method if nutrient immobilization is not a problem. Our objective was to determine if incorporation of pecan wood chips into soil would affect the availability of nitrogen (N), phosphorus (P), and potassium (K). Pecan wood chips were incorporated into a silty clay soil at rates of 0, 4484, 8968, 13,452, and 17,936 kgp"ha-1 in May or June 2002, 2003, and 2004. Some plots received N (ammonium sulfate) at a rate of 0, 15.2, 30.5, 45.7, and 61.0 kgp"ha-1

to adjust the C:N ratio of trimmings to 30:1. Wood chip incorporation did not significantly decrease inorganic N regardless of application rate or number of applications. When ammonium sulfate was added to balance the C:N ratio, soil inorganic N increased with the rate of wood chip application, also indicating that N immobilization did not occur. Soil-available P and K were not significantly affected after one, two, or three wood chip applications. Soil-available K increased when ammonium sulfate was added to balance the C:N ratio. Soil incorporation of pecan wood chips does not appear to immobilize N, P, or K, thus providing growers with an environmentally viable means of wood disposal.

This citation is from AGRICOLA.

1173. Nutrient dynamics in tropical acid soils amended with wood ash.

Nkana, J. C. V.; Demeyer, A.; and Verloo, M. G.

Agrochimica 44(5/6): 197-210. (2000)

NAL Call #: 385 AG84; ISSN: 0002-1857

Descriptors: acid soils/ chemical composition/ leachates/ lime/ liming/ magnesium/ nitrate/ nutrient availability/ nutrients/ organic carbon/ potassium/ soil amendments/ soil composition/ soil types/ sulfate/ tropical soils/ udults/ ultisols/ wood ash

Abstract: The effects of wood ash and lime on the dynamics of soil nutrients were studied in the laboratory using columns of mixed samples of topsoils from three tropical acid soils (Kandiudult) in the forest zone of central Cameroon. Amendments were applied to attain 80% base saturation and at amounts corresponding to 1 and 2 times the content of exchangeable aluminium. The soil columns were leached for a period of 90 days with an amount of deionized water equivalent to the annual rainfall. Available nutrients in the soil were measured with NH_4OAc pH 4.65 extract. In general, wood ash affected leachate composition more than lime. Application of wood ash led to increases in concentrations of dissolved organic carbon, NO_3 , SO_4 , Ca, Mg and K in the leachates and losses increased with wood ash application rates. Available Ca in the soil subsequent to leaching increased with both wood ash and lime, while available Mg and K increased with wood ash but was not affected with lime. Increases in the leached and available Ca, Mg and K were significant with wood ash application compared to liming. In these particular experimental conditions, an annual maintenance dressing with wood ash of 4.6 t/ha in Mbalmayo soil, 5.7 t/ha in Mengang soil and 4.3 t/ha in Nkolbisson soil would provide enough Ca to compensate losses. However, when taking into account simultaneous additions of Mg and K with wood ash, only their leaching losses can be recovered. Therefore, adequate supplementation with Mg and K fertilizers is still needed to obtain maximum crop yield for the next growth cycle.

This citation is from AGRICOLA.

1174. On-site composting of greenhouse crop residuals.

Cheuk, W.; Fraser, B. S.; and Lau, A.

Biocycle 43(10): 32-34. (2002)

NAL Call #: 57.8 C734 ; ISSN: 0276-5055

Descriptors: composting/ composts/ crop residues/ greenhouses/ pruning trash/ sawdust/ waste disposal/

waste management/ waste treatment/ waste utilization/ wood residues/ glasshouses

Abstract: This paper describes the on-site composting of crop residuals (fruit culls and plant prunings, whole plants removed at the end of the growing season, and spent sawdust growing medium) from vegetable greenhouses in British Columbia, Canada.

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1175. Organic amendments enhance biological suppression of plant-parasitic nematodes in sugarcane soils.

Stirling, G. R.; Wilson, E. J.; Stirling, A. M.; Pankhurst, C. E.; Moody, P. W.; and Bell, M. J.

In: 2003 Conference of the Australian Society of Sugar Cane Technologists. Townsville, Queensland, Australia.; pp. 11; 2003.

Descriptors: cultural control/ decomposition/ grass clippings/ hay/ lucerne/ nematode control/ nitrate/ nitrogen/ pest control/ plant parasitic nematodes/ plant pests/ population density/ sawdust/ soil/ soil amendments/ soil fertility/ soil management/ sugarcane/ sugarcane trash/ alfalfa/ eelworms

Abstract: Previous research has shown that population densities of plant-parasitic nematodes are reduced when a legume crop is grown in rotation with sugarcane. However, this effect is only temporary, as nematodes usually return to high densities within 12 months of planting sugarcane. This rapid resurgence suggests that natural enemies that normally keep plant-parasitic nematodes under control in natural environments may be depleted by the soil-management practices used to grow sugarcane. This paper describes an experiment in which organic materials were added to sugarcane soils in an attempt to enhance biological activity and increase the suppressiveness of soils to plant-parasitic nematodes. The amendments used were sawdust, sugarcane trash, grass hay and legume hay with or without nitrogen, and feedlot manure, poultry manure, chitin and mill mud without additional nitrogen. The chemical and biological changes occurring during the decomposition process were monitored for 12 months, while the capacity of amended soils to suppress lesion and root-knot nematodes was assessed periodically using bioassays. Seven months after amendments were incorporated, soils amended with sawdust, sugarcane trash or grass hay were more suppressive to root-knot nematode than soils amended with nitrogenous materials. Sugarcane grown in soil amended 6 months previously with sawdust, sugarcane trash, grass hay or lucerne hay had 78, 61, 96, and 92%, respectively, fewer lesion nematodes in roots than sugarcane growing in non-amended soil. Low concentrations of nitrate nitrogen in the soil, a fungal dominant soil biology and high numbers of omnivorous nematodes were most closely associated with suppression. These results indicate that the biology of sugarcane soils can be altered by changing the quality and quantity of organic inputs. Amendments with high C/N ratios are most effective in enhancing biological control activity against plant-parasitic nematodes.

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1176. Organic amendments for management of *Heterodera cajani* in pulses.

Devi, S. L.

Indian Journal of Nematology 32(2): 143-146. (2002)

NAL Call #: QL391.N4I5; ISSN: 0303-6960

Descriptors: animal manures/ application rates/ cattle manure/ cowpeas/ cultural control/ Indian mustard/ linseed oilmeal/ neem seed cake/ nematode control/ nodulation/ non wood forest products/ oilseed cakes/ organic amendments/ pest control/ pig manure/ pigeon peas/ plant parasitic nematodes/ plant pests/ poultry manure/ rice husks/ sawdust/ wheat bran/ black eyed peas/ Capparales/ eelworms/ *Heterodera cajani*/ linseed cake/ minor forest products/ neem/ neem seed oilmeal/ non timber forest products/ oil cakes/ poultry litter / rice hulls/ *Secernentea*/ southern peas/ Tylenchida

Abstract: In pot and field experiments conducted in Uttar Pradesh, India, sawdust, rice husk, wheat bran, cow dung, rabbit dung, goat dung, pig dung, and poultry manure, when applied at 400 kg/ha to the soil on which arhar (*Cajanus cajan*) and moong bean (*Vigna sinensis* [V. unguiculata]) were grown, increased plant growth and rhizobium nodulation, and reduced H. cajani population. Oil cake (neem, mustard, and linseed) at 100 and 400 kg/ha were also effective.

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1177. Organic fertilizers based on humic substances for *Pelargonium* and *begonia* crops.

Morard, M. and Morard, P.

PHM Revue Horticole 477: 40-42. (2006); ISSN: 0031-5087.

Notes: Original title: Fertilisants organiques a base de substances humiques en cultures de *Pelargonium* et *begonia*.

Descriptors: fertilizers/ ornamental plants/ sawdust/ soilless culture/ waste utilization/ ornamentals

Abstract: A biostimulant was developed by transformation of sawdust and tested for soilless culture of *Pelargonium* and *begonia* in France. For *Pelargonium*, treatment with 70 mg of biostimulant per litre of nutritive solution resulted in a significant increase in the number of flowers and leaves. Similar effects were obtained for *begonia*.

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1178. Organic matter quality and management effects on enrichment of soil organic matter fractions in contrasting soils in Zimbabwe.

Mapfumo, P.; Mtambanengwe, F.; and Vanlauwe, B.

Plant and Soil 296(1/2): 137-150. (2007)

NAL Call #: 450 P696; ISSN: 0032-079X

Descriptors: application rates/ cattle manure/ clay loam soils/ crop yield/ fertilizers/ maize/ maize stover/ nutrients/ sandy soils/ sawdust/ small farms/ soil organic matter/ soil texture/ soil types/ sunn hemp/ use efficiency/ corn/ organic matter in soil

Abstract: Maintenance of soil organic matter (SOM) at levels that sustain optimal supply of soil nutrients and enhance efficiency of externally added fertilizers is a major challenge for smallholder farming systems of southern Africa. A study was conducted to quantify the interactive effects of organic resource quality and management on SOM formation and subsequent maize yields under

contrasting soil types. *Crotalaria juncea* L., *Calliandra calothyrsus* Meissn., cattle manure, maize (*Zea mays* L.) stover and *Pinus patula* Schiede and Schltdl. and Cham. sawdust were applied at 1.2 and 4 t C ha⁻¹ at Domboshawa and Makoholi Experimental Stations, simulating some of the soil amendments commonly available on smallholder farms. Soils at Domboshawa are sandy-clay loams with 220 g clay kg⁻¹ while the sandy soils at Makoholi had <100 g clay kg⁻¹. At 12-14 weeks after incorporation, organic resource quality effects on particulate organic matter (POM) C enrichment were most significant ($p < 0.01$) in the macro-POM (250-2,000 µm diameter) fraction of both soil types constituting 15-30% of total soil C on coarse sand soil and 5-10% on sandy clay loam soils. The highest increases were under C. calothyrsus, manure and sawdust treatments. There was evidence of sub-soil enrichment under these two treatments on sandy soils at different sites. While no significant treatment effects were observed on the size of organo-mineral fraction, there was a significant ($p < 0.05$) separation of treatments in terms of potential mineralizable N from the same fraction. On coarse sands, organo-mineral fraction under medium to high-quality materials such as manure and C. juncea released ~50 mg N kg⁻¹, compared to 8-18 mg N kg⁻¹ from sawdust and maize stover, suggesting that such materials enhanced the N-supply capacity of this fraction without necessarily increasing its size. The same trends were observed under sandy clay loams although, in contrast to coarse sands, the high-quality materials released no more than 25 mg N kg⁻¹, suggesting that the added C was protected against short-term mineralization. These contrasting properties were also reflected in maize yield patterns. On sandy clay loams, a significant linear relationship between maize yield and the amount of mineralizable N in the macro-POM fraction ($R^2 = 0.50$; $p < 0.01$) was evident, while the best predictor for maize yield on coarse sands was the amount of mineralizable N from the organo-mineral fraction ($R^2 = 0.86$). We concluded that maize productivity on contrasting soil types hinges on different soil organic fractions and therefore require different management strategies. Sustainability of cropping on sandy soils is likely to depend on a regular supply of high-quality C materials, which enhance the nutrient supply capacity of the small organo-mineral fraction. Under the relatively C protective sandy clay loams, it is apparently the size of the macro-POM fraction which largely determines crop yields in the short-term.

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1179. Organic mulches, wood products, and composts as soil amendments and conditioners.

Stratton, M. L. and Rechcigl, J. E.

Handbook of Soil Conditioners: Substances that Enhance the Physical Properties of Soil: 43-95. (1998)

NAL Call #: S661.7.H35 1998

Descriptors: amendments/ bark/ composting/ composts/ management/ mulches/ non wood forest products/ sawdust/ soil chemistry/ soil conditioners/ soil physical properties/ wood products/ minor forest products/ mulching materials/ non timber forest products/ physical properties of soil

Abstract: The beneficial effects of wood products, mulches and composts as soil amendments and conditioners are reviewed. Wood products are generally used as mulches, but sawdust and bark have also been used as soil

amendments. The effects of mulches on soil physical properties (structure, erosion, moisture, temperature), soil chemistry (soil fertility, plant nutrition), soil organisms, pests, and weeds are considered. The composting process is outlined and the effects of compost on soil physical properties (structure, bulk density, erosion, moisture), soil chemistry, soil organisms and pests, and weeds are reviewed. Management issues relating to mulching and composting are discussed.

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1180. Organic okro (*Abelmoschus esculentus*): Its growth, yield and organoleptic properties.

Taiwo, L. B.; Adediran, J. A.; Ashaye, O. A.; Odofin, O. F.; and Oyadoyin, A. J.
Nutrition and Food Science 32(4/5): 180-183. (2002); ISSN: 0034-6659

Descriptors: application rates/ colour/ crop quality/ crop yield/ fertilizers/ flavour/ growth/ microbial activities/ okras/ organic fertilizers/ organoleptic traits/ pods/ poultry manure/ sawdust/ taste/ texture/ color/ flavor/ organoleptic properties/ poultry litter

Abstract: Okro [okra] (*Abelmoschus esculentus*) was grown in the field [location and date not given] and greenhouse and applied with organic-based (OBF), organic (sawdust and poultry manure) and chemical fertilizers. Okro soups produced from the okro fruits harvested from the various fertilizers treatments were subjected to sensory evaluation tests. Application of 10 t/ha organic fertilizers on the greenhouse okro plants led to significant increases in microbial activities in the root zone and it also gave the highest pod yield. In the sensory evaluation test, panellists preferred organically-grown okro soup to the chemically-grown variant when they assessed the colour, taste, texture, flavour and drawness. Organically grown okro enjoyed more acceptability than the chemically grown. In the field trial, no significant effects of all the treatments were found on some growth parameters assessed. However, application of 5 t OBF/ha led to significant increases in the number of okro pods.

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1181. Organic waste materials for soil fertility improvement in the border region of the Eastern Cape, South Africa.

Adediran, J. A.; Baets, N. de; Mnkeni, P. N. S.; Kiekens, L.; Muyima, N. Y. O.; and Thys, A.
Biological Agriculture and Horticulture 20(4): 283-300. (2003)

NAL Call #: S605.5.B5 ; ISSN: 0144-8765

Descriptors: calcium/ cellulose/ copper/ iron/ lignin/ magnesium/ mineralization/ nitrogen/ organic wastes/ phosphorus/ pig manure/ pineapples/ polyphenols/ potassium/ poultry manure/ sawdust/ sewage sludge/ soil fertility/ tobacco/ zinc/ microbial biomass/ poultry litter

Abstract: Sixteen organic wastes (tobacco, sawdust, pig dung, poultry manure, pineapple waste, sewage sludge, hoof and horn meal, coffee waste, bone meal, paunch contents, blood meal, and carcass meal) with potential for enhancing soil productivity were identified in the Border

region of the Eastern Cape, South Africa and were analysed for elemental composition. Pineapple waste (Pw), tobacco waste (Tw), poultry manure (Pm), pig dung (Pd) and commercial compost (Cp) were further analysed for their lignin, polyphenol and cellulose contents. The nutrient release patterns and carbon mineralization of these organic wastes were investigated in laboratory incubation studies in which the organic wastes were mixed with 100 g of soil at rates that supplied 100 kg N ha⁻¹ and incubated for 12 weeks. Incubation of the four organic wastes and Cp resulted in the release of N, P, K, Ca, Mg, Zn, Fe and Cu indicating the potential of the materials to supply these nutrients to crop plants. The mineralization of N was highest during the first four weeks of incubation and the rate of release followed the order Cp>Pd identical-to Pm>Pw identical-to Tw. The N mineralization rate was positively correlated with total N and lignin content and negatively related to the C:N ratio, cellulose, polyphenol and polyphenol:total N. All organic materials had a positive influence on soil microbial biomass but Tw had the least effect, possibly due to the toxic effects of nicotine. With the exception of Pm, organic wastes that had P contents above the critical value of 0.2% released considerable amounts of P especially towards the end of the incubation. Compared with the other micronutrients studied, Zn was released by the organic materials in larger quantities and in proportion to the Zn content of the materials. Based on N mineralization, nature and cost of the materials, Pm, Pd, Pw and Tw were found to be suitable for the improvement of soil productivity. Poultry manure and Pd could be applied directly to soils as sources of N for annual crops while Tw and Pw could be mixed with inorganic fertilizers or used as raw materials in composting.

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1182. Performance characteristics of West African dwarf goat fed *Rhizopus* treated sawdust.

Belewu, M. A. and Popoola, M. A.
Scientific Research and Essays 2(11): 496-498. (2007); ISSN: 1992-2248

Descriptors: crude protein/ diets/ feed intake/ goat feeding/ lignin/ liveweight gain/ sawdust/ West African Dwarf goat breed/ crude fiber/ liveweight gains/ Mucoraceae

Abstract: Feed intake and liveweight gain of West African dwarf (WAD) goats consuming *Rhizopus* treated sawdust were determined. 27 WAD goats in a 3x3 Latin square design with a 196-day period consumed normal diet with 20% untreated sawdust (Treatment 1, control), while Treatments 2 and 3 contained fungus treated sawdust at 20 and 25%, respectively. Crude protein, crude fibre and ether extract consumed increased (P<0.05) by the addition of the fungus treated sawdust for Treatment 3. In contrast, the lignin intake was significantly lower (P<0.05) in Treatments 2 and 3. The weight gain of the experimental animals was highest in Treatment 3. In conclusion, fungus treated sawdust-based diet for growing WAD goats may improve performance as a result of increasing feed intake and liveweight gain.

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1183. pH correction in *Salix* sp. sawdust-perlite mixture used as horticultural growing media in soil less cultivations.

Gariglio, N. F.; Alsina, D. A.; Nescier, I.; and Castellaro, F. J.

Investigacion Agraria Produccion y Proteccion Vegetales 16(2): 205-211. (2001); ISSN: 0213-5000.

Notes: Original title: Correccion del pH en sustratos a base de serrin de Salicaceas.

Descriptors: pH/ *Salix*/ sawdust/ perlite/ soil-less medium

Abstract: *Salix* sp. sawdust is used as growing media in soil less cultivations at Santa Fe (Argentina). However, its pH, as well as that of its mixture with perlite, is higher than the suggested for soil less crops. The aim of this work was to evaluate pH correction and its persistence in *Salix* sp. sawdust-perlite mixture substrates. Sulphur 1% w/w, ferrous sulphate 1% w/w and sphagnum peat (pH 5.67) 10% v/v replacing equal amounts of perlite were evaluated as pH correctors. *Salix* sp. sawdust-perlite, 1:1 (v/v) mixture was used as control. pH and electrical conductivity in the drainage solution were measured to evaluate pH correction and pH persistence. Samples from each treatment were placed in a glass column and daily irrigated with nutrient solution. In another trial, perlite was replaced by different levels of peat and the pH response was evaluated. It was observed that the pH correction obtained through the addition of mineral substances was not adequately persistent due to the rapid washing of the minerals. However, incorporation of 10% sphagnum peat replacing perlite allowed an optimum and stable pH to be reached for most of the soil less cultivations.

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1184. Physical and chemical changes during composting of wood chip-bedded and straw-bedded beef cattle feedlot manure.

Larney, F. J.; Olson, A. F.; Miller, J. J.; DeMaere, P. R.; Zvomuya, F.; and McAllister, T. A.

Journal of Environmental Quality 37(2): 725-35. (Mar. 2008-Apr. 2008)

NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: Alberta/ animals/ carbon: analysis/ cattle/ hordeum/ housing, animal/ manure: analysis/ nitrogen: analysis/ phosphorus: analysis/ soil: analysis/ temperature/ wood

Abstract: In the 1990s, restrictions on incineration encouraged the forest industry in western Canada to develop new uses for their wood residuals by product. One such use was as a replacement for cereal straw bedding in southern Alberta's beef cattle (*Bos taurus*) feedlot industry. However, use of carbon (C)-rich bedding, such as wood chips, had implications for subsequent composting of the feedlot manure, a practice that was being increasingly adopted. In a 3-yr study, we compared composting of wood chip-bedded manure (WBM) and barley (*Hordeum vulgare* L.) straw-bedded manure (SBM). There were no significant differences in temperature regimes of SBM and WBM, indicating similar rates of successful composting. Of 17 physical and chemical parameters, five showed significant ($P < 0.10$) differences due to bedding at the outset of composting (Day 0), and 11 showed significant differences at final sampling (Day 124). During composting (10 sampling times), seven parameters showed significant bedding effects, 16 showed significant time effects, and four showed a Bedding x Time interaction. Significantly

lower ($P < 0.10$) losses of nitrogen (N) occurred with WBM (19%) compared with SBM (34%), which has positive implications for air quality and use as a soil amendment. Other advantages of WBM compost included significantly higher total C (333 vs. 210 kg Mg⁻¹) for SBM) and inorganic N (1.3 vs. 1.0 kg Mg⁻¹) for SBM) and significantly lower total phosphorus (4.5 vs. 5.3 kg Mg⁻¹) for SBM). Our results showed that wood chip bedding should not be a problem for subsequent composting of the manure after pen cleaning. In combination with other benefits, our findings should encourage the adoption of wood chips over straw as a bedding choice for southern Alberta feedlots. This citation is from PubMed.

1185. Physical and chemical characteristics of substrates for the production of *Ilex paraguariensis* St. Hil. seedlings.

Wendling, I.; Guastala, D.; and Dedecek, R.

Revista Arvore 31(2): 209-220. (2007); ISSN: 0100-6762.

Notes: Original title: Caracteristicas fisicas e quimicas de substratos para producao de mudas de *Ilex paraguariensis* St. Hil.

Descriptors: cattle manure/ chemical properties/ composts/ cost benefit analysis/ growing media/ humus/ physical properties/ pine bark/ propagation/ propagation materials/ sawdust/ seedling growth/ seedlings/ stems/ substrates/ plant propagation/ potting composts/ rooting media

Abstract: This work aimed to evaluate the physical and chemical properties of different materials and their compositions, as well as their efficiency in the production of *Ilex paraguariensis* seedlings in plastic tubes. The work was conducted at the Baldo S.A. Company nursery in Sao Mateus do Sul, Parana, Brazil. Six materials were used to formulate 14 treatments: cattle manure, semi-decomposed sawdust, *Ilex paraguariensis* chopped stems, underground earth, commercial substrate based on pinus bark and earthworm humus. The results indicated that the treatments containing sawdust, *Ilex paraguariensis* stems and mainly cattle manure, besides being more economical, produced good quality seedlings. The treatments consisting of 40% cattle manure and 60% sawdust stood out because of the good cost-benefit ratio and the easiness of preparation. Substrate chemical characteristics did not affect the physical characteristics, as well the influence of physical characteristics on *Ilex paraguariensis* seedling production depends on the analysed variable.

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1186. Physical, chemical properties and microbial population of soil as affected by application of chemical fertilizer and swine manure fermented with sawdust on Cheju brown volcanic ash pasture soil.

Kim MoonChul; Hyun HaeNam; and Lee SungCheol
Journal of the Korean Society of Grassland Science 20(2): 139-146. (2000)

NAL Call #: SB202.K6H352; ISSN: 1013-9354

Descriptors: application rates/ ash/ availability/ calcium/ fertilizers/ magnesium/ manures/ nitrogen/ nitrogen fertilizers/ phosphorus/ potassium/ sawdust/ sodium/ soil bacteria/ soil fungi/ soil organic matter/ soil pH/ hogs/ organic matter in soil/ South Korea/ swine

Abstract: A trial was carried out to investigate the effect of fermented saw-dust pig manure (FSP) and N fertilizer application on physical, chemical properties and microbial

population of soil on Cheju brown volcanic ash pasture during the period from September, 1997 to January, 1999. Average soil N contents during 3 different periods, August and October, 1998, and January, 1999 were 0.39, 0.41 and 0.39% for fertilizer N level 0, 150 and 300 kg/ha, respectively. Soil N contents determined in January, 1999, was significantly increased by an increase of fertilizer N. Nitrogen contents in the soil applied with 0, 3, 6 and 12 t/ha of FSP were 0.43, 0.40, 0.38 and 0.38%, respectively, showing decreasing tendency of soil with increasing levels of FSP application. Soil N contents determined in August, 1998 and January, 1999, were significantly decreased by increasing levels of FSP application. Organic matter contents of the soil applied with N 0, 150 and 300 kg/ha was 8.04, 8.37, and 9.08%. Soil organic matters determined on the 1st and 2nd period tended to increase with increasing level of fertilizer N. FSP application significantly decreased organic matter contents of pasture soil, (9.14, 8.79, 8.28 and 7.78% OM in soil applied with FSP 0, 3, 6 and 12 t/ha of FSP), respectively. Soil OM determined in October, 1998, also showed a significant decrease with increasing level of FSP. Soil pH, available phosphorus, exchangeable K, Ca, Mg and Na in pasture soil studied were not influenced by fertilizer N or FSP application during all three periods. N application tended to increase soil bacteria count, (27.0x10⁴ cfu/g, 29.4x10⁴ cfu/g and 53.6 10⁴ cfu/g in the soil applied with 0, 150 and 300 kg N/ha, respectively). The number of colonies of soil bacteria and fungi determined in June and October, 1998 was not increased remarkably by FSP application, but the number of colonies of bacteria determined in March, 1998 showed a significant increase with increasing level of FSP application. In conclusion, N contents and OM of soil increased with increasing level of N application, but decreased with increasing level of FSP application. This citation is from AGRICOLA.

1187. Physico-chemical properties of organic and inorganic materials used as container media.

Choi JongMyung; Chung HaeJoon; and Choi JongSeung
Korean Journal of Horticultural Science and Technology
18(4): 529-535. (2000); ISSN: 1226-8763

Descriptors: aeration / bark compost/ calcium/ cation exchange capacity/ container grown plants/ electrical conductivity/ greenhouse crops/ growing media/ magnesium/ ornamental plants/ particle size distribution/ peat/ perlite/ physicochemical properties/ pine bark/ porosity/ potassium/ rice husks/ rockwool/ sawdust/ sodium/ soil chemical properties/ soil physical properties/ vermiculite/ bark humus/ chemical properties of soil/ compost/ mineral wool/ ornamentals/ physical properties of soil/ potting composts/ rice hulls/ rock wool/ rooting media

Abstract: The physicochemical properties were investigated of organic (composted rice hulls, sawdust, pine bark and Russian [Sphagnum] peat) and inorganic materials (vermiculite, perlite and rockwool) commonly used as substrates for greenhouse container crops. Of the organic media composted dry bark had the highest proportion of particles greater than 1.0 mm (72%) followed by composted wet bark (69%). Only 33-34% of rice hull and sawdust compost particles were greater than 1.0 mm. With the exception of ground rockwool and imported vermiculite, all types of inorganic media showed high proportions (63-90%) of particles greater than 1.0 mm. Russian peat and rockwool showed the highest total porosity and container

capacity of the organic and inorganic substrates, respectively. Air space was low (4%) in Russian peat and composted sawdust indicating that aeration could be a problem for container-grown crops in these substrates. Electrical conductivity was significantly higher in composted sawdust than in other substrates. Cation exchange capacity was generally higher in organic (50-80 meq/100 g) than in inorganic substrates (6-27 meq/100 g) with the exception of domestic vermiculite (64 meq/100 g). Potassium (as K₂O) and sodium (Na₂O) contents were significantly lower and calcium (CaO) and magnesium (Mg) contents significantly higher in Russian peat than in other organic substrates. Reproduced with permission from the CAB Abstracts database.

1188. Physiological quality of *Ocotea porosa* (Ness et Martius ex Ness) seeds after different storage and sowing conditions.

Tonin, G. A. and Perez, S. C. J. G. de A.
Revista Brasileira de Sementes 28(2): 26-33. (2006)
NAL Call #: SB113.2.R48; ISSN: 0101-3122.

Notes: Original title: Qualidade fisiologicade sementes de *Ocotea porosa* (Nees et Martius ex Nees) apos diferentes condicoes de armazenamento e semeadura.

Descriptors: chemical composition/ containers/ moisture content/ plant composition/ plant water relations/ sawdust/ seed germination/ seeds/ shading/ storage/ substrates/ water content/ chemical constituents of plants/ *Ocotea porosa*

Abstract: The seed moisture level at harvest and the following procedures are very important factors for germination, and will result in the success or failure of plant establishment. The aim of this study was to add information about the viability and vigour of *O. porosa* (imbuia) seeds, such as the right time to harvest, the best storage procedure and how to produce plants inside a greenhouse. In this study, the seed moisture level was 40 and 30% and differences in chemical composition were detected. They were stored in plastic bags and glass recipients under ambient conditions in a cool room. The seeds from different conditions were sown in plastic bags containing different substrates (agricultural compound, cerrado soil plus sawdust) maintained under full sunlight and 65% artificial shading. A combined analysis was carried out to know the relationships between the parameters and to check the type of dependence between them. A linear relationship between the parameters was detected, and thus a cluster analysis was performed. The highest rate and percentage of seedling emergence were registered with seeds presenting 40% moisture level, stored under ambient conditions, inside plastic bags, sown in agricultural substratum plus cerrado soil and sawdust, and maintained under artificial shading. Seed storage in glass recipients decreased seed viability and vigour.

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1189. Pine sawdust pretreated with fungi strains as a substrate for the cultivation of tomatoes.

Andrade S. N. and Valenzuela F. E.
Agro Sur 30(2): 28-34. (2002)

NAL Call #: S15.A395; ISSN: 0304-8802.

Notes: Original title: Aserrin de pino pretratado con cepas fungicas como sustrato para la produccion de plantulas de tomate (*Lycopersicon esculentum* Mill).

Descriptors: crop production/ height/ leaves/ length/ red soils/ roots/ sawdust/ seedling emergence/ seedlings/ seeds/ soil amendments/ soil types/ survival/ tomatoes/ Basidiomycetes/ Cortinariaceae/ Cortinariales/ Gymnopilus/ *Gymnopilus spectabilis*/ *Pleuroflammula croceosanguinea*/ red earths

Abstract: The cultivation of tomato plantlets (*Lycopersicon esculentum*) on sawdust of *Pinus radiata* pretreated with strains of Agaricales UACHMGs-99 (*Gymnopilus spectabilis*) and UACHMPc-280 (*Pleuroflammula croceosanguinea*) was studied. Pretreated sawdust was mixed with clayish red soil (1:1 vol/vol). As controls sawdust alone, clayish red soil and a mixture of both were used. Triplicated substrates were deposited in containers and in each container 50 tomato seeds were sown and cultivated during one month in a chamber (16/8 h light/darkness, 4,000 lux, 10-24 degrees C+or-1 degrees C). For sixty plantlets per treatment, the emergence and survival percentage, height, root length, number of leaves and dried weight were determined. Statistical analysis was performed on the data, using ANOVA and a Tukey Test. The tomato plantlets cultivated on the substrate with pretreated sawdust had a higher survival (98.5 to 100%), plant height (12.2 to 16.5 cm) and root length (13.9 cm) were measured. The study demonstrated the presence of significant differences between tomato plantlets cultivated on substrates that included pretreated sawdust versus the controls. Therefore, the pretreated sawdust of *P. radiata* could be used for the cultivation of tomato plantlets. This citation is from AGRICOLA.

1190. Polycyclic aromatic hydrocarbons in ash: Determination of total and leachable concentrations.

Enell, A.; Fuhrman, F.; Lundin, L.; Warfvinge, P.; and Thelin, G.

Environmental Pollution 152(2): 285-92. (Mar. 2008)
NAL Call #: QH545.A1E52; ISSN: 0269-7491

Descriptors: adsorption/ environmental monitoring/ instrumentation: methods/ fertilizers/ incineration/ particulate matter/ polycyclic hydrocarbons, aromatic:

Abstract: Before wood ash can be used as a soil fertilizer, concentrations of environmentally hazardous compounds must be investigated. In this study, total and leachable concentrations of 16 polycyclic aromatic hydrocarbons (PAHs) were determined in four ash samples and one green liquor sludge. The ash sample with the highest carbon content also contained high levels of PAHs; three of the ash samples had total concentrations exceeding the limit permitted by the Swedish Forest Agency for recycling to forest soils. The leachable concentrations were higher for the non-stabilized samples; this was probably due to colloid-facilitated transport of the contaminants in these samples. However, the leachable concentrations were overall relatively low in all the samples studied. The amounts of PAHs introduced to forest soils by additions of stabilized, recyclable ash products will be determined primarily by the rate of weathering of the ash particles and the total concentration of contaminants.

This citation is from PubMed.

1191. Possibility of using organic substrates as substitutes for common hydroponic media and finding suitable nutrient solution for soilless culture in greenhouse grown tomato.

Delshad, M.; Kashi, A. K.; and Babalar, M.
Iranian Journal of Agricultural Sciences 37(1): 176-186. (2006); ISSN: 1017-5652

Descriptors: ascorbic acid/ chemical composition/ crop quality/ crop yield/ dry matter/ firmness/ growing media/ hydroponics/ leaves/ perlite/ protected cultivation/ sawdust/ soilless culture/ stems/ substrates/ titratable acidity/ tomatoes/ cultivation under glass or plastic/ potting composts/ rooting media/ vitamin C

Abstract: The efficacy of coarse and fine perlite (3:1; M1) and sawdust (M2) as hydroponic media for soilless culture of greenhouse tomato was evaluated along with 2 nutrient solutions, S1 (a commercial standard solution for soilless-cultured, greenhouse-grown tomato) and S2 (modified Coic solution). Plants grown in perlite exhibited better growth than those grown in sawdust. Yield (number and weight of fruits per plant), fruit firmness and stem diameter were higher in tomatoes grown in perlite medium, whereas early yield, fruit vitamin C content, titratable acidity, dry weight percentage, numbers of leaves and trusses per plant as well as plant stem length were similar in both M1 and M2. Stem diameter in plants supplemented with S2 solution was higher than in those supplemented with S1, whereas fruit titratable acidity in the latter was higher. No other significant differences were observed between the nutrient solutions. Reproduced with permission from the CAB Abstracts database.

1192. Potential for sawdust and leaves of *Chromolaena odorata* as soil amendments for plant growth in an oil polluted soil.

Akonye, L. A. and Onwudiwe, I. O.

Niger Delta Biologia 4(2): 47-55. (2004); ISSN: 1118-8731

Descriptors: biomass/ cassava/ chlorophyll/ cowpeas/ fuel oils/ groundnuts/ growth/ leaves/ maize/ okras/ polluted soils/ rooting/ roots/ sawdust/ soil amendments/ soil pollution/ soil types/ toxicity/ waste management/ waste utilization/ black eyed peas/ corn/ manioc/ peanuts/ southern peas/ tapioca plant

Abstract: The potential for sawdust and leaves of *Chromolaena odorata* to act as amendment agents in oil-polluted soils was explored in Nigeria. The agents were independently applied to soils polluted with crude oil at two levels (2% and 6%) in a greenhouse pot test with *Abelmoschus esculentus*, *Zea mays*, *Manihot esculenta*, *Arachis hypogaea*, *Vigna unguiculata* and *Axonopus compressus*. The addition of the agents generally improved plant biomass yield, root proliferation, and chlorophyll a more at 2% than at 6% over the polluted treatments but not with the controls. The overall performance of the various plants showed that the legumes *Arachis hypogaea* and *V. unguiculata* responded more favourably than *Abelmoschus esculentus*, *Z. mays*, *M. esculenta*, and *Axonopus compressus* in that order. These results are indicative of the ability of sawdust and *chromolaena* leaves to either reduce the toxicity of the oil pollutant or induce favourable soil properties or both, thus supporting a wide range of plant growth.

This citation is from AGRICOLA.

1193. Potential for the cultivation of exotic mushroom species by exploitation of Mediterranean agricultural wastes.

Philippoussis, A.; Diamantopoulou, P.; Zervakis, G.; and Ioannidou, S.

In: Science and Cultivation of Edible Fungi. Proceedings of the 15th International Congress on the Science and Cultivation of Edible Fungi. Maastricht, Netherlands.; pp. 523-530; 2000.

Descriptors: agricultural wastes/ cotton/ cotton gin trash/ crop yield/ cultural methods/ edible fungi/ growing media/ poplars/ production/ sawdust/ straw/ utilization/ vegetables/ wheat/ wheat straw/ Bolbitiaceae/ farm wastes/ gin trash/ Lentinaceae/ Mediterranean countries/ Pluteaceae/ Poriales/ potting composts/ rooting media/ Tricholomataceae/ vegetable crops

Abstract: Four agricultural wastes abundant in eastern Mediterranean countries (wheat straw, cotton gin-trash, peanut shells and poplar sawdust), were comparatively evaluated as substrates for the cultivation of selected strains of *Pleurotus ostreatus*, *P. eryngii*, *P. pulmonarius*, *Agrocybe aegerita*, *Lentinula edodes* and *Volvariella volvacea*. Both quantitative and qualitative parameters were examined, i.e. substrate incubation efficacy, earliness, yield, biological efficiency, basidiomata number, weight and size. Wheat straw and cotton gin-trash were the most suitable substrates for *Pleurotus* spp. and *A. aegerita* (the former being more advantageous for high BE's and size, the latter for earliness and length of cultivation cycle), followed by poplar sawdust and peanut shells. Cotton gin-trash was unsuitable for *L. edodes*. *V. volvacea* growth was good on cotton gin-trash and wheat straw. The results, verified for *P. ostreatus* and *P. pulmonarius* strains in successive cultivation studies of 5 *Pleurotus* strains on cotton gin trash, are encouraging for the exploitation of cotton gin-trash as an alternative substrate for the cultivation of exotic fungal species. Reproduced with permission from the CAB Abstracts database.

1194. The potential for the field production of vegetables with the 'Earth Box' system.

Csizinszky, A. A.

In: 14th International Congress on Plastics in Agriculture. Tel Aviv, Israel.; pp. 635-642; 1998.

Descriptors: bark/ fruit vegetables/ growing media/ leaching/ mulches/ peat/ pine bark/ plastic film/ polyethylene/ protected cultivation/ sawdust/ tomatoes/ trickle irrigation/ vegetables/ cultivation under glass or plastic/ mulching materials/ polythene/ potting composts/ rooting media/ vegetable crops

Abstract: Tomatoes and bell peppers were grown in the 'Earth Box' in 1996. The 'Earth Box' is a closed production system: the bottom compartment contains a water reservoir and the top compartment the soil and fertilizer. There is no leaching of fertilizer or water from the boxes to the environment. Tomatoes (cv. Agriset 761) were grown in Spring 1996 in a split-plot design. Main plots were three growth media: 100% soil (Eau Gallie fine sand) (100 soil); 100% prepared medium mix of 40% peat, 20% sawdust and 40% pine bark (100% medium); and 50% fine sand: 50% prepared medium mix (50% medium). Sub-plots were unshaded (U) and shaded (S) boxes. In the U sub-plots a

0.032-mm-thick white on black polyethylene film covered only the top of the box and in the S sub-plots the plastic film covered the top and the south side of the box. Peppers, (cv. Capistrano) were grown in Autumn 1996 with the same 3 growing media as were the tomatoes, but in shaded (S) boxes only. In the control plots, tomatoes and peppers were grown with the full-bed polyethylene mulch system with micro (trickle) irrigation. Tomato yields in the 100% medium treatment were similar to those in the microirrigated plots with 625 mm irrigation, compared with only 406 mm irrigation in the Earth Boxes. Pepper yields in the 50% medium and 100% medium treatments were also similar to yields in the microirrigated plots and received 155 mm irrigation in the boxes compared with 468 mm irrigation in the microirrigated control plots. Tomato and bell pepper yields in the boxes were lowest with the 100% soil (fine sand) treatment due to poor root growth in this medium. Reproduced with permission from the CAB Abstracts database.

1195. The potential for the sequential production of vegetables in the field with the 'Earth Box' system.

Csizinszky, A. A.

Acta Horticulturae 513: 137-144. (2000)

NAL Call #: 80 Ac82; ISSN: 0567-7572

Descriptors: cabbages / crop yield/ cucumbers/ cultivars/ growing media/ irrigation/ mulches/ NPK fertilizers/ peat soils/ pine bark/ polyethylene film/ potting/ salts in soil/ sandy soils/ sawdust/ sequential cropping/ Capparales/ cultivated varieties/ Earth Box/ gherkins/ mulching materials/ potting composts/ rooting media/ United States of America/ watering

Abstract: Three vegetable crops, bell peppers, *Capsicum annuum* (cv. Capistrano); cabbage, *Brassica oleracea* var. capitata (cv. Tastie) and cucumber, *Cucumis sativus* (cv. Dasher II); were grown in Bradenton, Florida, USA, during the fall, winter and spring (September 1996-June 1997) in sequence in the Earth Box and compared with yields of the same three vegetable crops grown on the same land using the full-bed polyethylene mulch system with micro-irrigation. Soil in the micro-irrigated plots was the Eau Gallie fine sand. The Earth Box, made of recycled plastic, is a 244 cm long, 33 cm high and 40.6 cm wide closed production system. The bottom (9 cm deep) compartment contains the water reservoir and is separated from the 24-cm deep soil compartment above it by a perforated plate. There is no leaching of fertilizer or water, from the box to the environment. The boxes were filled with three growth media: 100% soil; 100% prepared medium mix of peat, sawdust and pine bark; and 50% fine sand: 50% prepared medium. Dry fertilizers were banded prior to planting in a narrow, 5 cm groove for the crops (N:P:K at kg/ha equivalent) as follows: bell pepper: 292:35:243; cabbage: 228:0:98; and cucumber: 119:0:82. The top and south side of the boxes were covered with a 0.032 mm thick white on black polyethylene film. Best yields in the boxes were recorded from the 50% medium treatment. Marketable yields of cucumbers, with 118 mm irrigation and bell peppers with 288 mm irrigation in the 50% medium treatment were similar to yields in the micro-irrigated plots with 320 mm and 344 mm irrigation, respectively for cucumbers and bell peppers. Cabbage yields were lower in the boxes than in the micro-irrigated plots. Very high

residual concentrations of total soluble salts were measured in the growth media in the boxes after each cropping. Little or no differences were found in leaf elemental concentrations among the treatments. Reproduced with permission from the CAB Abstracts database.

1196. Potential replacements for rockwool as growing substrate for greenhouse tomato.

Allaire, S. E.; Caron, J.; Menard, C.; and Dorais, M. *Canadian Journal of Soil Science* 85(1): 67-74. (2005)
NAL Call #: 56.8 C162; ISSN: 0008-4271

Descriptors: aeration / air/ available water/ bark/ crop production/ crop yield/ diffusivity/ drainage/ gases/ growing media/ hydraulic conductivity/ mixtures/ peat/ performance/ physical properties/ porosity/ protected cultivation/ rockwool/ sawdust/ substitutes/ substrates/ tomatoes/ water/ wood shavings/ cultivation under glass or plastic/ mineral wool/ potting composts / rock wool/ rooting media

Abstract: The greenhouse industry needs renewable, cheap, and available substitutes for rockwool. The physical properties and performance of rockwool substitutes such as low grade peat, composted bark white spruce and fir, shavings, sawdust, and peat-bark mixtures were compared during two greenhouse experiments with tomato grown in plastic bags. Air and water filled porosities greatly differed between substrates, particularly for sawdust and shavings. Relative gas diffusivity (D_s/D_o) and the hydraulic conductivity were less different between substrates. The physical properties of the substrates changed over a production cycle but the changes were small compared to treatment differences. Yields in peat-bark substrates were similar to rockwool substrates during both the short and long experiments but were lower in sawdust and shavings during the long experiment. The yield differences expected between media were less than the differences between some substrate physical properties of the various media. Yields were positively related to easily available water (EAW) and negatively related to D_s/D_o and air-filled porosity (AFP). This indicated excessive drainage for the low-yielding substrates. In plastic bags, media properties related to aeration were not good indicators of production because the plants adapted to the lack of aeration by modifying their root distribution. White spruce and fir bark alone or mixed with low-grade peat showed high potential for greenhouse tomato production and represent an environmental sound alternative to rockwool. Reproduced with permission from the CAB Abstracts database.

1197. Potentiality of antagonists in reducing white rot disease of French bean in amended soil.

Das, M. G. and Das, B. C. *Crop Research Hisar* 29(3): 503-508. (2005)
NAL Call #: SB4.C66 ; ISSN: 0970-4884

Descriptors: biological control/ biological control agents/ crop yield/ farmyard manure/ fungal antagonists/ fungal diseases/ organic matter/ plant disease control/ plant diseases/ plant pathogenic fungi/ plant pathogens/ rice husks/ sawdust/ seed treatment/ seeds/ soil pH/ biocontrol agents/ biological control organisms/ FYM/ green bean/ Hyphomycetes/ Leotiales/ phytopathogens/ rice hulls/ Sclerotiniaceae/ snap bean

Abstract: The most suitable soil amendment and fungal antagonist for controlling white rot disease (*Sclerotinia sclerotiorum*) on French bean cv. Contender were investigated. Seeds were treated with spore suspensions of *Trichoderma harzianum*, *Gliocladium virens* and *Aspergillus flavus*. The soil amendments, farmyard manure (FYM at 2% w/w), rice husk and sawdust, were supplied to pots where the seeds were sown. The most effective treatment combination for controlling the disease was seed treatment with *T. harzianum* + FYM soil treatment. This treatment increased plant growth and yield. The application of antagonists + amendments resulted in low soil pH and high organic matter content.

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1198. The practicability of swine manure compost deodorization, and effect of mixed sawdust to odor removal.

Sakai, T.; Kawahara, H.; and Shikimachi, H. *Japanese Journal of Swine Science* 44(3): 144-147. (2007);
ISSN: 0913-882X

Descriptors: ammonia/ comparisons/ composts/ deodorizing/ methyl sulfide/ mixing/ odours/ pig manure/ removal/ sawdust/ methyl mercaptan/ methyl sulphide/ odors/ smells

Abstract: An improvement of swine manure in deodorizing swine faeces is reported by adding sawdust to the swine manure in Japan. A mixed swine manure with sawdust obtained a higher removal rate of ammonia, methyl mercaptan and dimethyl-sulfide than swine manure itself, showing 100%, 93% and 92% removal respectively, whereas swine manure obtained removal rates of 99%, 86% and 75%, respectively. For this comparison test, water content was kept at over 40%, which is considered essential to promote bacteria activities in deodorizing process in both cases.

This citation is from AGRICOLA.

1199. Preferences of housed finishing beef cattle for different floor types.

Lowe, D. E.; Steen, R. W. J.; and Beattie, V. E. *Animal Welfare* 10(4): 395-404. (2001); ISSN: 0962-7286
Descriptors: animal behaviour/ animal housing/ beef cattle/ behaviour/ floor type/ litter/ mats/ sawdust/ slatted floors/ steers/ straw/ animal behavior/ behavior/ bullocks/ preferences

Abstract: Six pairs of steers were allowed to choose between two types of floors in a paired choice test. The four floors tested were a fully slatted floor, a fully slatted floor covered with rubber mats, a solid floor with sawdust bedding, and a solid floor with straw bedding. All combinations of floor types were tested and the choices were repeated eight times, using naive animals. The animals were allowed 17 days to habituate, and on days 18-21 their behaviour was recorded by video for 72 hours. Straw was the most preferred floor type, followed by sawdust, then mats, and finally slats. During a second test period, rubber mats were compared with rubber strips, and no significant preferences were found.

Reproduced with permission from the CAB Abstracts database.

1200. Preliminary study of the effect of continuous and intermittent aeration on composting hog manure amended with sawdust.

Hong, J. H.; Keener, H. M.; and Elwell, D. L.
Compost Science and Utilization 6(3): 74-88. (Summer 1998)

NAL Call #: TD796.5.C58 ; ISSN: 1065-657X

Descriptors: pig manure/ composting/ sawdust/ aeration/ ammonia/ carbon nitrogen ratio/ nitrogen/ ammonium nitrogen/ degradation/ odor emission/ losses/ dry matter
This citation is from AGRICOLA.

1201. A preliminary study on control of cucumber root-knot nematode by organic amendments.

Liu HuiZhi; Li HongLian; Yuan HongXia; Xing XiaoPing; Wang ZheYue; and Sun BingJian

Plant Protection 30(6): 58-60. (2004); ISSN: 0529-1542

Descriptors: chaff/ cucumbers/ groundnut oilmeal/ leaves/ nematicidal plants/ nematicides/ non wood forest products/ organic amendments/ pest control/ pines / plant parasitic nematodes/ plant pests/ rapeseed oilmeal/ sawdust/ soil amendments/ wheat/ eelworms/ gherkins/ groundnut cake/ minor forest products/ non timber forest products/ peanut oilmeal/ Secernentea/ Tylenchida

Abstract: In pot and plot experiments, soil was treated with 12 types of plant organic matter to study the effect on control of cucumber root-knot nematodes (*Meloidogyne* spp.). Pot experiments showed that properly fermented leaves of castor oil plant, wheat chaff, leaves of Chinaberry and peanut cake had a control efficiency of 70.44, 68.17, 56.09, and 54.92%, respectively. In a plot experiment, the efficacy of wheat chaff, Chinaberry leaves, leaves of castor oil plant and rapeseed cake mixed with soil at 1% (W/W) was 71.55, 69.99, 63.14, and 62.19%, respectively. Cucumber growth improved with the organic amendments, especially wheat chaff, and slightly less by Chinaberry leaf, pine sawdust and rapeseed cake.

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1202. Procedure to measure the level of polycyclic aromatic hydrocarbons in wood ashes used as fertilizer in agroforestry soils and their transfer from ashes to water.

Rey-Salgueiro, L.; Garcia-Falcon, M. S.; Soto-Gonzalez, B.; and Simal-Gandara, J.

Journal of Agricultural Food Chemistry 52(12): 3900-4. (June 2004); ISSN: 0021-8561

Descriptors: agriculture/ chromatography, high pressure liquid/ fertilizers: analysis/ forestry/ polycyclic hydrocarbons, aromatic: analysis/ soil/ water: chemistry/ wood

Abstract: Before wood ash can be safely used as a fertilizer in soils, possible negative effects such as input of organic contaminants or remobilization of contaminants already stored in the soil must be investigated. The objective of this study was to optimize and characterize extraction methods to isolate and quantitatively measure polycyclic aromatic hydrocarbons (PAHs) concentrations in wood ash that can be used as amendment of soils. It will be then possible to examine the effects of wood ash application on PAHs concentrations in the washing waters with the aim of evaluating their distribution by storage in the different compartments and what influences their stability and persistence. Simple, rapid and inexpensive methods have been set up for the determination of seven polycyclic

aromatic hydrocarbons (PAHs) in wood ashes and ash aqueous extracts without interferences from other chemical contaminants using organic solvent extraction and/or SPE techniques and analyzed by an optimized RP-HPLC-FLD method. The feasibility of extraction for the determination of PAHs in wood ashes has been evaluated because PAHs are strongly sorbed to such a matrix, which explains why the PAHs content in ash was seldom studied. The method resulted to be of recoveries ranging from 81 to 97% for the different PAHs, with repeatabilities (RSDs%) better than 6%. Detection levels were from 0.2 to 2.2 microg/kg, while quantification limits were from 0.7 to 5.6 microg/kg, low enough to evaluate the presence of PAHs in wood ashes. This citation is from PubMed.

1203. Production and composition of manure from pigs fattened on sawdust, wood shaving or bark-based litter material.

Texier, C.; Baron, P.; and Charnet, F.

Techni Porc 27(4): 29-37. (2004); ISSN: 0181-6764.

Notes: Original title: Production et composition des fumiers de porcs engraisés sur sciure, copeaux ou écorce.

Descriptors: bark/ excretion/ finishing/ litter/ pig housing/ pig manure/ sawdust/ straw/ surveys/ wood shavings/ fattening/ piggeries/ sties/ swine housing

Abstract: This article provides reference data on the production, composition and excretion of manure from pigs fattened in sawdust or other wood waste products as litter in comparison to straw. Dry and fresh sawdust, dry wood shavings and fresh bark were tested. The results of a survey led by the IDF in association with the ITP and conducted on the Farming Group and Chamber of Agriculture technicians were analysed. The survey confirmed that this practice remained marginal and demonstrated the lack of knowledge among pig breeding technicians with regard to the use of sawdust as litter material, which could be due in particular to a very limited amount of references on the subject. There was a very diverse range of practices applied in the use of sawdust as litter, and the absence of a model for production was a major disincentive to the development of this technique. Its advantages in environmental terms could be expected to lead to an increased development in the use of sawdust litter. Building design could be streamlined to enable some of the more unpleasant tasks such as litter maintenance to be mechanized.

This citation is from AGRICOLA.

1204. Production and economic aspects of conventional and alternative pig fattening.

Margeta, V.; Tolusic, Z.; and Kralik, I.

Agriculture Scientific and Professional Review 11(1): 49-53. (2005); ISSN: 1330-7142

Descriptors: backfat/ carcass composition/ carcass grading/ carcass quality/ carcass yield/ costs/ crossbreds/ deep litter housing/ fat thickness/ feed conversion efficiency/ finishing/ litter/ liveweight gain/ meat production/ muscle tissue/ pig housing/ sawdust/ straw/ costings/ fattening/ hogs/ liveweight gains/ piggeries/ sties/ swine/ swine housing

Abstract: The aim of this research was to compare the productive, slaughtering and economic characteristics of conventional and deep litter housing systems of pig fattening. The research was carried out on 105 crossbreds (LW x GL) x GL, divided into three groups. Pigs of the first

group were kept on straw-bedded floor, while the second group was kept on sawdust. The third group was kept in a conventional solid floor system without straw. When compared to pigs kept on deep litter, pigs kept in the convention housing system had higher liveweights, better average daily liveweight gains and better feed conversion during fattening. Pigs kept on deep litter housing had thinner backfat, greater portions of muscular tissue in carcasses and more favourable classification of carcasses to commercial classes than the pigs kept on sawdust and conventional housing. The deep litter housing system also provided better financial results than the conventional housing systems.

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1205. Promoting microbial immobilization of soil nitrogen during restoration of abandoned agricultural fields by organic additions.

Szili Kovacs, T.; Torok, K.; Tilston, E. L.; and Hopkins, D. W.

Biology and Fertility of Soils 43(6): 823-828. (2007)

NAL Call #: QH84.8.B46; ISSN: 0178-2762

Descriptors: abandoned land/ grasslands/ immobilization/ microbial activities/ natural grasslands/ nitrogen/ nutrient availability/ organic amendments/ regeneration/ sandy soils/ sawdust/ soil types/ sucrose/ microbial biomass/ natural pastures/ saccharose

Abstract: Application of organic materials to soils to enhance N immobilization into microbial biomass, thereby reducing inorganic N concentrations, was studied as a management option to accelerate the reestablishment of the native vegetation on abandoned arable fields on sandy soils the Kiskunsag National Park, Hungary. Sucrose and sawdust were used at three different topographic sites over 4 years. N availability and extractable inorganic N concentrations were significantly reduced in all sites. Soil microbial biomass C and microbial biomass N increased significantly following C additions, but the microbial C to microbial N ratio remained unaffected. It is concluded that the combined application of the rapidly utilized C source (sucrose) promoted N immobilization, whereas the addition of the slowly utilized C source (sawdust) maintained the elevated microbial biomass C and microbial biomass N in the field.

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1206. Properties of livestock feces compost, 1: Effect of bulking agents or the location of piles on chemical properties of dairy cattle and beef cattle feces compost.

Koyama, F. and Takamuku, K.

Bulletin of the Fukuoka Agricultural Research Center

(Japan)(19): 110-114. (2000); ISSN: ISSN 1341-4593.

Notes: 3 tables; 4 fig.; 16 ref. Summaries (En, Ja). Citation notes: JP (Japan).

Descriptors: manure compost/ livestock/ bulking agents/ dairy manure/ beef manure

Abstract: We analyzed the application of cattle feces compost for better soil management in Fukuoka prefecture with a view toward determining the chemical properties of compost attributable to different types of cattle and bulking

agents. The results were as follows: (1) Phosphorus pentoxide in beef cattle compost mixed with sawdust (A) was significantly higher than that of dairy cattle compost mixed with sawdust (B). On the other hand, calcium oxide in (A) tended to be lower than (B). These differences were probably due to the ingredients in the feed. The total carbon in (A) was higher than (B) because most of the bedding was made up of sawdust. As a result, the C/N ratio in (A) amounted to 24. (2) The moisture content and quality of the fertilizer properties in dairy cattle compost mixed with rice hulls (C), compared with (B). decreased due to drainage. (3) The range of difference in chemical properties between (A) and (B) was drastic because some of the droppings were piled outdoors during the maturing process. Not only was the moisture content of these droppings were higher, but the electric conductivity, potassium oxide and sodium oxide levels were also higher. (4) Potassium oxide in cattle compost mixed with sawdust tended to be higher than in the past. It seems that the reason for this increase coincides with the larger number of composting facilities in use that mix cattle feces and urine. (5) If 1 ton of the standard cattle compost maturing at indoor facilities were applied, then the potassium oxide content of fertilizer would be between 9 and 10kg. Thus, we recommend reducing the level of potassium oxide application of cattle compost.

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1207. Protection against potato scab.

Divis, J. and Kristufek, V.

Sbornik Jihoceska Univerzita Zemedelska Fakulta, Ceske Budejovice Fytotechnicka Rada 15(2): 73-80. (1998); ISSN: 1210-6259.

Notes: Original title: Ochrana proti strupovitosti brambor.

Descriptors: climate/ contamination/ cultivars/ cultural control/ disease resistance/ green manures/ plant disease control/ plant diseases/ plant pathogenic bacteria/ plant pathogens/ plant pathology/ potatoes/ root crops/ sawdust/ soil/ soil amendments/ straw/ tubers/ varietal susceptibility/ cultivated varieties / phytopathogens/ phytopathology/ resistance to disease

Abstract: Two experimental plots in a region commonly affected by the common potato scab (caused by *Streptomyces scabies*) were used to assess the effect of sawdust, straw and green manure incorporation in the soil on the degree of tuber infection. Two potato cultivars were used, cv. Karin (highly resistant) and cv. Desiree (susceptible). Results showed that none of the organic additives had a noticeable effect. The main factors influencing tuber infection were the level of soil contamination by the pathogen, the degree of varietal resistance to the disease, and climatic conditions. Reproduced with permission from the CAB Abstracts database.

1208. Quality of different bedding materials and their influence on the compostability of horse manure.

Airaksinen, S.; Heinonen Tanski, H.; and Heiskanen, M. L.

Journal of Equine Veterinary Science 21(3): 125-130.

(2001); ISSN: 0737-0806

Descriptors: ammonia/ bacterial count/ composting/ decomposition/ fabrics/ fertilizers/ horse dung/ linen/ litter/ paper/ peat/ sawdust/ straw/ water holding capacity/ wood chips

Abstract: The air quality of the stable and management and composting of manure can be improved by choosing bedding material with certain desirable properties. The optimal bedding material doesn't cause hygiene problems in the stable. It absorbs ammonia, is economic in use, and decomposes quickly with manure. The objective of this trial was to compare both quality of different bedding materials and their influence on the composting process of horse manure. Bedding materials used in the study were wood chips, straw, peat, hemp, linen, sawdust, shredded newspaper and the mixtures, peat/wood chips, peat/sawdust, and peat/straw. Peat and peat mixtures had the best quality of ammonia absorption, water holding, and manure fertilization value. The number of fungi and bacteria were lower in shredded newspaper and wooden materials than in straw, linen, hemp, and peat. The composting temperature became high enough for at least a partial destruction of parasites and seeds within the rubbish heaps in all boxes. Only peat manure was ready for further plant production after one month's composting period. Other bedding materials were decomposed only partially or not at all during the study.

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1209. Quantity and quality of humic acids extracted from sandy soils fertilized with vermicomposts.

Kalembasa, D. and Wisniewska, B.

Annales Universitatis Mariae Curie-Skłodowska. Sectio E Agricultura (Poland) 59(4): 1911-1917. (2004)

NAL Call #: 512 L96AE; ISSN: 0365-1118.

Notes: Summary (En). Citation Notes: PL (Poland).

Descriptors: humic acids/ sawdust/ sandy soils/ fertilization/ vermicomposts

Abstract: A significant increase in the amount of produced organic waste made it necessary to work out different methods of their utilization, including the vermicomposting process. Vermicomposts were produced with the *Eisenia fetida* Sav. on the basis of waste activated sludge with the addition of mixed sawdust and waste from a meat processing factory. Vermicomposts were applied in a pot experiment on two soil materials: weakly loamy sand and heavy loamy sand. The *Lolium multiflorum* Lam. was the tested plants harvested eight times during two vegetation periods. After two years of experiment from total amount of carbon introduced into pots taken as 100 percent, in slightly sand there was left 56.0 percent and in loamy sand - 59.4 percent. The quantity of organic carbon compounds extracted from the soil materials with 0.1 mol NaOH/cubic dm in the 1st fraction was 70.2 percent and in the 2nd 29.8 percent of total carbon in which 81.4 and 55.2 percent were in humic acid, respectively. In the extracts from heavy loamy sand these values were 68.3 and 31.7 percent, including 84.2 percent and 57.2 percent in humic acids of total extracted carbon, respectively.

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1210. Rate effects of swine manure fermented with sawdust on efficiency of nitrogen utilization of silage corn and soil fertility.

Yook WanBang; Choi DongHo; and Choi KiChun

Journal of the Korean Society of Grassland Science 20(2): 123-130. (2000)

NAL Call #: SB202.K6H352; ISSN: 1013-9354

Descriptors: application rates/ composts/ maize/ manures/ nitrogen/ nitrogen fertilizers/ sawdust/ silage/ soil fertility/ soil organic matter/ utilization/ corn/ organic matter in soil/ South Korea

Abstract: This study was carried out to examine the effects of animal manure on efficiency of the nitrogen utilization of silage corn (*Zea mays*) and soil fertility. The experiment was conducted on the field plot at Gongiam, Kwangju, Kyunggi-Do for 3 years, from 1996 to 1998, and arranged in split-plot design with three replications. The main plots were two kinds of composts, such as swine manure fermented with sawdust (SMFWS) and swine manure fermented without sawdust (SMF). Subplots were the nitrogen fertilizer rate (0, 100, 200, 300 and 400 kg N/ha/year). The nitrogen (N) yield increased as the nitrogen fertilizer rate increased up to a rate of 300 kg N/ha, but decreased at rate of 400 kg N/ha. Nitrogen yield in SMF treatments was higher than that of SMFWS treatments. But there were no significant differences between SMFWS and SMF treatments. Organic matter (OM) content of the soils in SMFWS was higher than that of SMF, and was not significantly different between SMFWS and SMF treatments. OM content increased with increasing the nitrogen fertilizer rate. Total nitrogen (TN) content of the soils increased as the nitrogen fertilizer rate increased. No difference of TN content was found between SMFWS and SMF treatments.

This citation is from AGRICOLA.

1211. Rate effects of swine manure fermented with sawdust on productivity and nutritive value of silage corn.

Yook WanBang; Choi DongHo; Choi KiChun; An

SeongHyun; Yoon SeiHyung; and Lee JongKab

Journal of the Korean Society of Grassland Science 20(2): 115-122. (2000)

NAL Call #: SB202.K6H352; ISSN: 1013-9354

Descriptors: animal wastes/ application rates/ composts/ crop yield/ crude protein/ dry matter/ energy value / fodder crops/ in vitro digestibility/ maize/ nitrogen fertilizers/ pig manure/ sawdust / caloric value/ calorie value/ calorific value/ corn/ digestibility in vitro/ livestock wastes

Abstract: This study was carried out to determine fertilizer requirements for silage maize, using two kinds of composts, and to examine the potential possibility of utilization as an organic fertilizer. The experiment was conducted on the field plot at Gongiam, Kwangju, Kyunggi-Do for 3 years, from 1996 to 1998, and arranged in split-plot design with three replications. The main plots were two kinds of composts such as pig manure fermented with sawdust (SMFWS) and pig manure (fermented without sawdust (SMF)). Subplots were N application rates (0, 100, 200, 300 and 400 kg N/ha annually). The dry matter (DM) yield increased as N rate increased up to 300 kg N/ha, but decreased at 400 kg N. Dry matter yield in SMFWS treatment was higher than that of SMF treatment, but there was no significant difference between SMFWS and SMF treatments. Net energy for lactation (NE_L) and total digestible nutrients (TDN) in maize increased as the fertilization rate of SMFWS and SMF increased, and crude protein (CP) content increased by the fertilization of SMFWS and SMF. No difference of CP, NE_L and TDN was found between SMFWS and SMF treatments.

This citation is from AGRICOLA.

1212. Recovery assessment of lumber mill wastes: Composting product field test.

Chang ChangTang; Lee ChingHwa; Chiou ChyowShan; and Jeng FuTien

Resources, Conservation and Recycling 25(2): 133-150. (1999)

NAL Call #: TP156.R38R47; ISSN: 0921-3449

Descriptors: analysis / assessment/ byproducts/ composting/ composts/ cost analysis/ disposal/ economics/ field tests/ flowers/ forest products industries/ manures/ marine environment/ ornamental herbaceous plants/ ornamental plants/ sawdust/ sawnwood/ sea birds/ seafoods/ solid wastes/ waste wood/ wastes/ costing/ Filicopsida/ forest industry/ Formosa/ lumber/ ornamentals/ timber mill waste

Abstract: Lumber mill waste with a more than monthly generation of 5000 tons is one of the main solid waste sources in the I-Lan area of Taiwan. The lumber sawdust together with seafood processing residue and distillery byproducts, was evaluated within a composting machine as a disposal alternative to the conventional landfill and incineration methods. The addition of seabird manure provides adequate P source for the eventual composting product to be used as an alternative organic fertilizer to conventional chemical fertilizer. Thermophilic bacteria were added to facilitate composting reaction at 70 degrees C. The composting product was further evaluated for effectiveness as organic fertilizer in greenhouse and field studies. The tested plants include *Zinnia elegans*, *Celosia cristata* and *Asplenium nidus*. The control experiments include soil alone as well as soil with the addition of chemical fertilizer or compost product. The experimental results demonstrate that flower growth of the *C. cristata* is enhanced in the presence of composting product. The cost analysis indicates that it is economically feasible to yield a useful composting product.

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1213. Relating compost measures of stability and maturity to plant growth.

Cooperband, L. R.; Stone, A. G.; Fryda, M. R.; and Ravet, J. L.

Compost Science and Utilization 11(2): 113-124. (2003)

NAL Call #: TD796.5.C58 ; ISSN: 1065-657X

Descriptors: ammonium nitrogen/ biological activity in soil/ biomass/ cannery wastes/ carbon dioxide/ carbon nitrogen ratio/ cattle manure/ composting/ composts/ crop residues/ electrical conductivity/ growth/ maturity/ microorganisms/ mineralization/

nitrate nitrogen/ nitrogen/ nutrient uptake/ pH/ plant nutrition/ potato waste/ poultry manure/ respiration/ sawdust/ stability/ ammonia nitrogen/ dissolved organic carbon/ hydrogen ion concentration/ micro organisms/ potential of hydrogen/ poultry litter

Abstract: Assessment of compost maturity is important for successful use of composts in agricultural and horticultural production. We assessed the 'maturity' of four different sawdust-based composts. We composted sawdust with either cannery waste (CW), duck manure (DM), dairy (heifer) manure (HM) or potato culls (PC) for approximately one year. Windrows were turned weekly for the first 60 days of composting, covered for four winter months and then turned monthly for six more months. We measured compost microbial respiration (CO_2 loss), total C and N,

C:N ratio, water soluble $\text{NO}_3\text{-N}$ and $\text{NH}_4\text{-N}$, dissolved organic carbon, pH and electrical conductivity at selected dates over 370 days. Compost effects on ryegrass biomass and N uptake were evaluated in a greenhouse study. We related compost variables to ryegrass growth and N uptake using regression analysis. All composts maintained high respiration rates during the first 60 days of composting. Ammonium-N concentrations declined within the first 60 days of composting, while $\text{NO}_3\text{-N}$ concentrations did not increase until 200+ days. After 250+ days, DM and PC composts produced significantly more ryegrass biomass than either CW or HM composts. Total C, microbial respiration and water-extractable $\text{NO}_3\text{-N}$ were good predictors of compost stability/maturity, or compost resistance to change, while dissolved organic carbon, C:N ratio and EC were not. The compost $\text{NO}_3\text{-N}/\text{CO}_2\text{-C}$ ratio was calculated as a parameter reflecting the increase in net N mineralization and the decrease in respiration rate. At ratio values $>8 \text{ mg NO}_3\text{-N}/\text{mg CO}_2\text{-C}/\text{day}$, ryegrass growth and N uptake were at their maximum for three of the four composts, suggesting the ratio has potential as a useful index of compost maturity.

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1214. Relationships between microbial biomass nitrogen, nitrate leaching and nitrogen uptake by corn in a compost and chemical fertilizer-amended Regosol.

Heraï, Y.; Kouno, K.; Hashimoto, M.; and Nagaoka, T.

Soil Science and Plant Nutrition 52(2): 186-194. (2006)

NAL Call #: 56.8 SO38; ISSN: 0038-0768

Descriptors: ammonium sulfate/ application rates/ composts/ leaching/ maize/ nitrate/ nitrate nitrogen/ nitrogen/ organic amendments/ plant nutrition / Regosols/ rice/ rice straw/ sawdust/ soil amendments/ soil flora/ soil types/ straw/ temporal variation/ ammonium sulphate/ corn/ microbial biomass/ paddy/ rhagosols

Abstract: To determine the relationships between microbial biomass nitrogen (N), nitrate-nitrogen leaching ($\text{NO}_3\text{-N}$ leaching) and N uptake by plants, a field experiment and a soil column experiment were conducted. In the field experiment, microbial biomass N, $0.5 \text{ mol L}^{-1} \text{ K}_2\text{SO}_4$ extractable N (extractable N), $\text{NO}_3\text{-N}$ leaching and N uptake by corn were monitored in sawdust compost (SDC: 20 Mg ha^{-1} containing 158 kg N ha^{-1} of total N [approximately 50% is easily decomposable organic N]), chemical fertilizer (CF) and no fertilizer (NF) treatments from May 2000 to September 2002. In the soil column experiment, microbial biomass N, extractable N and $\text{NO}_3\text{-N}$ leaching were monitored in soil treated with SDC (20 Mg ha^{-1})+rice straw (RS) at five different application rates (0, 2.5, 5, 7.5 and 10 Mg ha^{-1} containing 0, 15, 29, 44 and 59 kg N ha^{-1}) and in soil treated with CF in 2001. Nitrogen was applied as $(\text{NH}_4)_2\text{SO}_4$ at rates of 220 kg N ha^{-1} for SDC and SDC+RS treatments and at a rate of 300 kg N ha^{-1} for the CF treatment in both experiments. In the field experiment, microbial biomass N in the SDC treatment increased to 147 kg N ha^{-1} at 7 days after treatment (DAT) and was maintained at $60\text{-}70 \text{ kg N ha}^{-1}$ after 30 days. Conversely, microbial biomass N in the CF treatment did not increase significantly. Extractable N in the surface soil increased immediately after treatment, but was found at lower levels in the SDC treatment compared to the CF treatment until 7 DAT. A small amount of $\text{NO}_3\text{-N}$ leaching was observed

until 21 DAT and increased markedly from 27 to 42 DAT in the SDC and CF treatments. Cumulative $\text{NO}_3\text{-N}$ leaching in the CF treatment was 146 kg N ha⁻¹, which was equal to half of the applied N, but only 53 kg N ha⁻¹ in the SDC treatment. In contrast, there was no significant difference between N uptake by corn in the SDC and CF treatments. In the soil column experiment, microbial biomass N in the SDC+RS treatment at 7 DAT increased with increased RS application. Conversely, extractable N at 7 DAT and cumulative $\text{NO}_3\text{-N}$ leaching until 42 DAT decreased with increased RS application. In both experiments, microbial biomass N was negatively correlated with extractable N at 7 DAT and cumulative $\text{NO}_3\text{-N}$ leaching until 42 DAT, and extractable N was positively correlated with cumulative $\text{NO}_3\text{-N}$ leaching. We concluded that microbial biomass N formation in the surface soil decreased extractable N and, consequently, contributed to decreasing $\text{NO}_3\text{-N}$ leaching without impacting negatively on N uptake by plants. Reproduced with permission from the CAB Abstracts database.

1215. Replacement of straw by sawdust or wood shavings in fattening pig buildings: Effect on composting of litters.

Texier, C.; Levasseur, P.; and Vaudelet, J. C.
Journées de la Recherche Porcine en France 32: 77-82. (2000)
NAL Call #: SF391.I53 ; ISSN: 0767-9874.
Notes: Original title: Remplacement de la paille par de la sciure ou des copeaux de bois, en porcherie d'engraissement: influence sur le compostage des litières.
Descriptors: animal housing/ composting/ finishing/ manures/ pig housing/ pig manure/ fattening/ hogs/ piggeries/ sties/ swine/ swine housing
Abstract: The effects of different litter compounds (straw, sawdust and wood shavings) on the amount of manure produced per pig and the composting ability of the litter were studied in 2 trials. With 60 kg of straw each pig produced 200 kg of dung. Using only 40 kg of wood shavings the amount of manure was reduced by 15%. However, when 70-80 kg of sawdust was used, manure production increased by 5-10% when compared to straw. Average nitrogen output was 1.4 kg per pig on straw litter and <1 kg when straw was replaced by sawdust or wood shavings. The manure was turned over mechanically 3 times and composted for 3 months. Weight loss

during composting of litter produced with sawdust or wood shavings was -30% while that for straw litter was -45%. Reproduced with permission from the CAB Abstracts database.

1216. The response of apple trees to fertigation and mulch.

Rubauskis, E.; Skrivele, M.; Dimza, I.; and Berlands, V.
Sodininkyste ir Darzininkyste 21(3): 126-133. (2002); ISSN: 0208-4212
Descriptors: apples/ crop yield/ fertigation/ mulches/ mulching/ nitrogen fertilizers/ potassium fertilizers / sawdust/ soil amendments/ soil water/ trickle irrigation/ fertirrigation/ mulching materials/ potash fertilizers/ soil moisture
Abstract: An experiment was conducted during 1997-2001 at Dobeles, Latvia to study the response of one-year-old dwarf apple (cultivars Melba and Korichnoe Novoe) trees to

fertigation (drip irrigation) and sawdust mulch (supplied in tree strips). Nitrogen and potassium fertilizers were supplied to trees in equal rates in the fertigation treatment, while in the sawdust mulch treatment, 20% more nitrogen was supplied. Fertilizers were supplied to plants throughout the experiment. Soil samples at 0-30 and 30-60 cm soil layers were taken every week. Data on trunk diameter, yield, fruit size, fruit weight and soil moisture condition were recorded. Meteorological data for five years were collected. Both soil moisture treatments significantly increased the yield of apple trees. Soil mulching improved vegetative growth more than cropping. The influence of soil moisture treatment on yield efficiency (yield per trunk cross-sectional area) depended both on the cultivar and the size of yield. The yield per trunk cross-sectional area of Melba was 1.5-4.2 times larger than Korichnoe Novoe. The soil moisture treatments did not influence fruit quality during the three-year period of cropping. Reproduced with permission from the CAB Abstracts database.

1217. Response of corn to bio and organic fertilizers in a newly reclaimed sandy soil.

Radwan, S. M. A. and Saber, M.
Improved Crop Quality by Nutrient Management: 253-257. (1999)
Descriptors: chemical composition/ composts/ crop yield/ grain/ iron/ maize/ NPK fertilizers/ organic fertilizers/ sandy soils/ sawdust/ sulfur fertilizers/ trace element fertilizers/ corn/ micronutrient fertilizers/ sulphur fertilizers
Abstract: Field experiments were carried out in a newly reclaimed sandy soil in South Tahrer province, Egypt, during 1997 and 1998 to evaluate the effect of two rates of composted sawdust (20 or 40 msuperscript 3/feddan) with or without elemental sulphur (300 kg/feddan), Nofatrein (macro- and micronutrients) foliar fertilizer, Coatingen (Zn, Mn and Fe chelates) seed dressing and/or the multi-strain biofertilizer Microbein on the chemical composition and yield of maize cv. Single Cross 10. The 100-grain weight increased from 16.8 g with the usual rate of NPK fertilizer to 18.9 and 20.4 g with either 20 or 40 msuperscript 3/feddan composted sawdust, respectively. Combining the biofertilizer with either organic or chemical fertilizers led to a marked increase in grain and straw yields compared with their sole effect under different treatments. The greatest N, P, Zn, Fe and Cu contents of grain were achieved when Microbein was combined with elemental sulphur or Nofatrein. Generally, combinations of composted sawdust (40 msuperscript 3/feddan) and Microbein with elemental sulphur or Nofatrein led to highly significant differences over the usual rate of chemical NPK fertilizer for maize yield and chemical composition. Reproduced with permission from the CAB Abstracts database.

1218. Response of cowpea, okra and tomato sawdust ash manure.

Owolabi, O.; Ojeniyi, S. O.; Amodu, A. O.; and Hazzan, K.
Moor Journal of Agricultural Research 4(2): 178-182. (2003); ISSN: 1595-4153
Descriptors: application rates/ calcium/ cowpeas/ crop yield/ fruits/ leaves/ magnesium/ manures/ nutrient content/ okras/ phosphorus/ pods/ potassium/ sawdust/ tomatoes/ wood ash/ black eyed peas/ southern peas

Abstract: Field experiments were conducted in 1999-2001 at Akure and Obaile in southwest Nigeria to investigate the effect of sawdust ash manure treatments on cowpea (cv. IT82D-716), okra (cv. NAAe-47-4) and tomato (cv. Roma). Nutrient analysis of leaf and pod of okra given different sawdust ash manure treatments was performed. Sawdust ash applied at 3-12 t/ha increased pod yield of okra, with 9 t sawdust ash/ha being the optimum. Sawdust ash applied at 3, 6 and 9 t/ha increased okra leaf and pod P, K, Ca and Mg contents. Sawdust ash manure increased number and weight of tomato fruits significantly. Relative to the control, the 2, 4, 6 and 8 t ash/ha treatments increased number of tomato fruits by 109, 226, 265 and 226%, respectively, and the equivalent values for fruit weight were 29, 55, 64 and 57%. Sawdust at 4 t/ha is recommended for cowpea and tomato.

This citation is from AGRICOLA.

1219. Response of gugo to different potting media.

Gonzales, L. L.; Quimio, M. J. Jr; and Calinawan, R. M. *Canopy International* 27(4): 3, 11. (2001); ISSN: 0115-0960

Descriptors: coir/ growing media/ growth/ potting/ propagation/ sawdust/ seed germination/ seed treatment/ seeds/ sexual reproduction/ shoot cuttings/ soaking/ soil/ stems/ survival/ coconut fibre/ Entada phaseoloides/ plant propagation/ potting composts/ rooting media

Abstract: The response of gugo (*Entada phaseoloides*) to different potting media (pure soil, coir dust and sawdust) was tested at the Jamboree site of the Los Banos Experimental Station, Laguna, Philippines. Propagation methods, both by seeds and by stem cuttings, were performed. Parameters such as survival, and plant growth and development were assessed. Results showed that gugo could be propagated best by sexual means. Scraping the seed hilum and soaking the seeds in tap water for 24 h recorded a seed germination percentage of approximately 98% before potting. The seed germination reached 83.3% with pure sawdust as potting medium. Propagation trials using stem cuttings from various portions of the stem (base, middle and top) planted in different potting media failed to produce shoots. Propagation of gugo by seeds through scraping of hilum is prescribed as the adaptable and appropriate technique for the species.

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1220. Response of Musa species to macro-propagation II: The effects of genotype, initiation and weaning media on sucker growth and quality in the nursery.

Baiyeri, K. P.

African Journal of Biotechnology 4(3): 229-234. (2005)
NAL Call #: TP248.13 .A37; ISSN: 1684-5615

Descriptors: bananas/ genotypes/ growing media/ growth/ leaves/ plant height/ plant residues/ poultry manure/ rice husks/ rooting/ sawdust/ suckers/ survival/ vegetative propagation/ vigour/ potting composts/ poultry litter/ rice hulls/ rooting media/ vigor

Abstract: Sucker plantlets of five *Musa* genotypes were derived from sword-sucker-corms using ricehull and sawdust as initiation media. Plantlets initiated were transferred to three weaning/rooting media formulated with ricehull (RH), sawdust (SD) and poultry manure (PM).

Weaning media and genotypes had significant ($P < 0.05$) effects on most of the sucker plantlet growth parameters studied. There was variable adaptation pattern of genotypes to weaning/rooting media. RH+PM (3:1 v/v) enhanced the best sucker quality in terms of number of photosynthetically active leaves, plant height, plant girth and plant vigour in four ('PITA 22', 'Agbagba', 'FHIA 17' and 'Nsukka local') out of the five genotypes evaluated. Except 'PITA 25' all other genotypes had the poorest performance in SD+PM (3:1 v/v). Medium SD+RH+PM (1.5:1.5:1 v/v/v) supported good quality sucker in 'Agbagba', 'FHIA 17', 'Nsukka Local' and 'PITA 25'. Percent survival in each weaning medium was influenced by genotype and the rooting status of plantlets at the time of excision. However, from the study RH+PM was adjudged the best medium for raising plantlets to vigorous suckers for field planting. Reproduced with permission from the CAB Abstracts database.

1221. Response of onion (*Allium cepa*, L.) plants and associated weeds to biofertilization under some plant mulches.

Radwan, S. M. A. and Hussein, H. F. *Annals of Agricultural Science Cairo* 46(2): 543-564. (2001); ISSN: 0570-1783

Descriptors: application rates/ butralin/ cultural control/ herbicides/ hoeing/ mulches/ nitrogen content / NPK fertilizers/ onions/ phosphorus/ physical control/ rhizosphere/ rice/ rice straw/ sawdust / straw/ weed control/ weeds/ biofertilizers/ mulching materials/ paddy/ weedicides/ weedkillers

Abstract: Two field experiments were conducted in Egypt during the winter season of 1999 and 2000 to study the effect of multi strains biofertilizer (phosphate dissolving bacteria, *Azospirillum* spp. and *Pseudomonas* spp.) with different levels of NPK fertilizer (50 and 75% of recommended rate) under different weed control treatments, including 4 plant mulches (sawdust, rice straw, clover weed or cogon grass [*Imperata cylindrica*]), hand hoeing and butralin herbicide with one hoeing on onion (*Allium cepa*) plants and associated weeds. The number of *Azospirillum* spp. in biofertilized rhizosphere recorded higher densities with 50% NPK application, while the number of phosphate dissolving bacteria and *Pseudomonas* spp. showed higher populations with 75% NPK application under different weed control treatments. Generally, hand hoeing treatment recorded higher number of tested microorganisms in onion rhizosphere as compared to unweeded check, butralin herbicide and applied different plant mulches except clover weed mulch treatments. Numbers of broadleaved weeds were significantly decreased by increasing the rate of NPK fertilizer, in the presence and absence of biofertilizer application, while the grassy weed was increased. Broadleaved weeds were more susceptible to mulching treatments than grassy weeds. Application of hand-hoeing (trice), sawdust mulch, rice straw mulch, clover weed mulch, cogon grass mulch and butralin herbicide + one hoeing significantly decreased the total dry weight of weeds at 75 days from transplanting and produced higher bulb yields over unweeded by 143.2, 127.2, 118.1, 151.6, 123.1 and 133.3%, respectively. The highest values of N and P content in onion bulbs were obtained as a result of

combined action biofertilizer and 75% NPK under different weed control treatments. However, sawdust mulch treatment recorded the greatest value of N content in the presence of biofertilizer + 50% NPK, while Zn and Fe contents reached their highest values under 100% NPK application.

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1222. Response of some tomato cultivars to sawdust compost and nitrogen sources under a calcareous soil condition. I. Plant growth, yield and nutrient uptake.

El Gazy, S. M. and Rifaat, M. G. M.

Annals of Agricultural Science, Moshtohor 39(2): 1089-1111. (2001); ISSN: 1110-0419

Descriptors: application rates/ calcareous soils/ crop yield/ cultivars/ dry matter/ leaves/ nitrogen fertilizers/ nutrient availability/ nutrient content/ nutrient uptake/ phosphorus/ plant nutrition/ potassium/ sawdust/ soil acidity/ soil types/ tomatoes/ trace elements/ yield components/ cultivated varieties/ microelements

Abstract: Two pot experiments were carried out during the early summer seasons of 1999 and 2000 on a calcareous soil in Giza, Egypt to investigate the effects of sawdust compost and different N sources on 2 tomato cultivars, Line 73 and Floradade. Each pot received 7 kg soil. Two rates of sawdust compost were used: i.e. 2.5 and 5.0% as pot media, in addition to the control treatment. The N fertilizer was added at 4 sources, i.e. nitric acid solution (0.1 N), nitric-calcium nitrate (1:1) mixture, calcium nitrate solution and urea solution on N content basis. All these sources were added at one rate (40 kg/feddan), 35 mg N in each rate every 15 days (280 mg N/pot containing 7 kg soil with a total of 8 rates) compared with no mineral N application. The tomato cultivars differed significantly; Line 73 produced higher number of leaves, dry matter content as well as fruit yield than Floradade, which contained higher concentrations of macronutrients and micronutrients. Adding sawdust compost significantly increased number of leaves, fruit yield and nutrient uptake. The highest increments were achieved under the higher compost rate of 5%. N application was very important to tomato plants in such soil regardless of the form added. The completely and partially acidic N form induced a positive effect on the availability of nutrients such as P, K and micronutrients, which was reflected on the uptake by all organs. Floradade was more sensitive to soil acidification than Line 73. Adding sawdust compost to the calcareous soil in the presence of acidic N form could be recommended for best results in terms of fruit yield and favourable nutrient uptake. Reproduced with permission from the CAB Abstracts database.

1223. Response of sugar beet and corn crops to sawdust compost and farmyard manure with combination of N sources: In relation to the effective properties of a calcareous soil.

Negm, M. A.; Mohammedein, A. A. M.; Zaki, R. N.; and Elmeneasy, A. I. A.

Egyptian Journal of Soil Science 45(3): 279-296. (2005) NAL Call #: 56.8 J825 ; ISSN: 0302-6701

Descriptors: calcareous soils/ clay loam soils/ composts/ controlled release/ crop yield/ equations/ farmyard manure/ grain/ harvest index/ improvement/ manures/ nitrogen/ organic fertilizers/ properties/ residual effects/ responses /

roots/ sawdust/ seasons/ soil properties/ soil types chemical/ sugarbeet/ treatment/ urea/ yields/ FYM/ slow release

Abstract: In a field trial at Noubaria, where the soil is normal calcareous one having a sandy clay loam texture, locally composted saw-dust (SDC) at rates 4 and 8 ton was compared with 12 ton farmyard manure (FYM) both were in combination with diluted HNO₃, urea or slow-release N compound named Enciabien at 20 kg N/fed. rate. During two successive seasons, sugar beet and corn were cropped to study the direct and residual effects of the organic manures on the role of soil through 10 months and crop yields. The obtained results indicated that yield of sugar beet roots increased significantly by manuring over the control without differences between the 3 manure treatments, while the 8 level of SDC was the only significantly effective on increasing corn grain yield over the control and FYM. Nitrogen sources did not effect on sugar beet roots but either of urea or Enciabien was significantly the highest. However, Enciabien was the lowest in case of corn. The ratio of root/shoot in sugar beet was significantly affected with the higher rate of SDC over FYM and control while N sources were as the same as control. Weight of 100 grains increased significantly with the higher rate of SDC and FYM over the lowest SDC rate and control. Urea and Enciabien, were superior to others for 100 grain weight, whereas, com harvest index was not affected with neither organic nor mineral applications. There were real relationships between some soil properties (as independent variables) and sugar beet crop, root/shoot ratio corn grain yield weight of 100 grains (as dependent variable). The regression equations were calculated for those significant relationships and discussed due to behaviour of the effective soil properties after 1, 5.5 and 10 months of organic additions. In conclusion, saw-dust compost could be a satisfactory manure for production of sugar beet followed by corn where the compost was combined with urea and a slow release-N (Enciabien). Due to application, improvement of certain soil properties enhancing crop responses under calcareous condition. This citation is from AGRICOLA.

1224. Responses of soil nematode populations, community structure, diversity and temporal variability to agricultural intensification over a seven-year period.

Yeates, G. W.; Wardle, D. A.; and Watson, R. N.

Soil Biology and Biochemistry 31(12): 1721-1733. (1999) NAL Call #: S592.7.A1S6; ISSN: 0038-0717

Descriptors: application/ biomass/ carbon/ communities/ composition/ cultivation/ diversity/ ecosystems/ equilibrium/ free living nematodes/ herbicides/ indicators/ interactions/ maize/ microbial flora/ monitoring/ mulching/ nematology/ predators/ productivity/ sawdust/ soil/ structure/ temporal variation/ treatment/ weeds/ corn/ microflora/ surveillance systems/ weedicides/ weedkillers

Abstract: Nematode communities and other ecosystem variables were investigated over 7 years under an annual (maize) and a perennial (*Asparagus officinale*) crop in New Zealand using three weed management practices (cultivation, herbicide application, mulching) which can be related to agricultural intensification. Crop productivity and soil conditions did not change significantly during the trial. All management practices influenced the nematode fauna but the greatest long-term effects were from sawdust mulching. In the mulched plots there was an initial flush of

both total and bacterial-feeding nematodes but both subsequently declined, which was coincident with enhanced populations of top predatory nematodes. The apparent negative interaction between bacterial-feeding and predatory nematodes was also demonstrated through the former being significantly ($P < 0.001$) negatively correlated with soil carbon, bacterial mass and weed biomass and the latter being positively correlated with the same variables. Herbicide use did not exert any consistent detrimental effects on nematode communities and the nematode fauna in the herbicide treated plots tended to have greater diversity (as indicated by the Shannon-Weiner index) than that in many of the other plots. The effects of cultivation varied, but under the perennial crop the greatest number of total and bacterial-feeding nematodes were commonly at 5-10 cm depth in cultivated plots. While most treatments had relatively little general effect on the composition of the nematode fauna over the study period, several important specific effects were only apparent after at least 3 years. Thus to effectively evaluate the relative effects of different agricultural practices in the long-term it is necessary to sample until the ecosystem has achieved some degree of equilibrium rather than monitoring only initial cropping cycles.

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1225. Responses to fertility and disturbance in a low-diversity grassland.

Gendron, F. and Wilson, S. D.

Plant Ecology 191(2): 199-207. (2007)

NAL Call #: QK900 .P63; ISSN: 1385-0237

Descriptors: biomass/ botanical composition/ dispersal/ grasslands/ introduced species/ light/ nature conservation/ nitrogen/ nutrient availability/ persistence/ sawdust/ soil fertility/ species diversity/ vegetation types

Abstract: We examined variation in species composition in a low-diversity, anthropogenic grassland in response to 11 years of nitrogen (N) manipulation and disturbance. The species-poor grassland (2-3 species/0.5 m²) represents a wide spread vegetation type (>10 million ha in North America) dominated by the introduced perennial grasses *Bromus inermis* and *Agropyron cristatum*. Four levels of N and three of soil disturbance were applied in all combinations to plots (5x15 m, N=120) in a completely randomized design each year. Seeds or transplants of 47 species were added to ensure that dispersal was not a barrier to changes in species composition. After 11 years of treatment, all but the most disturbed plots continued to be dominated by *B. inermis*. The cover of the second-most abundant species, *A. cristatum*, decreased with disturbance but did not vary significantly with N. Despite the lack of changes in the identity of the dominant species, our environmental manipulations strongly influenced ecosystem characteristics. Added N increased soil available N, and decreased the cover of bare ground and light availability. Soil disturbance decreased aboveground biomass, and increased the cover of bare ground and light availability. Sawdust application, designed to decrease N availability, significantly reduced community biomass, and increased light availability and the cover of bare ground, but did not alter nutrient availability or species composition. The results highlight the difficulty of restoring diversity in species-poor,

anthropogenic communities dominated by introduced species, and thus the importance of conserving remnants of diverse natural grasslands.

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1226. Restoration of a coastal California grassland after invasion by nitrogen-fixing shrubs, French broom and Scotch broom.

Haubensak, K. A. and D'Antonio, C. M.

Ecological Restoration 24(2): 93-99. (2006); ISSN: 1522-4740

Descriptors: biomass/ carbon/ coastal areas/ enrichment/ grasslands/ growth/ introduced species/ invasion/ leaves/ nitrogen/ nitrogen fixing trees/ nutrient availability/ plant competition/ sawdust/ soil amendments/ trees/ *Genista monspessulana*/ United States of America

Abstract: We studied the effect of two years of sawdust addition on the growth of native perennial grasses in a site where we manually removed two introduced nitrogen-fixing shrubs, French broom (*Genista monspessulana*) and Scotch broom (*Cytisus scoparius*) in central coastal California. We tested the hypothesis that sawdust addition to soil would reduce plant-available nitrogen levels, and thereby decrease the competitive effect of fast-growing exotic annual grasses on slower-growing native perennial grasses. Sawdust did not alter the competitive interaction between annuals and native perennials: native perennial grass seedlings were greatly suppressed by the presence of annuals and this was not changed by sawdust addition. In the absence of competition with annuals, we observed both direct stimulation and suppression by sawdust on native species. Annual grass biomass did not respond to sawdust addition. Nitrogen:carbon ratios of leaf tissue were similar across all species, suggesting that both annuals and perennials responded similarly to depletion of soil resources. Our results confirm that although it is possible to use sawdust to reduce nitrogen availability in broom-invaded soils, it is difficult to target the species that will benefit.

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1227. Retention properties of wood residues and their potential for soil amelioration.

Dunisch, Oliver; Lima, Valmiqui Costa; Seehann, Gunther; Donath, Johannes; Montoia, Valdinez Ribeiro; and Schwarz, Thomas

Wood Science and Technology 41(2): 169-189. (Feb. 2007); ISSN: 0043-7719

Descriptors: wood residues/ soil amendments

Abstract: The particle size distribution, the nutrient content and the sorption behaviour of six solid wood and ash/charcoal residues collected in three wood-processing companies in Germany and Brazil were investigated in order to elucidate the potential of these residues for the development of new products for soil amelioration. The absorption of N, P, and K by the residues and the leaching of nutrients from impregnated samples were studied in the laboratory at substrate temperatures of 20 and 300° C. The release of elements by the impregnated samples and the sorption behaviour of ash/charcoal incorporated in the soil were also studied in the field on a temperate site (Hamburg,

53° 32'N 09° 59'E), on a subtropical site (Ivai, 25° 15'S 50° 45'W), and on a tropical site (Aripuana, 10° 09'S 59° 26'W). Under laboratory conditions the solid wood residues absorbed 2.0-9.1% of the N, 0.1-0.4% of the P, and 1.0-8.5% of the K available in the impregnation solution. At a temperature of 20° C, selected sieve fractions of the ash/charcoal residues absorbed up to twice as much as N and up to 100 times more K than the treated wood residues. The absorption of N, P, and K to the ash/charcoal residues increased significantly at a substrate temperature of 300° C compared to a substrate temperature of 20° C. In absolute numbers, the leaching of N, P, and K from the impregnated ash/charcoal residues was in the range of the release by the impregnated solid wood residues, whilst the relative rate of nutrient leaching was strongly reduced. The field experiments confirmed the results obtained in the laboratory and indicated that ash/charcoal residues are suitable raw materials for the development of new products for soil amelioration, in particular for application under humid climate conditions. This citation is from AGRICOLA.

1228. Rice growth and nutrient accumulation as affected by different composts.

Shu YungYu and Chung RenShih

Communications in Soil Science and Plant Analysis 37(7/8): 1139-1156. (2006)

NAL Call #: S590.C63; ISSN: 0010-3624

Descriptors: animal manures/ cattle dung/ composts/ crop residues/ growth/ heading/ leaf sheaths/ leaves/ nitrogen/ phosphorus/ pig manure/ plant nutrition / potassium/ rice/ rice husks/ roots/ sawdust/ seeds/ stems/ tillering/ tillers/ Formosa/ paddy/ rice hulls

Abstract: This study evaluated the effects of four different kinds of compost: pea-rice hull compost (PRC), cattle dung-tea compost (CTC), hog dung-rice hull compost (HDR), and hog dung-sawdust compost (HDS). These types of compost differ in nitrogen composition and in the dry matter yield and nutrient accumulation [nitrogen (N), phosphorus (P), potassium (K)], of rice plants. The rice (*Oryza sativa* L.) plants were planted in an Oxisol soil. Plants were cultivated in pots, which contained 3 kg of soil, mixed with the four different composts (PRC, 404 g; CTC, 395 g; HDR, and HDS, 450 g) and chemical fertilizer (CHEM) (N:P₂O₅:K₂O=120:96:72) The residual effect was studied after the crop was harvested. All treatments were replicated four times, with a randomized complete block design. The nutrient concentrations in the root, leaf sheath, leaf blade, stalk, and grain were analysed at different growth stages. After the first crop, the dry matter yield and the amount of N, P, and K absorbed from the CTC or HDS treatments were higher than those of the other treatments, at the most active tillering stage. The growth and nutrient accumulation of rice plants given the PRC treatment were higher than those given the CHEM treatment at the heading stage or the HDR treatment at the maturity stage. In the second crop, the dry matter yield from the PRC, CTC, and HDR treatments was higher than from the other treatments. The nutrient accumulation of the rice plants was positively correlated with the dry matter yield. The residual effect of the HDS compost was the least among all four composts. Reproduced with permission from the CAB Abstracts database.

1229. Risk of phytotoxicity of sawdust substrates for greenhouse vegetables.

Dorais, M.; Menard, C.; and Begin, G.

Acta Horticulturae 761: 589-594. (2007)

NAL Call #: 80 Ac82; ISSN: 0567-7572

Descriptors: biomass/ chlorophyll/ cucumbers/ greenhouse crops/ growing media/ indicators/ leaf area/ peat/ perlite/ phytotoxicity/ pines/ risk/ sawdust/ seedlings/ substrates/ tomatoes/ waste wood/ gherkins/ potting composts/ rooting media

Abstract: The use of forestry wastes based substrates for greenhouse production constitutes a sustainable alternative to largely used inorganic or peat substrates. Our recent studies have shown benefits of using *Picea glauca* sawdust/composted bark based substrates compared to rockwool in terms of reducing production costs with equivalent or higher yield and root growth. However, in addition to their specific physical properties, forestry waste products can contain phytotoxic compounds such as manganese, heavy metals, terpenes and phenols. These compounds can have serious consequences owing to the direct root contact with the concentrated form. Phytotoxic molecules can be detected and quantified by complex analytic methods, while bioassays are rapid, economic and include known and unknown toxic compounds. Therefore, this study was intended to evaluate the phytotoxicity risk of fresh sawdusts and sawdust species mixture substrates on greenhouse vegetable crops (tomato, cucumber and sweet pepper) by biotests. Ten tree species have been selected according to the usual byproducts of the Canadian forest industry (*Abies balsamea*, *Picea* sp., *Pinus* sp., *Thuja* sp., *Chamaecyparis nootkatensis*). Plant biomass, leaf area and Chl a fluorescence parameters were measured after 3-5 weeks of growth depending on the crop. The experimental design was a complete bloc with ten replicates (3 pots of 10 cm diameter per e.u.) including positive (peat/perlite substrate) and negative controls (peat/perlite substrate+dichlobenil). Our results have shown that *Thuja* sp. based substrates were phytotoxic for tomato, cucumber and pepper seedlings, while other tree species did not reduce plant biomass and leaf area. The F_v/F_m ratio was not a good indicator of the plant phytotoxicity. Reproduced with permission from the CAB Abstracts database.

1230. Role of certain composted plant or animal residues in the control of *Rotylenchulus reniformis* on cowpea.

Ismail, A. E. and Badawi, M. A.

Pakistan Journal of Nematology 16(2): 127-136. (1998)

NAL Call #: QL391.N4P34; ISSN: 0255-7576

Descriptors: bananas/ cattle manure/ chemical control/ composts/ cowpeas/ grain legumes/ maize/ nematocidal plants/ nematicides/ nematology/ organic amendments/ plant nematology/ plant parasitic nematodes/ plant residues/ residues/ rice/ rice straw/ sawdust/ soil amendments/ straw/ black eyed peas/ corn/ eelworms/ paddy/ pulses/ Secernentea/ southern peas/ Tylenchida

Abstract: Soil amendment with 5 organic composts of plant or animal residues (sawdust (SD), rice straw (RS), banana tree (BT), maize stalks (MS) and cattle dung (CD) @ 0.25, 0.5 and 1.0% w/w) showed significant (P<=0.05 and/or 0.01) reduction in numbers of *R. reniformis* larvae in soil, females and egg masses on roots as well as the nematode

build-up, as compared to control. All doses of BT compost were the most effective in reducing numbers of the nematode stages, females, egg masses and the nematode build-up followed by 1.0% of both MS and SD composts. All doses of organic composts significantly increased growth of cowpea cv. Balady. Generally, there were positive significant correlations between doses of composts and reduction in the nematode stages, and increases in cowpea growth parameters. Most of the applied composts showed positive correlation between N, P and K uptake and the compost doses.

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1231. The role of organic manures on P and S use efficiency by potato in acidic soil of Fagu (Shimla).

Sud, K C and Sharma, R C.

In: Potato, Global Research and Development Proceedings of the Global Conference on Potato. New Delhi, India.; Vol. 2.; pp. 877-882; 2002.

Descriptors: acid soils/ application rates/ dry matter/ farmyard manure/ leaves/ mineral uptake/ nutrient availability/ nutrient uptake/ organic amendments/ phosphorus/ phosphorus fertilizers/ pine needles/ potatoes/ poultry manure/ rice husks/ sawdust/ soil pH/ soil types/ stems/ sulfur/ sulfur fertilizers/ translocation/ tubers/ use efficiency/ elemental sulphur/ FYM/ phosphate fertilizers/ poultry litter/ rice hulls/ sulphur/ sulphur fertilizers

Abstract: Five organic manures/materials (farmyard manure, pine needles, poultry manure, rice husk and sawdust) were evaluated at three levels of P and S (no P and no S, 100 ppm P+50 ppm S, and 200 ppm P+100 ppm S) using labelled formulations with potato as a test crop in a study conducted in Himachal Pradesh, India. A significant increase in dry matter yield and nutrients uptake by leaves, stem and tubers was obtained with 100 ppm P+50 ppm S. Organic manures did not differ much among themselves with regard to tuber dry matter yield. Radioassay data on the P and S availability from labelled carriers and their utilization by the potato indicated that translocation of P and S was highest in leaf and stem, respectively. Among the organic manures, paddy husk and sawdust were found to be inferior with regard to P availability to potato. Likewise, pine needles and sawdust were less effective in increasing S availability from labelled carrier. Laboratory studies showed that increase in P availability to potato in presence of organic manures was due to their ability in lowering soil pH and chemical potentials. Correlation matrix between biological and radioassay data showed a significant relationship between % P utilization and P uptake by leaves and stem whereas S uptake by leaves and tubers had a high degree of correlation with the % S diff and % S utilization values. Reproduced with permission from the CAB Abstracts database.

1232. The role of organic substances in the increase of productivity of dunes and poor former agricultural lands.

Gorzalak, A.

Sylwan 142(8): 27-33. (1998)

NAL Call #: 99.8 SY52; ISSN: 0039-7660.

Notes: Original title: Rola substancji organicznych w podnoszeniu produktywnosci wydym oraz sabych gruntow porolnych.

Descriptors: agricultural land/ dune soils/ dunes/ forest litter/ land improvement/ organic amendments/ organic fertilizers/ peat/ pine bark/ productivity/ sand dune stabilization/ sandy soils/ sawdust/ soil amendments/ soil biology/ soil chemistry/ soil texture/ duff/ farmland

Abstract: The textural and chemical properties are described of sand dune (soils) in Poland, and an account given of organic materials used as dune fertilizers (including peat, forest litter, pine bark and sawdust) and as fertilizers on former agricultural land (pine bark and sawdust). The effects of these fertilizers are described, as well as methods for dune stabilization and the introduction of various (soil) organisms (such as ants).

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1233. The role of sawdust in cattle mycobacteriosis.

Majoris, Tibor; Cseh, Kalman; and Guzsany, Mihaly
Magyar Allatorvosok Lapja 120(9): 535-538. (1998); ISSN: 0025-004X.

Notes: .

Descriptors: wood waste/ sawdust/ cattle/ mycobacteriosis

Abstract: The authors analyse the origin of a tuberculin-positive result on a large scale cattle farm. They have performed an epidemiological investigation to identify possible sources of infection. *Mycobacterium gordonae* was isolated by The Hungarian Animal Health institute from sawdust used as bedding of cows. Other possible origin has not been discovered. This is the first time to prove the role of atypic mycobacterias in the cattle mycobacteriosis by demonstrating *M. gordonae*. The economical consequences of paraallergic reactions caused by husbandry and feeding anomalies are: decrease of performance, isolation, diagnostic slaughter and the employees' extra examinations - all significant expenses. These costs are more substantial than the general epidemic control measures. Additionally, the tuberculosis free status can be endangered.

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1234. Rubber wood saw dust: An ideal substrate for summer mushroom cultivation.

Kochuthresiamma Joseph; Kothandaraman, R.; and Mathew, J.

Planter 74(871): 527-529. (1998); ISSN: 0126-575X

Descriptors: crop yield/ cultural methods/ edible fungi/ growing media/ plant residues/ rubber plants/ sawdust/ tropical crops/ vegetables/ potting composts/ rooting media/ vegetable crops

Abstract: The cultivation of summer mushroom (*Calocybe indica*) on rubberwood sawdust in India is described. The mycelium covered the surface of the beds in 20 days during the spawn run; small buttons formed 15 days after casing, the fruiting bodies being fully developed within 7 days. A FW of 533 g mushrooms/kg sawdust was produced. The mushrooms are symmetrical, umbrella-shaped, fleshy and milky white with a thick bulbous base.

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1235. Sand-compost-hydrogel mix for low cost production of tomato seedlings.

El Hady, O. A.; Adam, S. M.; and El Kader, A. A. A.

Egyptian Journal of Soil Science 42(4): 767-782. (2002)

NAL Call #: 56.8 J825 ; ISSN: 0302-6701

Descriptors: composting/ composts/ crop production/ fertigation/ growing media/ leaves/ low input agriculture/ nitrogen/ nutrient content/ organic matter/ organic wastes/ phosphorus/ plant residues/ potassium/ refuse/ sand/ sandy soils/ sawdust/ seed germination/ seedling growth/ seedlings/ seeds/ soil types/ stems/ tomatoes/ use efficiency/ water use efficiency/ fertirrigation/ hydrogel / municipal wastes/ potting composts/ rooting media/ trash

Abstract: Different media were prepared to be used for commercial production of some local hybrids of tomato seedling (*Lycopersicon esculentum*) namely: Dokki 1, Ain Shams 2 and Wady. Examined media were: (I) sandy soil; (II or III) medium I mixed with 2% or 4% (W/W) of fine compost (produced by aerobic composting of some local organic wastes, i.e town refuse, sawdust, plant residues and organic manure at the ratio of 1:1:1:1); (IV or V) medium I mixed with 0.1% or 0.2% (w/w) of an absorbent material (mixture of an anionic polyacrylamide k polyacrylate 30% anionicity and a cationic polyacrylamide allylamine hydrochloride 20% cationicity hydrogels at the ratio of 2:3); and (VI, VII and VIII) medium I mixed with mixture of examined compost and hydrogel at the ratio of 1% compost+0.1% hydrogel, 2% compost+0.1% hydrogel and 2% compost+0.2% hydrogel (w/w), respectively. Fertigation was carried out twice a week using 1 g/l fertilizer solution 19:19:19. Some growth parameters (viz., germination percentages; seedlings height; stem diameter; leaves number and area; fresh and dry weight of seedlings); N, P and K content and both water and fertilizers use efficiency by produced seedling as well as some physico-bio-chemical properties of the media at the end of the growing period, were taken as bases for preference. Under the conditions of conducted experiment and taking the economical aspects into consideration, the hybrid Wady and the growing medium No. VII seem to be suitable. Production of 1000 seedlings needs 250, 5 and 0.25 kg of sand, compost and hydrogel, respectively, that cost ~7 L.E.

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1236. Sawdust and bark to treat nitrogen and faecal bacteria in winter stand-off pads on a dairy farm.

Luo, J.; Donnison, A.; Ross, C.; Bolan, N.; Ledgard, S.; Clark, D.; and Qiu, W.
New Zealand Journal of Agricultural Research 51(3): 331-340. (2008)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: sawdust/ bark/ nitrogen/ fecal bacteria/ winter/ stand-off pads/ dairy farms

Abstract: New Zealand farmers are increasingly using improved management systems including moving animals out of paddocks to protect wet soils from damage during winter. The cows can be held up to 20 h a day on specially constructed unroofed outdoor stand-off pads. A field study was undertaken to investigate excreta nitrogen (N) transformations, N and faecal bacterial transport to drainage, and denitrification N losses when *Pinus radiata* bark or sawdust were used as filling materials in stand-off pads. About 3 months after use only 4.0% of the N that was deposited on the bark or sawdust pad by cows had been transported to the drainage. Similarly, after the 3 months of use only 9.8% of the *Escherichia coli* bacteria that were deposited on the bark pad had been transported to the drainage and with even less, 0.3%, leached From the

sawdust pad. The sawdust pad tended to retain more *Campylobacter* than the bark pad. About 6 months after use, gaseous N losses due to denitrification from the sawdust or bark pad accounted for about 4.5 and 1.7% of the deposited excreta N, respectively. Denitrification activity was limited by the available nitrate in the pad materials, and decreased after cows were moved out of the pads.
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1237. Sawdust and moss as components of the substrate for rooting green cuttings of plum and *Prunus divaricata*.

Samoshchenkov, E. G. and Tikhomirov, V. A.
Sadovodstvo i Vinogradarstvo 1: 9-11. (2000); ISSN: 0235-2591

Descriptors: fruit crops/ fruits/ greenwood cuttings/ growing media/ peat/ perlite/ plums/ sand/ sawdust/ temperate fruits/ potting composts/ rooting media

Abstract: Green cuttings of plum (cv. Eurasia 21), 10-3-68 (a promising clonal rootstock), and 13-113 and 9-114 (winter-hardy forms of *Prunus divaricata*) were rooted under mist in various substrates. These were standard peat and perlite and peat and sand (controls), and also moss and sawdust either alone or mixed with soil, sand, well decomposed fen peat (pH 6.0) and perlite. The results from several years of trials are tabulated, and show that practically all substrates that included moss gave better rooting than the controls. Consistently good results were obtained with moss, moss and sawdust, moss and sand, moss and perlite. Sawdust alone and sawdust and perlite also gave very good results with all the cuttings. Rooting was best in clone 13-113 and rootstock 10-3-68. Rooting was poorest in those substrates containing peat. Accordingly it is recommended that moss should be added to any rooting substrate, and also that peat should be excluded from surface substrates in direct contact with the cuttings.

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1238. Sawdust as a regulator of intake of a protein-energy supplement by dairy heifers during the dry season.

Malafaia, P.; Lizieire, R. S.; Ronchi, A. R.; Valente, T. N. P.; Pereira, D. de L.; and Padilha, T. de F.
Livestock Research for Rural Development 16(3): article 15. (2004); ISSN: 0121-3784.

Notes: Original title: Serragem de madeira como controlador da ingestao diaria de um suplemento proteico energetico por novilhas durante a epoca seca.

Descriptors: cows/ dairy cows/ dry season/ feed intake/ heifers/ liveweight gain/ protein supplements/ sawdust/ sodium chloride/ liveweight gains

Abstract: Daily weight gain, costs and nutritional aspects were evaluated in 28 dairy heifers fed two protein-energy supplements for 114 days during the dry season. The heifers were divided into two groups. To one group a protein-energy supplement containing 35% of sodium chloride as a regulator for voluntary supplement intake was given. To the other group, 35% of powdered sawdust was mixed into the protein-energy supplement in order to verify if this organic residue could be used as a regulator for the daily supplement intake. The animals were weighed every 30 days and the protein-energy supplement intake was measured each day. There was no difference in daily

weight gain when sodium chloride (0.189 kg day⁻¹) or sawdust (0.212 kg day⁻¹) was used as regulator for the supplement intake. The daily intake of the supplement containing sodium chloride was 0.166 kg day⁻¹, whereas the intake of the supplement containing sawdust was 0.196 kg day⁻¹. The results of the experiment confirm the hypothesis that sawdust can be incorporated into protein-energy supplements to substitute sodium chloride for the regulation of daily supplement intake. The use of sawdust could be an alternative to avoid environmental problems caused by this ligno-cellulosic material. This citation is from AGRICOLA.

1239. Sawdust-based cultivation of mushrooms by using residual lumber smoke-heated.

Oku, T.; Ishiguri, F.; Tamegai, J.; Otomo, M.; Yokota, S.; Yoshizawa, N.; and Henmi, T.

Bulletin of the Utsunomiya University Forests 38: 101-106. (2002)

NAL Call #: 99.9 UT72; ISSN: 0286-8733

Descriptors: edible fungi/ mushrooms/ pines/ sawdust/ Douglas fir/ Lentinaceae/ Poriales/ Tricholomataceae

Abstract: Utilization of Douglas fir (*Pseudotsuga menziesii*) and Russian red pine (*Pinus* spp.) sawdust for sawdust-based cultivation of *Pleurotus ostreatus* and *Lentinula edodes* was investigated. In *P. ostreatus* cultivation by using Douglas fir sawdust, the first yield of fruiting bodies was improved by using smoke-heated sawdust, suggesting that the use of this sawdust was possible for sawdust-based cultivation of this mushroom and beech (*Fagus crenata*) sawdust, whereas in Russian red pine sawdust, the first yield of fruiting bodies was almost the same as those by using smoke-heated sawdust. On the other hand, in *L. edodes* cultivation, only few fruiting bodies were obtained in the medium which was made with smoke-heated sawdust during 4-month cultivation, suggesting that sawdust of both species were not suitable for the cultivation of *L. edodes*.

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1240. Sawdust-based cultivation of some mushrooms using unutilized wood resources.

Oku, T.

Bulletin of the Utsunomiya University Forests 40: 1-67. (2004)

NAL Call #: 99.9 UT72; ISSN: 0286-8733

Descriptors: bagasse/ crop yield/ cultivation/ edible fungi/ heat treatment/ industrial wastes/ lignocellulosic wastes/ maize meal/ moisture content/ pines/ pumice/ sawdust/ smoking/ substrates/ thinnings/ wood residues/ Basidiomycetes/ Coriolaceae/ Douglas fir/ *Grifola*/ *Grifola frondosa*/ heat processing/ Lentinaceae/ *Lyophyllum ulmarium*/ *Pholiota nameko*/ Poriales/ *Strophariaceae*/ Tricholomataceae

Abstract: Results are presented of several studies on the possibility of sawdust-based cultivation of some edible mushrooms using softwood thinnings with and without smoke-heating, or residuals and wastes from the wood industry, with an aim of using the softwoods in place of hardwoods. Mycelial growth and fruiting body production by maitake (*Grifola frondosa*) were determined on sawdust of untreated and smoked Japanese cedar (*Cryptomeria*

japonica) in comparison with beech (*Fagus crenata*). The effects of addition of corncob meal to the sawdust substrate on yield of fruiting bodies of shiitake (*Lentinula edodes*) was determined using smoke-heated Japanese cedar and Japanese larch (*Larix kaempferi*). Similar studies on the effect of pumice addition to the sawdust were done using the same sawdust for shiitake and maitake. The effects of wood meal size and moisture content of the substrate on shiitake mycelial growth were determined using Japanese cedar and oak (*Quercus serrata*). Possible use of wood residues for production of hiratake (*Pleurotus ostreatus*) and shiitake was determined using Douglas fir and Russian red pine with or without smoke-heating treatment. The final study investigated the use of crushed residuals of tatami board manufactured from grass straw and bagasse particleboard, in comparison with beech and Japanese cedar, for growth of shiitake, enokitake (*Flammulina velutipes*), nameko [*Pholiota nameko*], bunashimeji (*Lyophyllum ulmarium*), hiratake and maitake. This citation is from AGRICOLA.

1241. Screening of various substrates for sporulation and mass multiplication of bio-control agent *Trichoderma harzianum* through solid state fermentation.

Lakshmi Tewari and Chandra Bhanu

Indian Phytopathology 56(4): 476-478. (2003)

NAL Call #: 464.8 IN2 ; ISSN: 0367-973X

Descriptors: biological control agents/ cellulosic wastes/ chickpeas/ farmyard manure/ flours/ fungal spores/ growth/ maize cobs/ mushroom compost/ organic wastes/ rice/ rice bran/ rice straw/ sawdust/ straw/ substrates/ sugarcane bagasse/ wheat/ wheat bran/ wheat straw/ biocontrol agents/ biological control organisms/ FYM/ Hyphomycetes/ paddy

Abstract: Three different categories of substrates, i.e. agroindustrial cellulosic wastes (wheat straw, rice straw, shelled maize cob, sawdust, paper waste and sugarcane bagasse), organic manures (farmyard manure, spent compost of button mushroom and spent straw of oyster mushroom) and cereal brans (wheat and rice bran), were evaluated for growth responses of *T. harzianum* through solid state fermentation technique. The cellulosic agro-wastes were supplemented with 2 and 4% chickpea flour (on dry weight basis) as organic N supplement. The wheat and rice straw supported the maximum radial growth. All the organic manures supported good mycelial growth of the biological control agent while on cereal brans very slow growth was observed. Rice straw and wheat straw produced the maximum conidial counts (4.95x10⁸ and 4.86x10⁸/g powder, respectively), which were significantly higher to the counts on other cellulosic substrates in 20-day-old cultures. The lowest conidial counts (1.16x10⁸/g) after 20 days were recorded on paper waste. Among organic manures and cereal brans, the maximum and significantly higher CFU counts (40.80x10⁸/g) were recorded on rice bran at 15 days. The lowest CFU counts were recorded on FYM and spent button mushroom compost. Supplementation of all the cellulosic substrates with chickpea flour significantly enhanced the conidial yield. Significantly higher conidial counts were recorded at 4% than at 2% supplementation level. At 4% supplementation level, the maximum CFU counts (11.96x10⁸g) were

observed with rice straw that were at par with sugarcane bagasse (11.79x108/g) and wheat straw (11.52x108/g).

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1242. Seed drills for dry beans in Leon Province.

Boto Fidalgo, J. A. and Valenciano Montenegro, J. B. *Agricultura, Revista Agropecuaria* 67(792): 578-580. (1998); ISSN: 0002-1334.

Notes: Original title: Las sembradoras para judia grano en la Provincia de Leon.

Descriptors: coir/ emergence/ equipment/ pesticides/ sawdust/ seed drills/ seed germination/ seedlings/ sowing/ vermiculite/ coconut fibre/ green bean/ seed sowing/ snap bean

Abstract: Recommendations were formulated to improve current seed sowing techniques in order to increase percentage seed germination and seedling emergence in dry beans [*Phaseolus vulgaris*] grown in the Province of Leon, Spain. The recommendations include sowing seeds at 15-cm intervals near the soil surface (3-cm depth) along ridges, applying pesticides at sowing, and filling the sowing hole with a substrate (coir, vermiculite or sawdust) in order to prevent formation of a soil crust which impedes seedling emergence. Alterations were made to a conventional seed drill to accommodate the above recommendations and field trials were carried out in 6 plots in 1997. Problems associated with pests, diseases and the effect of soil crust development on seedling emergence were reduced or eliminated. At the start of flowering (end of July), plants from the experimental plots had stronger root systems than plants from conventionally sown plots. Sawdust was generally the best substrate as coir did not flow well in the machine and vermiculite flowed too easily, although seeds had a greater tendency to dry out in sawdust. Soil crust formation was only eliminated if the substrate filled the hole to the level of the soil surface.

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1243. Seed germination and seedling survival of *Tillandsia geminiflora* Brongn in different substrates.

Stringheta, A. C. O.; Silva, D. J. H. da; Cardoso, A. A.; Fontes, L. E. F.; and Barbosa, J. G. *Acta Cientiarum Agronomy* 27(1): 165-170. (2005); ISSN: 1679-9275.

Notes: Original title: Germinacao de sementes e sobrevivencia das plantulas de *Tillandsia geminiflora* Brongn, em diferentes substratos.

Descriptors: growing media/ nylon/ rice husks/ sawdust/ seed germination/ seedlings/ seeds/ substrates/ survival/ *Dicksonia sellowiana*/ *Filicopsida*/ potting composts/ rice hulls/ rooting media/ *Tillandsia geminiflora*

Abstract: In order to evaluate the germination percentage of *Tillandsia geminiflora*, seeds were sown in different materials: carbonized rice husks (CRH), *dicksonia* fern (*Dicksonia sellowiana*), sawdust and black nylon screen (with 80% shading). They were fixed by the plume or the seed itself. The highest germination percentage (76%) was obtained by the plume-fixed seeds on black nylon screen. To evaluate their survival rate, the plantlets were distributed in the following substrates: (1) CRH; (2) *dicksonia* fern; (3) sawdust; (4) *Salvinia auriculata*; (5) CRH (50%)+S.

auriculata (50%); (6) CRH (50%)+sawdust (50%); (7) CRH (50%)+*dicksonia* fern (50%); (8) *S. auriculata* (50%)+sawdust (50%); (9) *S. auriculata* (50%)+*dicksonia* fern (50%); and (10) sawdust (50%)+*dicksonia* fern (50%). Treatments 3 and 6 showed the highest plantlet survival rates of 78.5 and 62.5%, respectively.

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1244. Seed viability and seedlings vigour of jack fruit (*Artocarpus heterophyllus* Lam.) as influenced by different storage media.

Baghel, B. S.; Rajesh Tiwari; and Pandey, L. P. *South Indian Horticulture* 51(1/6): 204-206. (2003); ISSN: 0038-3473

Descriptors: ash/ charcoal/ duration/ jackfruits/ plant height/ sand/ sawdust/ seed germination/ seed testing/ seedlings/ seeds/ storage/ viability/ vigour/ vigor

Abstract: A study was conducted, to determine the suitable storage media for prolonging jackfruit seed viability in Jabalpur (Madhya Pradesh, India) in 1998. Treatments comprised: seed storage without media for 5, 10, 15 and 20 days, seed storage in ash for 5 days, seed storage in charcoal for 5, 10, 15 and 20 days, seed storage in sand for 5, 10, 15 and 20 days, seed storage in sawdust for 5, 10, 15 and 20 days. Seeds were sown just after extraction, and the earliest germination (11.66 days) was observed when seeds were stored in sawdust for 20 days. Very late seed germination (25.33 days) was observed in seeds stored without media for 20 days. Germination percentage (95.83%) and vigour were highest when the seeds were sown just after extraction (T1). Among the seeds stored for 20 days in different media, the highest germination percentage (93.75%) and vigour were recorded in charcoal dust. Plant height was highest in those seeds sown just after extraction.

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1245. The significance of *Cognettia sphagnetorum* (Enchytraeidae) on nitrogen availability and plant growth in wood ash-treated humus soil.

Liiri, M.; Ilmarinen, K.; and Setälä, H. *Plant and Soil* 246(1): 31-39. (Sept. 2002)

NAL Call #: 450 P696; ISSN: 0032-079X [PLSOA2]

Descriptors: *Pinus sylvestris*/ *Oligochaeta*/ nitrogen/ nutrient availability/ wood ash/ seedling growth/ soil pH/ biomass/ ammonium nitrogen/ nitrate nitrogen/ roots/ length/ conifer needles/ nitrogen content/ soil organic matter/ application rate/ root shoot ratio/ humus/ growth/ Internet resource

This citation is from AGRICOLA.

1246. Similarity of bacterial communities in sawdust- and straw-amended cow manure composts.

Green, S. J.; Michel, F. C. Jr.; Hadar, Y.; and Minz, D. *FEMS Microbiology Letters* 233(1): 115-123. (Apr. 2004) *NAL Call #:* QR1.F44; ISSN: 0378-1097

Descriptors: composted manure/ cattle manure/ bacteria/ community ecology

Abstract: We analyzed bacterial communities in two cow manure composts derived from the same feed manure and composted in the same location, but composted with different carbon amendments, and in peat-based potting

mixes amended with these composts. Bacterial communities were characterized by PCR-denaturing gradient gel electrophoresis (DGGE) analysis of extracted DNAs, and population fingerprints generated for each sample were compared. Sequence analyses of dominant DGGE bands revealed that members of the phylum Bacteroidetes were the most dominant bacteria detected in this study (19 of 31 clones). These analyses demonstrate that bacterial community profiles of individual composts were highly similar, as were profiles of compost-amended potting mixes. However, potting mix profiles differed substantially from the original compost profiles and from that of the peat base. These data indicate that highly similar bacterial populations were active in the two composts, and suggest that the effects of the initial carbon amendment on the mature compost bacterial communities were minor, while factors such as the feed manure and composting location may have been more influential. This citation is from AGRICOLA.

1247. Simple cultivation of sweet pepper in wood chips with recycled nutrient solution. Low-tech hydroponics for sweet pepper.

Heuberger, H.; Grotz, U.; and Schnitzler, W. H. *Gemüse Munchen* 40(11): 22-25. (2004); ISSN: 0016-6286.

Notes: Original title: Einfacher Anbau von Paprika in Holzfaser mit rezirkulierender Nährlösung. Low-tech Hydroponik für Paprika.

Descriptors: cost analysis/ crop quality/ crop yield/ drainage water/ fertigation/ fertilizers/ fixed costs/ greenhouses/ hydroponics/ protected cultivation/ recycling/ rockwool/ soilless culture/ substrates/ variable costs/ wood chips/ costing/ cultivation under glass or plastic/ fertirrigation/ glasshouses/ mineral wool/ rock wool

Abstract: Sweet pepper cultivars Spartakus and Fiesta were sown mid-December and planted on wood chips (Toresa special) early January, with harvesting from early May (green peppers) until end July. In 2001, 2 mixtures of fertigation fertilizer and standard fertilizer were used, while in 2002 and 2003 3 basic fertilizer treatments with additional N ($\text{NH}_4\text{:NO}_3$ of 1:3.7, 1:1.3, and 1:10, respectively) were used. Data are presented on crop yield, pH of irrigation water, water quality of recycled irrigation water, composition of drainage water, fixed and variable costs, and crop quality. The simple closed system is compared to a high-tech system with rockwool and a computer-based fertilizer program. Costs for the simple system were calculated at 1840 EURO/year compared to 5320 EURO/year for the high-tech system, assuming for both systems general cultivation costs per 1000 m² of 16 600 EURO/year.

This citation is from AGRICOLA.

1248. Simplified floor constructions in cubicles for cattle.

Ekelund, K.; Herlin, A.; Michanek, P.; and Ventorp, M. *Specialmeddelande Institutionen for Jordbrukets Biosystem och Teknologi, Sveriges Lantbruksuniversitet* 229: 46 pp. (1998).

Notes: Original title: Forenklade golv konstruktioner i liggbas for notkreatur i losdrift.

Descriptors: animal behaviour/ animal welfare/ behaviour/ cattle housing/ concrete/ costs/ cow housing/ floors/ litter/ mats/ nutrients/ sawdust/ animal behavior/ animal rights/ behavior/ cattle sheds/ costings/ cowsheds/ flooring

Abstract: This report is based on a review of experiences abroad and on a study in Sweden concerning the function of different lying area surfaces on: lying behaviour, hygiene of lying area, and contamination of soil. In the USA, cubicles placed directly on the soil have been used for a number of years with sand for litter/bedding. The advantages of sand are claimed to be comfort and health, the disadvantages, high use of bedding (25 kg/day per cubicle), animals dig in the sand, and difficulties with manure management. Soil samples were taken from 10 of these dairy farms in the USA (cubicles directly on the soil with no liquid barrier) at depths of 0-300 and 300-600 mm. Results are presented but are very variable. Cleanliness of the cubicles and laying down and lying behaviour were compared for 2 surfaces: a sand/sawdust mixture on compacted tarmac, and a thin layer of sawdust on a soft rubber mat (Comfort matReg.) on stone meal base. Cleanliness of cubicles was monitored twice a day, for 8 cubicles of each surface, over a 14 day period. The sand/sawdust mixture was superior and significantly cleaner, but bedding consumption was 6-7 times higher than for the rubber mat/sawdust. High bedding requirements lead to high costs, but a clean lying area is important for udder health, milk quality, and consumer opinions on dairy barns. The laying down and lying behaviour of 8 cows was monitored continuously over 3 days on each lying surface. Cows had a slightly shorter preparation time to lie down (probably due to comfort) on the sand/sawdust mix than on the rubber mat. The yearly cost (interest and depreciation) for a concrete floor as a cubicle base is of secondary importance to other building costs, and bedding or mat costs. Simplified floor constructions in cubicles would appear to be of greatest value in low cost buildings such as uninsulated lying barns. Reproduced with permission from the CAB Abstracts database.

1249. Soil fertility management with wood ash.

Nkana, J. C. V.

Crop Management and Postharvest Handling of Horticultural Crops. Volume III: Crop Fertilization, Nutrition and Growth: 201-228. (2003)

Descriptors: agriculture/ alkalinity/ application to land/ base saturation/ cation exchange capacity/ chemical composition/ chemical properties/ crop yield/ environmental impact/ forests/ growth/ leaching/ microbial activities/ mineral content/ nutrient availability/ nutrient content/ physical properties/ plant composition/ plant nutrition/ soil acidity/ soil chemical properties/ soil physical properties/ soil solution/ solubility/ stabilization/ wood ash/ chemical constituents of plants/ chemical properties of soil/ environmental effects/ land application/ physical properties of soil

Abstract: This paper summarizes the results of studies related to wood ash application to soils. The physical and chemical properties of wood ash and its effects on soil properties, plant nutrition and growth and nutrient availability in plants are discussed. The factors affecting the

efficiency of wood ash as a soil additive are presented. The environmental impact and management of wood ash are highlighted.

This citation is from AGRICOLA.

1250. Soil management systems and morphology and yield of apple trees cvs. Lobo and Sampion.

Tomaszewska, Z.

Biuletyn Naukowy. Akademia Rolniczo Techniczna w Olsztynie (Poland)(no.3): 159-164 . ((1999)); ISSN: 1505-4705.

Notes: Original title: Zroznicowane systemy pielegnacji gleby a wzrost i plonowanie jabloni odmian Lobo i Sampion. 2 tables; 8 ref. Summaries (En, Pl). Citation notes: PL (Poland).

Descriptors: soil management systems/ mulching/ sawdust/ manure/ morphology/ yield/ apple trees

Abstract: The results of mulching with sawdust and manure of applying sod and black fallow in an apple orchard of cvs. Lobo and Sampion planted in the belt-two-row system are presented. Black fallow resulted in a good growth of trees. Mulching retarded the growth of the stem diameter and current season shoots in the first two years of the study. The highest yields were obtained from the trees grown in black fallow. However, in the third year a high yield of cvs. Lobo was obtained from the plots mulched with manure and of Sampion from the plots mulched with sawdust. Productivity coefficient had a similar shape.

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1251. Soil P fractions as affected by on-farm composts in a controlled incubation study.

Gagnon, B. and Simard, R. R.

Canadian Journal of Soil Science 83(2): 223-226. (2003)

NAL Call #: 56.8 C162; ISSN: 0008-4271

Descriptors: cattle manure/ composting/ composts/ crop residues/ horse manure/ leaves/ nutrient availability/ phosphorus/ Podzols/ poultry manure/sandy loam soils/ sawdust/ sheep manure/ soil amendments/ soil types/ straw/ waste wood/ wood chips/ poultry litter

Abstract: Information on the different forms and availability of P following compost addition to soil may help to better manage manure in respect to plant growth and the environment. An experiment was conducted to investigate through a sequential extraction procedure the availability of P of fresh dairy manure and several on-farm compost-soil mixtures (fresh solid dairy manure with straw, dairy manure with straw, dairy manure with hardwood shavings, beef manure with straw, horse manure with wood chips, poultry litter, sheep manure with straw, and vegetable residues, chicken manure, sawdust and leaves) after a 13-week incubation in glass jars at 35 degrees C. Materials were mixed at a rate of 200 mg N kg⁻¹ with an Arago sandy loam (Humo-Ferric Podzol), supplying from 64 to 301 mg P kg⁻¹. Fresh dairy manure gave the highest net increase of resin-P and labile P fractions in terms of percentage of total P added, whereas poultry litter compost was the most efficient in increasing NaHCO₃-inorganic P. Among the compost materials, poultry litter, vegetable residue and sheep manure increased labile P fraction the most. The contribution of the young dairy manure compost to this fraction was largely negative, and lower than those of fresh manure or partially and well-decomposed manure

composts. A large part of added P was found in the moderately labile P fraction. The organic P fractions in the soil were less affected by manure or compost addition. This study indicated that the material P availability was reduced by composting, and was more affected by the origin of residue than by manure management.

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1252. Soil salinity and sodicity after application of fresh and composted manure with straw or wood-chips.

Miller, J. J.; Beasley, B. W.; Larney, F. J.; and Olson, B. M. *Canadian Journal of Soil Science* 85(3): 427-438. (Aug. 2005)

NAL Call #: 56.8 C162 ; ISSN: 0008-4271.

Notes: Summary in French.

Descriptors: soil salinity/ soil sodicity/ saline sodic soils/ clay loam soils/ sodium/ adsorption/ soil chemical properties/ electrical conductivity/ composted manure/ cattle manure/ straw/ wood chips/ application rate/ mineral fertilizers/ fertilizer application/ soil amendments/ soil salts/ barley/ *Hordeum vulgare*/ Alberta

This citation is from AGRICOLA.

1253. Soil temperature fluctuations under sward, sawdust cover, herbicide-cleared ground, and under mechanical cultivation. III. Summer and autumn of 2000.

Ysiak, G. and Houbowicz, T.

Prace z Zakresu Nauk Rolniczych 91: 155-162. (2001);

ISSN: 0079-4708.

Notes: Original title: Wplyw systemu utrzymania gleby w sadzie na zmiane temperatury w glebie. III. Lato i jesien 2000.

Descriptors: apples/ autumn/ cultivation/ soil temperature/ summer/ fall

Abstract: From 30th May till 5th November 2000, air temperature at the level of 2 m as well as soil temperature at the depth of 30 cm under sward, sawdust cover, herbicide-cleared ground and under mechanical cultivation were recorded in an 8-year-old apple orchard. It was found that in the orchard the soil management systems had some influence on the dynamics of soil temperature fluctuations at the depth of 30 cm. The smallest daily fluctuations were recorded under the sawdust cover, and the largest under mechanical cultivation. Data collected on two warmest periods during summer and one cool period in early autumn are described and discussed in detail.

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1254. Sorption and transport of metals in preferential flow paths and soil matrix after the addition of wood ash.

Bundt, M.; Zimmermann, S.; Blaser, P.; and Hagedorn, F. *European Journal of Soil Science* 52(3): 423-431. (Sept. 2001)

NAL Call #: S590.E97; ISSN: 1351-0754 [ES0SES]

Descriptors: wood ash / leaching/ sorption isotherms/ exchangeable cations/ soil chemistry/ soil physical properties/ transport processes

This citation is from AGRICOLA.

1255. Sources of mulching on the changes of physical and chemical properties in Alfisol soil in West Bengal, India.

Nabakumar Mahata; Tarafdar, P. K.; Biswas, T; and De, S. K.

Environment and Ecology 26(3): 1129-1131. (2008)

NAL Call #: TD172.E5; ISSN: 0970-0420

Descriptors: Alfisols / bulk density/ crop residues/ erosion/ erosion control/ farmyard manure/ leaves/ mulches/ mulching/ nitrogen/ nutrient availability/ phosphorus/ porosity/ potassium/ sawdust/ soil chemical properties/ soil density/ soil fertility/ soil organic matter/ soil physical properties/ soil types/ straw/ water holding capacity/ chemical properties of soil/ FYM/ mulching materials/ organic matter in soil/ physical properties of soil

Abstract: A study was undertaken to determine the effect of different mulching materials (straw, farmyard manure (FYM), sawdust, grasses and leaves) on the physical and chemical properties of bare Alfisol under rainfed situation in Baradiha, West Bengal, India. Results revealed that physical properties like soil bulk density decreased by 12.2%, and porosity and water holding capacity increased by a maximum of 20.7 and 23.6%, respectively, under FYM mulching over fallow plots. The chemical properties like organic matter, total N, available K and P also increased by a maximum of 187.55, 411, 337 and 74%, respectively, under FYM over fallow plots. Soil loss varied from 4.9 to 16.9 t/ha and lowest under straw mulch.

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1256. Southern redcedar and southern magnolia wood chip mulches for weed suppression in containerized woody ornamentals.

Ferguson, J.; Rathinasabapathi, B.; and Warren, C.

HortTechnology 18(2): 266-270. (2008)

NAL Call #: SB317.5.H68; ISSN: 10630198 [HORTF]

Descriptors: *Amaranthus retroflexus*/ *Digitaria sanguinalis*/ *Juniperus silicicola*/ large crabgrass/ *Magnolia grandiflora*/ nursery crops/ organic production/ redroot pigweed/ weed control/ *Amaranthus*/ *Amaranthus retroflexus*/ *Cornus*/ *Cornus florida*/ *Digitaria sanguinalis*/ *Juniperus*/ *Juniperus virginiana silicicola*/ *Lagerstroemia*/ *Lagerstroemia indica*/ *Magnolia grandiflora*/ Magnoliaceae

Abstract: Wood chip mulches from southern redcedar (*Juniperus silicicola*) and southern magnolia (*Magnolia grandiflora*) were evaluated for their effectiveness in weed control in nursery containers. In greenhouse tests, southern redcedar and southern magnolia wood chip mulches significantly inhibited the germination of redroot pigweed (*Amaranthus retroflexus*) and large crabgrass (*Digitaria sanguinalis*). In a field trial, nursery containers with 'Carolina Beauty' crape myrtle plants (*Lagerstroemia indica*) were sown with large crabgrass and redroot pigweed seeds, mulched with southern redcedar or southern magnolia wood chips, and compared with plants without mulch and plants treated with a mixture of isoxaben and trifluralin (Snapshot). Wood chips from both southern redcedar and southern magnolia were as effective as a mixture of isoxaben and trifluralin in suppressing weed growth in nursery containers. The wood chip mulches had no inhibitory effect on the growth of crape myrtle plants. In a similar, longer-term field trial using containerized dogwood (*Cornus florida*) plants sown with large crabgrass and redroot pigweed, the southern

redcedar wood chip mulch was most effective in weed suppression when used in combination with a low dose of the chemical herbicide.

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1257. Spatial variability of tomato rooting system and implications on irrigation management in soilless cropping with substrates.

Marouelli, W. A.; Carrijo, O. A.; and Zolnier, S.

Horticultura Brasileira 23(1): 57-60. (2005)

NAL Call #: SB320.43 .B7H67; ISSN: 0102-0536.

Notes: Original title: Variabilidade espacial do sistema radicular do tomateiro e implicacoes no manejo da irrigacao em cultivo sem solo com substratos.

Descriptors: coir/ electrical conductivity/ irrigation/ nutrient solutions/ rice husks/ root systems/ roots / sawdust/ soilless culture/ spatial variation / substrates/ tomatoes/ water deficit/ coconut fibre/ rice hulls/ watering

Abstract: The distribution of tomato rooting system and horizontal variability of matric potential (Ψ_{sm}) and electrical conductivity of the solution were evaluated on green coconut fibre, carbonized rice husk, carbonized coarse sawdust and commercial substrates packed in plastic bags. Each plant was irrigated by a single dripper, set up 7 cm apart. Higher root concentrations and lower Ψ_{sm} , under temporary water deficit conditions, occurred close to the plant for coconut fibres and rice husk, and close to the dripper for coarse sawdust and commercial substrates. The lower root concentration between a dripper and the following plant, irrigated by another emitter, occurred probably due to the high electrical conductivity of the nutrient solution in that zone (up to 8.3 dS m⁻¹).

Correlations between root concentration vs. Y_m and root concentration vs. electrical conductivity were significant for all substrates. Evaluation of Ψ_{sm} variability on substrates for plants exposed to water deficit allowed a qualitative estimation of the root system distribution of tomato crop, easier than the direct method. For irrigation scheduling purpose, moisture sensors should be placed between the plant and its respective dripper.

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1258. Status of oak mushroom cultivation and production in Korea focused on Hwasung and Yongin cities in Gyeonggi Province.

Lee SangHyun; Kang HagMo; Choi Soolm; Lee

ChangHeon; Kim Hyun; Cho YoungJin; Lim HoSub; and Kohroki, K.

Journal of the Faculty of Agriculture, Kyushu University 52(1): 239-247. (2007); ISSN: 0023-6152

Descriptors: cultivation/ edible fungi/ sawdust/ spawn/ South Korea/ Tricholomataceae

Abstract: The overall production of oak mushrooms has steadily increased in Korea, but the mushroom market is plagued with a wave of falling prices and intensified competition as imports of Chinese oak mushrooms increase. Imported Chinese oak mushrooms are mostly grown on sawdust blocks, which are costly in Korea because of higher labor costs and log prices. Mushroom farmers, therefore, strive to seek ways to compete with Chinese oak mushrooms, and the use of broad-leaved tree species is under consideration to promote sawdust-based mushroom cultivation. Korean oak mushrooms are

expected to be more competitive when they are grown on sawdust rather than log while imports of Chinese mushrooms are still limited due to difficulties sustaining freshness. However, there are some obstacles such as the acquisition of superior strains of mushroom to promote sawdust cultivation of oak mushroom. Thus, The study investigated the status of production and sales of oak mushroom and the intent of mushroom farmers toward mushroom culture in wooden trays by conducting a questionnaire survey involving mushroom farmers in the two cities in Gyeonggi Province. Results of the study revealed that there were differences in production volume and revenue per oak log between mushroom farmers in the two areas. Many farmers showed distrustful reactions towards strains distributed because of frequent loss and damages caused by purchased strains. It is, therefore, necessary to encourage farmers to increase productivity by standardizing culture techniques and supplying good strains of mushrooms. More farmers in Hwasung City are interested in mushroom cultivation in wooden trays, but farmers in Yongin City were less enthusiastic about mushroom cultivation in wooden trays after witnessing failures of other farmers. The findings of the study signifies the need for introducing effects of mushroom culture in wooden trays among mushroom farmers, and developing superior strains of mushrooms to promote mushroom growth using wooden trays.
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1259. Stimulation of predacious nematodes through soil amendments in small scale agriculture.

Azmi, M. I.

Advances in Agricultural Research in India 10: 79-82. (2000); ISSN: 0971-6394

Descriptors: castor oilmeal/ cattle dung/ cowpeas/ farmyard manure/ groundnut oilmeal/ groundnuts/ leucaena leaf meal/ neem seed cake/ plant parasitic nematodes/ plant pests/ poultry manure/ predator prey relationships/ predators/ sawdust/ soil amendments/ Adenophorea/ black eyed peas/ Dorylaimida/ eelworms/ FYM/ groundnut cake/ neem/ neem seed oilmeal/ peanut oilmeal/ peanuts/ poultry litter/ Secernentea/ southern peas/ Tylenchida

Abstract: A pot experiment was conducted on cowpea to determine the effects of various soil amendments namely: neem seed cake, castor oilmeal, groundnut oilmeal and sawdust at 400 kg/ha (0.2 g/kg soil); neem leaf and leucaena leaf meal at 4000 kg/ha (2 g/kg soil); farmyard manure, cow dung and poultry manure at 6000 kg/ha (3 g/kg soil), on predacious (*Iotonchus* sp.) and plant parasitic nematodes (*Meloidogyne* sp.). Reduction of plant parasitic nematode population was maximum with application of neem seed cake whereas predator prey ratio increased with poultry manure, cow dung, farmyard manure, castor cake, groundnut oilmeal, neem seed cake, sawdust, and neem leaf. The shoot dry weight of cowpea was maximum with neem seed cake treatment. Initial nematode infestation in the soil was very low (500 plant parasitic nematodes/100 g soil) which was conducive for the conservation of predators.

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1260. Structure of fungal communities in barren post agricultural soil 1 and 2 years after pine sawdust application.

Kwasna, H. and Sierota, Z.

Phytopathologia Polonica 17: 13-21. (1999); ISSN: 1230-0462

Descriptors: chemical composition/ phosphorus/ plant pathogenic fungi/ plant pathogens/ plant pathology/ soil/ soil amendments/ soil fungi/ Hyphomycetes/ mitosporic fungi/ *Mortierella vinacea*/ *Mortierellaceae*/ *Penicillium herquei*/ phytopathogens/ phytopathology/ Scotch pine/ Scots pine/ *Trichoderma pubescens*/ Zygomycetes

Abstract: Changes in chemical compounds and in structure of fungi communities in post agricultural soil lying barren for 6 years, 1 and 2 years after *Pinus sylvestris* sawdust application in Poland, were determined. It was found that the high increase in *Trichoderma* population, caused by application of

fresh *Pinus* sawdust, is not a long lasting phenomenon. The decrease of carbon, nitrogen and phosphorus content which was due to the sawdust decomposition caused the decrease in frequency and increase in diversity of the fungal community two years after sawdust application. The most common species were *T. harzianum*, *T. pubescens*, *Penicillium herquei* and *T. harzianum*, *P. chrysogenum*, *Mortierella vinacea*, respectively 1 and 2 years after the treatment. The frequency of *T. harzianum* decreased, however, more than 3 times in the second year after sawdust application.

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1261. Studies on cultivation of oyster mushroom (*Pleurotus* spp.) on different forest wastes.

Hamza, H. R.; Khan, S. M.; and Khan, S. M.

In: Integrated Plant Disease Management Proceedings of 3rd National Conference of Plant Pathology, NARC.Islamabad.); pp. 144-147; 2002.

Descriptors: cattle dung/ cotton waste/ cottonseed husks/ crop yield/ edible fungi/ horse dung/ non wood forest products/ sawdust/ wheat bran/ *Lentinaceae*/ minor forest products/ non timber forest products/ *Poriales*

Abstract: The sawdust of Shisham (*Dalbergia sissoo*) supplied alone or in combination with 10% cotton seed hulls, 5% horse dung, 5% wheat bran or 5% cow dung were evaluated for the productivity of *P. ostreatus*. Sisham sawdust combined with 10% cotton seed hulls proved the best for spawn running with a mean 13.35 days, followed by Sisham sawdust combined with 5% horse dung, 5% wheat bran, 5% cow dung and Shisham sawdust alone. Maximum yield was obtained by Shisham + 10% cotton seed hulls while minimum yield was obtained by Shisham sawdust alone. Six different substrates, viz. cotton waste, sawdusts of Popular, Kikar, Pine, Shisham and Diar, were also evaluated for the productivity of *P. ostreatus*. Cotton waste proved the best for spawn running with a mean of 8.15 days followed by popular, pine, kikar and Shisham, while Diar showed no spawn running. Yield was highest on cotton waste followed by Popular, Shisham, Kikar and Pine, while Diar gave no yield.

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1262. Studies on the composts produced from layer feces mixed with sawdusts and their effect on the growth of *Brassica campestris* L.

Tanaka, Hirofumi; Toku, Yasumitsu; Isoi, Toshiyuki; Fukaya, Takako; and Horiuchi, Noriko

Scientific Reports of the Faculty of Agriculture Meijo University 37(67-72)(2001); ISSN: 0910-3376

Descriptors: composting/ layer feces/ sawdust/ *Brassica campestris* L

Abstract: Sawdusts were mixed with layer feces by the weight ratios of 1:0.11, 1:0.25, 1:0.5, 1:0.75 and 1:1, then moistened with water. The mixtures in plastic pots were composted in the greenhouse for 12 weeks with agitating every week. Carbon/nitrogen ratios were determined in every two weeks. After 12 weeks of composting, the germination and growth tests were performed with Komatsuna (*Brassica campestris* L. var. *perviridis*). 1) C/N ratios of the composts were not decreased by the 12 weeks of composting showing the hardly decomposable nature of the sawdust. 2) Germination and growth tests directly sown on the composts showed the severe inhibition by the compost of 1:0.75 ratio. Inhibition by the excess ammonium ion was suggested by the analysis of the composts. 3) The composts were applied to Akadama soil (reddish soil located under volcanic ash soil, treated by 800degreeC) by the ratio of 1 t/10 t soil and the germination and growth were tested. Almost no detrimental effect was found in any composts on the germination. A vigorous growth was observed in the soil with the compost of 1:1 ratio.

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1263. Studies on the feasibility of composted agricultural cast-offs as growing media.

Liu QingChao; Wang KuiLing; Liu QingHua; Zhang QiXiang; Pan HuiTang; Liang ShuLe; and Yue Momo

Acta Horticulturae 767: 65-72. (2008)

NAL Call #: 80 Ac82; ISSN: 0567-7572

Descriptors: buffering capacity/ calcium/ cation exchange capacity/ cellulose/ coir/ composts/ greenhouses/ growing media/ iron/ magnesium/ maize/ manganese/ organic acids/ peat/ pH/ poinsettias/ protected cultivation/ sawdust/ soybean husks/ Balsaminales/ coconut fibre/ corn/ cultivation under glass or plastic/ glasshouses / hydrogen ion concentration/ *Impatiens hawkeri*/ Mn/ potential of hydrogen/ potting composts/ rooting media/ soybean husks

Abstract: Peat is widely used as a growing medium in greenhouse production, but heavy exploitation of peat will seriously destroy the ecological environment. It is necessary to find new material to substitute for peat. In this paper, the feasibility of composted peanut hull, soybean stalk, sawdust, coconut coir, maize core and lees from wine as growing media is reported for studies commencing in 2002. The physical characteristics of those materials were primarily suitable for growing media. Due to the accumulated organic acid, the pH of the lees was very low (pH 3.85). The soluble salts in peat were higher than all the other materials. The cation exchange capacity (CEC) of peat was 95.81 cmol.kg⁻¹, but the CEC of the sawdust was 26.92 cmol.kg⁻¹. The total organic matter and cellulose content in the materials were higher than those in peat, while the contents of Ca, Mg, Fe and Mn were lower. All materials, especially the lees, have excellent buffering capacity. The germination indices (GI) of three herbaceous flower species when soaked with the extracts of coconut coir, peanut hull and sawdust were similar to that of peat or

even higher. *Cyclamen persicum*, *Euphorbia pulcherrima* and *Impatiens hawkeri* grew better in those materials in pot than that in peat. This shows that most agricultural cast-offs investigated in this trial were excellent substitutes for peat. Reproduced with permission from the CAB Abstracts database.

1264. Studies on the production of sclerotia by *Pleurotus tuber-regium* (Fr.) singer.

Chen MeeiHsing and Peng JinTong

Journal of Agricultural Research of China 48(2): 143-148. (1999); ISSN: 0376-477X

Descriptors: agricultural wastes/ cotton/ cultural methods/ edible fungi/ growing media/ husks/ rice/ rice straw/ sawdust/ sclerotia/ straw/ temperature/ vegetables/ water content/ farm wastes/ hulls/ Lentinaceae/ paddy/ Poriales/ potting composts / rooting media/ vegetable crops

Abstract: Three agricultural wastes were evaluated for their suitability as growing media for the production of sclerotia by *P. tuber-regium*. Cotton seed hulls and rice straw were more suitable than sawdust on the basis of biological efficiency. The best temperature and water content of the cotton seed hulls substrate for the production of sclerotia were 20 degrees C and 65% w/w. Supplementation of this medium with rice bran reduced markedly both production of sclerotia and biological efficiency. Reproduced with permission from the CAB Abstracts database.

1265. Studies on the seed germination of *Magnolia cubensis* (mantequero) from the site Topes de Collantes, Cuba .

Trocones, A. G.; Toledo, J. R.; Aladro, J. S.; and Pujols, O. In: *II Simposio Sobre Avances en la Produccion de Semillas Forestales en America Latina*.Memorias, Santo Domingo, Republica Dominicana.; pp. 187-189; 2000.

Notes: Original title: Estudios para la germinacion de semillas de *Magnolia cubensis* (mantequero) en la localidad de Topes de Collantes, Cuba.

Descriptors: drying/ forest trees/ sawdust/ seed germination/ seed moisture/ seed treatment/ seeds/ shade/ substrates/ trees/ woody plants/ *Magnolia cubensis*

Abstract: *M. cubensis* fruits were collected during November from 30-year-old trees. Three drying methods of fruits were compared, including drying outdoors (with and without shade) and indoors (laboratory). The effects of different submersion periods (6, 12 and 24 h) of seeds in water and 3 substrates (100% soil, 75% soil + 25% sand, and 50% soil + 40% sand + 10% sawdust) on seed germination were also investigated. The greatest reduction in moisture content (75%) was obtained after outdoor drying in the shade. Highest seed germination rates were obtained after submersion for 24 h and sowing in a substrate of soil + sand + sawdust.

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1266. Studies on the types and rates of application of cattle slurry and swine manure fermented with sawdust on productivity of silage corn and leaching of nutrients.

Na HoonChan; Jung MinWoong; Choi YeunSik; Choi KiChoon; and Yook WanBang

Journal of the Korean Society of Grassland Science 26(4): 177-186. (2006)

NAL Call #: SB202.K6H352; ISSN: 1013-9354

Descriptors: ammonium nitrogen/ animal manures/ application rates/ biomass production/ cattle slurry/ chemical composition/ crop yield/ crude protein/ dry matter/ dry matter accumulation/ leaching/ losses from soil/ lysimetry/ maize/ maize silage/ nitrate nitrogen/ nitrogen/ NPK fertilizers/ nutrients/ phosphate/ phosphorus/ pig manure/ productivity/ sawdust/ silage/ urea/ ammonia nitrogen/ corn/ losses from soil systems

Abstract: This lysimeter study was conducted to determine the effects of the types and rates of application of animal manure on the productivity of maize silage and soil pollution. The main plots considered in the study were types of cattle slurry (CS), swine manure fermented with sawdust (SMFS) and chemical fertilizer (CF). The subplots include the application rates of animal manure as urea (100, 200 and 400 kg N/ha). Dry matter and nitrogen yields of maize silage were enhanced with increased application rates of CS, SMFS and CF. Dry matter yield showed a decrease in order of CF > CS > SMFS ($P < 0.05$). Crude protein contents of the whole maize silage increased as with increased application rates of CS, SMFS and CF. $\text{NO}_3\text{-N}$ content in leaching water by application of animal manure reveals that there is a decrease in the order of SMFS > CF > CS ($P < 0.05$). However, $\text{NH}_4\text{-N}$ content was hardly influenced by the application of animal manure and $\text{NH}_4\text{-N}$ content increased as application rates increased. $\text{PO}_4\text{-P}$ content in leaching water by application of animal manure revealed that there is a decrease in the order of SMFS > CF > CS. PO_4 increased with application rates whereas PO_4 in leaching water maintained low levels. This citation is from AGRICOLA.

1267. Study of the propagation of Ginkgo in containers and [different] culture medium.

Zhang Yong; Zeng Ming; Yang TianXiu; and Yang ShuYun] *South China Fruits* 31(5): 58-59. (2002); ISSN: 1001-4195

Descriptors: animal manures/ container grown plants/ forest nurseries/ growth/ ornamental plants/ roots/ sand/ sawdust/ substrates/ superphosphate/ ornamentals

Abstract: An experiment was carried out with plastic bag with a diameter of 12 cm, a length of 25 cm and filled with different substrates. Substrates included different ratios of soil from vegetable plots, river sand, sawdust, dried leaves, calcium superphosphate and animal manure. The best growth was obtained with 60% vegetable plot soil + 15% river sand + 5% calcium superphosphate + 20% animal manure. With this mixture the greatest height, root collar diameter and number of roots were obtained. Reproduced with permission from the CAB Abstracts database.

1268. Study on container medium of Eucalyptus urophylla with bagasse and sawdust.

Cheng QingRong *Journal of South China Agricultural University* 23(2): 11-14. (2002); ISSN: 1001-411X

Descriptors: bagasse/ container grown plants/ fertilizers/ growth / Luvisols/ ornamental plants/ sawdust/ seedlings/ soil types/ ornamentals/ soils lessives

Abstract: The growth of Eucalyptus urophylla grown in a container medium with composted bagasse and sawdust mixed with coal ash and yellow soil was investigated under three levels of fertilizers. The results showed that the

following media were significantly better than or equal to peat: (1) sawdust: coal ash: yellow soil (in a ratio of 5:2:3), fertilized with level 2, or fertilized with level 1 and composted for 3 months, or composted for 6 months and not fertilized; (2) sawdust: coal ash (6:4), bagasse: coal ash: yellow soil (5:2:3), bagasse: coal ash (6:4) - these 3 media composted for 6 months and fertilized with level 2, or composted for 3 months and fertilized with level 1; (3) bagasse composted for 6 months and fertilized with level 2. Reproduced with permission from the CAB Abstracts database.

1269. Study on nitrogen mineralization characteristics of organic materials.

Lin YuWen; Liu TsangShen; and Wang ChungHo *Journal of Agricultural Research of China* 52(3): 178-190. (2003); ISSN: 0376-477X

Descriptors: bagasse/ carbon nitrogen ratio/ cattle manure/ composts/ mineralization/ pig manure/ poultry manure/ rice/ rice straw/ sawdust/ straw/ paddy/ poultry litter

Abstract: The nitrogen mineralization of nine commercial/farm-produced organic materials were investigated by incubation-leaching method. The accumulative mineralized N (AMN) released during 2, 4, 6 and 8 weeks incubation period was significantly negatively correlated with the naperian logarithm of C:N value of the organic materials. Nine materials were divided into two groups according to their mineralization characteristic curves of 8-week incubation. The continuous release of mineral N of Group 1 (hog manure I, hog manure II, chicken manure, sawdust compost and bagasse compost) started at the 1st week and reached the first AMN peak at the 1st or the 2nd week, and then was getting slow in the subsequent 1-5 weeks. After the slowing down period, hog manure I and chicken manure still released mineral N after incubation in the 2nd and 6th week, respectively. On the contrary, hog manure II, sawdust compost and bagasse compost presented N immobilization after 1 to 4 weeks. All in Group 2 (cattle manure, rice straw, sesbania and pure bagasse) presented N immobilization in the 8-week incubation, except for the 1st and 2nd day where N mineralization was observed in some material. Mineralization characteristic curve after the 8th week indicated AMN of hog manure I increased within 36 weeks, and the second AMN peak of chicken manure occurred at the 24th week. The N immobilization in cattle manure and rice straw was continuous, but the N mineralization of cattle started until after 28 weeks. N immobilization of rice straw lasted even after incubation test. Reproduced with permission from the CAB Abstracts database.

1270. The study on production and use of a compost: Use value of wood chips for bedding and compost.

Ohta, T. *Bulletin of the Zootechnical Experiment Station - Prefecture of Yamaguchi (Japan)* 19: 83-86. (Mar. 2004); ISSN: 0287-1262.

Notes: E; Summary (Ja). Citation notes: JP (Japan).

Descriptors: compost/ use value/ wood chips/ bedding/ livestock

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1271. Substrate effects on greenhouse cucumber growth and fruit quality in Australia.

Parks, S.; Newman, S.; and Golding, J.

Acta Horticulturae 648: 129-133. (2004)

NAL Call #: 80 Ac82; ISSN: 0567-7572

Descriptors: coconuts / coir/ colour/ crop quality/ crop yield/ cucumbers/ dry matter/ firmness/ fruits/ growing media/ growth/ hydroponics/ perlite/ rockwool/ sawdust/ soilless culture/ storage losses/ storage quality/ substrates/ texture/ coconut fibre/ color/ gherkins/ mineral wool/ potting composts/ quality for storage/ rock wool/ rooting media

Abstract: The yield and fruit quality of mini cucumbers (*Cucumis sativus* cv. Tandora), grown using different substrates in a run-to-waste system, was examined during a 17-week greenhouse experiment. The substrates included coir (*Cocos nucifera*), sawdust (*Pinus radiata*), rockwool, perlite and cucumber mix (a commercial soil conditioner). The management of the crop, including the nutrient and irrigation regime, was the same for each medium. At each harvest, cucumber fruit number and fresh weight were recorded for each experimental plant.

Additionally, quality and storability was assessed using fruits harvested at 7 (early season), 11 (mid-season) and 16 weeks (late season) after planting. Fruits were stored for 2 weeks at 10 degrees C. After an additional day at 20 degrees C, the cucumbers were assessed for weight loss, colour change and textural quality (crush strength and firmness). There was no significant effect of substrate on plant dry weight, cucumber number, cucumber weight or average weight per cucumber, or on the fruit quality measurements. However, there were differences in colour, deformation, crush strength and dry matter between harvests. There was no significant linear trend of yield over time for any media treatment. These results demonstrate that a range of growth media can be successfully used for hydroponic cucumber production.

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1272. Substrates and temperatures on germination of Phoenix roebelenii O'Brien.

Iossi, E.; Sader, R.; Pivetta, K. F. L.; and Barbosa, J. C.

Revista Brasileira de Sementes 25(2): 63-69. (2003)

NAL Call #: SB113.2.R48; ISSN: 0101-3122.

Notes: Original title: Efeitos de substratos e temperaturas na germinacao de sementes de tamareira ana (*Phoenix roebelenii* O'Brien).

Descriptors: ornamental palms/ ornamental plants/ sand/ sawdust/ seed germination/ seedling growth/ seedlings/ seeds/ substrates/ temperature/ vermiculite/ ornamentals

Abstract: The effects of substrate and temperature on seed germination and seedling growth in *P. roebelenii* were studied. Seeds with a moisture content of 21.83% were used in the germination tests. In the first experiment, four substrates (vermiculite, sawdust, sand and Sphagnum) and five temperatures (20, 25, 30, 35 and 40 degrees) were evaluated for their effects on seed germination and speed of germination index (SGI). In experiment 2, the effects of the aforementioned substrates on seed germination and seedling growth (dry weight and length of roots and aerial parts) were studied under uncontrolled conditions with temperatures between 27 and 28.5 degrees C. The germination test under controlled conditions was conducted

in a box under a light/dark period of 8/16 h. Regardless of the substrate, higher germination percentage was obtained at 25 and 30 degrees C. The highest SGI was obtained at 30 degrees C using either Sphagnum or sand as substrate. Sphagnum was superior in terms of most of the seedling parameters. SGI tests of dwarf palm seeds and seedlings suggested that vermiculite was not appropriate as substrate for *P. roebelenii*.

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1273. Suitability of untreated wood ash for recycling.

Stahl, E. and Doetsch, P.

Umweltwissenschaften und Schadstoff Forschung: 1-9.

(2008); ISSN: 09343504

Notes: doi: 10.1007/s12302-008-0001-9; Original title: Qualitat und Verwertungsmoglichkeiten von Holzaschen aus naturbelassenen Holzern.

Descriptors: agriculture/ fertilizer/ forest/ garden/ nutrient loops/ potash fertilizer/ wood/ wood ashes/ wood pellet heating appliance/ wood- fired heating appliance

Abstract: Background, aim and scope The increasing use of wood for generating heat and electricity requires that more and more fuels be obtained directly or indirectly from the forest. Sound, sustainable recycling management calls for the return of any generated wood ash back to the forest to make use of the nutrients it contains. Similarly, recycling this ash in other locations such as agricultural land or private gardens can serve equally well as fertilizer. At the same time, it is critical that no accumulated pollutants be introduced into the nutrient loop. Wood ash that is heavily laden with such pollutants must not be considered for recycling. As part of this research project, commissioned by the Ministry for the Environment and Conservation, Agriculture and Consumer Protection of the State of North Rhine-Westphalia in Germany (MUNLV), ash samples of 209 wood-fired appliances generating between 10 and 4000 kW of heat performance were taken from throughout the federal state of North Rhine-Westphalia. Untreated wood, either forested or scrap, was used as the sole fuel for these appliances. Materials and methods All course ash and fly ash samples were analyzed to determine their composition of main nutrients, heavy metals, and the elements Fe, Cl, Si, Al and Na. The purpose of this analysis was to evaluate the suitability of this wood ash for reintroduction to forest soils or as fertilizer in other types of soil. Results The majority of the wood ash samples in this study contained sufficiently high amounts of nutrients to match the requirement for stand-alone fertilizers (PK-fertilizer, potash fertilizer). However, the heavy metal content was highly variable, with a mean content high enough to prohibit them from being classified per se as PK- or potash fertilizer for agricultural land. Due to the high quantities of cadmium, application of this ash to garden soils would likewise be ill-advised. Discussion On forest soils German law permits application of a mixture of potash fertilizer containing, at most, 30% wood ash (course ash). Because of the high amounts of cadmium and copper, wood ash from our samples can only comprise a maximum of 28% when added to typically used potash fertilizers. Higher percentage of wood ash would exceed the cut-off value established by the German Fertilizer Ordinance

(Du?ngemittelverordnung - Du?MV). Conclusions The application of wood ash on agricultural land and in private gardens is, rightfully so, highly regulated by law. However, the rules governing application of wood ash in the forest are much more lax. Determination of heavy metal content in wood ash cannot be used to determine compliance with Du?MV standards because of the high content and fluctuating nature of heavy metals found.

Recommendations and perspectives Presently an alternative approach for classifying the ecologic risk of wood ash recycling is being developed. _ 2008 Springer-Verlag.

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1274. Susceptibility to diseases and productivity of strawberries in different cultural systems.

Laugale, V. and Morocko, I.

In: Proceedings of the International Conference Fruit Production and Fruit Breeding. Tartu, Estonia.); pp. 212-216; 2000.

Descriptors: crop yield/ mulching/ plant diseases/ plant pathogenic fungi/ plant pathogens/ plastic film/ sawdust/ strawberries/ wood shavings/ Coelomycetes/ Dermateaceae/ Hyphomycetes/ Leotiales/ Marssonina potitillae/ mitosporic fungi/ Mycosphaerellaceae/ phytopathogens/ polypropylene/ Ramularia tulasnei

Abstract: Experiments aimed at estimating the effectiveness of cultural systems and different mulching materials on strawberries were carried out at the Pure State Horticultural Research Station in 1996. In trials 5 different mulches (straw, black plastic, black polypropylene "Lutrasil 60", shavings and sawdust) plus bare ground as a control, 4 planting systems and strawberry cultivars Zefyr and Senga Sengana were used. Results obtained differed between cultural systems, mulches, growing years and cultivars. The following diseases were detected in the trials: white leaf spot (Ramularia tulasnei), leaf scorch (Marssonina potitillae), grey mold (Botrytis cinerea), Verticillium wilt (Verticillium spp.). Incidence and severity of diseases depended on the cultural system, mulching material applied and cultivar. Mulching materials, especially synthetic ones, limited the incidence of root and vascular tissue diseases. Total and 1st class berry yields were highest in cultural systems with 2.0-m wide polypropylene and black plastic mulches. Senga Sengana responded more to synthetic mulches than Zefyr. Reproduced with permission from the CAB Abstracts database.

1275. Sustainable mushroom production in Africa: A case study in Ghana.

Atikpo, M.; Onokpise, O.; Abazinge, M.; Louime, C.; Dzomeku, M.; Boateng, L.; and Awumbilla, B.

African Journal of Biotechnology 7(3): 249-253. (2008) NAL Call #: TP248.13 .A37; ISSN: 1684-5315

Descriptors: case studies/ composting/ composts/ edible fungi/ fish scrap/ growth/ hybrids/ mushrooms/ mycelium/ rice bran/ sawdust/ temperature/ fish waste/ Lentinaceae/ Poriales

Abstract: This study investigated a sustainable alternative to grow crops using organic wastes as biofertilizers. Fresh fish waste (FFW) and cooked fish waste (CFW) mixed with sawdust from *Trypochyton scleroxylon* wood species (Wawa) were made into compost heaps. Control compost from rice bran (CRB) was also prepared. Higher

temperatures were recorded from compost heaps prepared from both FFW (38-52 degrees C) and CFW (37-52 degrees C) than from CRB (33-45 degrees C); with reduction in composting time and generation of large numbers of microorganisms in the fish-based compost heaps. Mycelial colonization of compost bags and subsequent growth of oyster mushrooms (*Pleurotus* species) were faster in fish-based substrates (FFW and CFW) as compared to CRB. *P. eous* and *P. oestreatus* exhibited uniform spread of mycelia in the compost bags than *P. eous* hybrid. However, *P. eous* hybrid produced the fastest rate of mycelial growth, completely colonizing the substrate within 26 days. Growth of each species of mushroom investigated was independent of the substrate in which it was grown. Irrespective of the substrate used to grow the mushroom, the pattern of utilization and growth remained the same. Oyster mushrooms grown on fish-based substrates produced bigger and firmer fruiting bodies. This alternative could be very attractive to small farmers throughout the world, who are known to operate under adverse conditions and limited resources. Reproduced with permission from the CAB Abstracts database.

1276. Technical and environmental aspects of raising fattening pigs and weaned pigs on deep litter.

Nicks, B.

Annales de Medecine Veterinaire 148(1): 31-38. (2004); ISSN: 0003-4118.

Notes: Original title: Caracteristiques techniques et aspects environnementaux de l'eleveage de porcs charcutiers et de porcelets sevrés sur litières accumulees.

Descriptors: ammonia/ animal housing/ carbon dioxide/ deep litter housing/ finishing/ gas production/ greenhouse gases/ litter/ nitrogen/ rearing techniques/ sawdust/ straw/ fattening/ hogs/ swine

Abstract: The technique of raising pigs on deep litter consists of leaving the animals on a 30 to 50 cm depth straw or sawdust which can be used for several batches. This article gives the synthesis of the experimental results of rearing 3 to 4 successive batches of fattening pigs or 5 to 6 batches of weaned pigs on straw-based or sawdust-based deep litters. For fattening pigs, this rearing technique required an average of 80 kg sawdust or 45 kg of straw per pig and produced, on average, 123 kg per pig of sawdust-based compost or 159 kg per pig of straw-based manure with a nitrogen content of 1.29 and 1.87 kg, respectively. For weaned pigs, the rearing technique required on average 15 kg of sawdust or 6 kg of straw per pig and produced, on average, 17 kg of sawdust-based compost per pig or an equivalent quantity of straw-based manure with a nitrogen content of 177 and 210 g, respectively. The cumulative greenhouse gas emissions (CO₂, CH₄, N₂O), calculated in CO₂ equivalents were higher with sawdust-based litter than with straw-based litter by 42% during fattening periods and 53% during postweaning periods. On the contrary, NH₃ emissions were higher from the straw-based litter than from the sawdust-based litter but only during postweaning periods (+160%), but not during fattening periods. None of the two litters present a decisive advantage over the other based on the environmental point of view.

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1277. Thermo-technical properties of floor structures for lying cubicles.

Lendelova, J. and Pogran, S.

Research in Agricultural Engineering UZPI (Czech Republic) 49(4): 146-150. (2003); ISSN: 1212-9151.

Notes: 2 graphs, 3 tables; 8 ref. . Summaries (En, Sk).

Citation notes: CZ (Czech-Republic).

Descriptors: thermo-technical properties/ floor structures/ lying cubicles/ dairy cows/ sawdust

Abstract: Thermal properties of concrete or ceramic floors with different types of beddings (rubber mattresses, straw, sawdust, sand, etc.) of different thickness were tested in two housing systems for dairy cows. Thermal absorptive capacity (TAC) values were calculated for each combination tested and surface temperatures (ST) of several types of beddings were evaluated in function of the time spent by the cows lying on them. TAC values depended on the type of floor and bedding as well as the bedding thickness. They increased with decreasing bedding thickness. Uncovered floors showed much higher TAC values than the covered ones and concrete floor higher than the ceramic one. Very low TAC values were obtained for foam-rubber mattresses, straw and sawdust beddings. ST values increased with the time spent by the animals lying down, the course of the increase as well as the values depended on the bedding. They were high when rubber-foam or rubber mattresses were used and low with uncovered concrete floor.

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1278. Tomato crop production under different substrates and greenhouse models.

Carrijo, O. A.; Vidal, M. C.; Reis, N. V. B. dos ; Souza, R. B. de; and Makishima, N.

Horticultura Brasileira 22(1): 5-9. (2004)

NAL Call #: SB320.43 .B7H67; ISSN: 0102-0536.

Notes: Original title: Produtividade do tomateiro em diferentes substratos e modelos de casas de vegetacao.

Descriptors: coir/ crop yield/ fruits/ growing media/ insect pests/ plant pests/ protected cultivation/ rice husks/ rockwool/ sawdust/ soilless culture/ substrates/ tomatoes/ waste utilization/ weight/ Brasilia/ coconut fibre/ cultivation under glass or plastic/ mineral wool/ potting composts/ rice hulls/ rock wool/ rooting media/ Tuta/ Tuta absoluta

Abstract: An experiment was conducted in Brasilia [Distrito Federal], Brazil, to evaluate the performance of tomato crop production during 2000 and 2001, under 3 greenhouse models and different types of substrates. The greenhouse models were arch roof, even span, and an arch roof with upper convective aperture. The substrates were rice husk, carbonized rice husk, coconut fibre [coir], sawdust, coarse sawdust, rockwool and a substrate for seedling production used at Embrapa Hortalias. No significant statistical difference was verified for tomatoes cultivated in coconut fibre (10.4 kg/m²), sawdust (9.9 kg/m²), carbonized rice husk (9.3 kg/m²) and coarse sawdust (9.0 kg/m²). On the other hand, the smallest production was obtained for tomatoes cultivated in rockwool (6.4 kg/m²). There was a yield reduction between cultivation years due to the South American tomato moth (*Tuta absoluta*) in all greenhouses. Coconut fibre and carbonized rice husk produced the heaviest fruits, 128 and 123 g, respectively.

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1279. Tomato fruit quality and yield as affected by NaCl in nutrient solutions.

Combrink, N. J. J.

Journal of the Southern African Society for Horticultural Sciences 8(2): 57-59. (1998); ISSN: 1017-0316

Descriptors: containers/ cracking/ crop quality/ crop yield/ fertigation/ fruit vegetables/ fruits/ nutrient solutions/ salinity/ sawdust/ size/ soilless culture/ storage/ tomatoes/ vegetables/ wood shavings/ yield losses/ fertirrigation/ vegetable crops

Abstract: Different levels of NaCl were added to a nutrient solution to study effects on cv. Daniela tomatoes. Standard production methods were applied. A mixture of pine shavings and sawdust was used as the substrate in 15-litre plastic containers. Fertigation frequency was controlled with a solar integrator. NaCl was added to a standard nutrient solution (EC = 2.2 mS/cm, pH=5.3) at levels of 18.75, 37.50, 56.25 and 75.00 mmol/litre, increasing the EC to 3.9, 5.6, 7.3 and 8.9 mS/cm, respectively. A spring crop was grown. The terminal growing points were removed from the main stems 8 weeks after transplanting, allowing about 7 trusses to develop. The fruit yield from plants grown in the standard nutrient solution was 4.24 kg/plant. The yield declined by about 30% when NaCl was added at 18.75 mmol/litre. For every additional 18.75 mmol/litre of NaCl added, a smaller, but further reduction in yield occurred. A decrease in fruit size was directly responsible for the yield reduction, since the number of fruits produced per plant was unaffected. Fruit cracking decreased at the higher salinity levels and the weight loss during a 2-week storage period (at 18 degrees C) also declined. Although significant taste differences could not be detected, total soluble solids (TSS) reached a maximum level of 8.8 degrees Brix at 5.6 mS/cm. The limited improvements in fruit quality were outweighed by significant fruit size and yield reductions at EC levels beyond 4.4 mS/cm. The local practice of producing tomatoes at EC levels between 2.0 and 3.5 mS/cm, seems to be acceptable for this cultivar. Reproduced with permission from the CAB Abstracts database.

1280. Transformation of organic matter during co-composting of pig manure with sawdust.

Huang, G F.; Wu, Q. T.; Wong, J. W. C.; and Nagar, B. B.

Bioresource Technology 97(15): 1834-1842. (2006)

NAL Call #: TD930.A32 ; ISSN: 0960-8524

Descriptors: absorbance/ aromatic compounds/ carbon nitrogen ratio/ chemical analysis/ chemical composition/ chromatography/ composting/ composts/ decomposition/ fractionation/ fulvic acids/ humic acids/ humification/ infrared spectroscopy/ organic carbon/ organic matter/ pig manure/ sawdust/ spectral analysis/ aromatics/ optical density

Abstract: Co-composting of pig manure with sawdust was studied in order to characterize the organic transformation during the process, using both chemical and spectroscopic methods. Humic acids (HA) and fulvic acids (FA) were fractionated from immature and mature pig manure compost, and characterized. After 63 days of composting, the ratio of total organic carbon and soluble organic carbon decreased to a satisfactory low level and the solid and soluble C/N ratios decreased rapidly for the first 35 days before attaining a constant value, indicating compost maturity. Humification could be responsible for the increase in humic acid proportion during composting. The increase in

the aromatic bonds after composting, as indicated by the reduction of C/H and C/O ratios of HA and FA, resulted in a more stabilized product. A substantial increase in high molecular weight compounds along with a small increase in low molecular weight compounds was found in mature compost. Moreover the HA also had more complex organic compounds at this stage. Fluorescence spectral analysis showed an increase in the maximum wavelength of HA associated with the contents of aromatic structures in solution. A decrease in relative absorbance of HA at 1160 cm⁻¹, 2950 cm⁻¹ and 2850 cm⁻¹ was seen in the FTIR spectra indicating the decomposition of complex organic constituents, into simpler ones. Increase in the aromatic compounds with higher stability could account for the relative increase in the absorbance of HA at 1650 cm⁻¹ and 1250 cm⁻¹ of the mature compost. The composition of FA was not much altered, indicating most of the degradation of organic matter occurred in HA. Data from organic carbon, C/N ratio, elemental analysis, E₄/E₆ ratio, gel chromatography, fluorescence and FTIR spectra indicated an increase in polycondensed structures and the presence of more stable organic matter in the mature compost. This citation is from AGRICOLA.

1281. Transition of soil nitrogen with high levels of compost application under greenhouse culture.

Maruo, N.; Furukawa, Y.; Taira, K.; and Asano, T. *Bulletin of the Nara Prefectural Agricultural Experiment Station* 33: 35-37. (2002); ISSN: 1345-6393

Descriptors: application rates/ cattle manure/ Chinese cabbages/ composts/ crop yield/ cultivation/ denitrification/ greenhouses/ nitrate/ nitrogen/ sawdust/ soil/ spinach/ uptake/ Capparales/ glasshouses

Abstract: In greenhouse plot trials, Chinese cabbage and spinach were grown in compost with or without addition of 150 t cattle manure compost with sawdust/ha. Application of compost increased nitrogen uptakes and yields. In most cases, denitrification was increased markedly up to 14 days after manure application. Cultivation decreased soil nitrate nitrogen when manure was applied but increased it when manure was not applied.

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1282. Tree species and wood ash affect soil in Michigan's Upper Peninsula.

Sartori, Fabio; Lal, Rattan; Ebinger, Michael H. ; and Miller, Raymond O.

Plant and Soil 298(1-2): 125-144. (Sept. 2007)

NAL Call #: 450 P696; ISSN: 0032-079X

Descriptors: Larix decidua/ wood ash/ Poplar/ Aspen/ short rotation woody crops/ soil carbon/ soil change/ soil cations

Abstract: Tree species and wood ash application in plantations of short-rotation woody crops (SRWC) may have important effects on the soil productive capacity through their influence on soil organic matter (SOM) and exchangeable cations. An experiment was conducted to assess changes in soil C and N contents and pH within the 0-50 cm depth, and exchangeable cation (Capo, Mgpo, K, and Na) and extractable acidity concentrations within the 0-10 cm depth. The effects of different species (European larch [*Larix decidua* P. Mill.], aspen [*Populus tremula* L. x *Populus tremuloides* Michx.], and four poplar [*Populus* spp.]

clones) and wood ash applications (0, 9, and 18 Mg ha-p#) on soil properties were evaluated, using a common garden experiment (N = 70 stands) over 7 years of management in Michigan's Upper Peninsula. Soils were of the Onaway series (fine-loamy, mixed, active, frigid Inceptic Hapludalfs). The NM-6 poplar clone had the greatest soil C and N contents in almost all ash treatment levels. Soil C contents were 7.5, 19.4, and 10.7 Mg C ha-p# greater under the NM-6 poplar than under larch in the ash-free, medium-, and high-level plots, respectively. Within the surface layer, ash application increased soil C and N contents (P < 0.05) through the addition of about 0.7 Mg C ha-p# and 3 kg N ha-p# with the 9 Mg ha-p# ash application (twofold greater C and N amounts were added with the 18 Mg ha-p# application). During a decadal time scale, tree species had no effects--except for K--on the concentrations of the exchangeable cations, pH, and extractable acidity. In contrast, ash application increased soil pH and the concentration of Capo (P < 0.05), from 5.2 pl 0.4 cmolc kg-p# (ash-free plots) to 8.6 pl 0.4 cmolc kg-p# (high-level ash plots), and tended to increase the concentration of Mgpo (P < 0.1), while extractable acidity was reduced (P < 0.05) from 5.6 pl 0.2 cmolc kg-p# (ash-free plots) to 3.7 pl 0.2 cmolc kg-p# (high-level plots). Wood ash application, within certain limits, not only had a beneficial effect on soil properties important to the long-term productivity of fast-growing plantations but also enhanced long-term soil C sequestration.

This citation is from AGRICOLA.

1283. Use of composted dairy cattle solid biomass, poultry litter and municipal biosolids as greenhouse growth media.

Freeman, T. M. and Cawthon, D. L.

Compost Science and Utilization 7(3): 66-71. (1999)

NAL Call #: TD796.5.C58 ; ISSN: 1065-657X

Descriptors: biomass/ capacity/ cattle manure/ composting/ composts/ growing media/ hay/ mortality/ peat/ perlite/ porosity/ poultry manure/ refuse/ sawdust/ techniques/ vermiculite/ death rate/ municipal wastes/ potting composts/ poultry litter/ rooting media/ trash

Abstract: Studies were conducted to evaluate use of composted dairy cattle solid biomass, poultry litter, and municipal biosolids as partial or complete peat moss substitutes in greenhouse growth media. Using in-vessel techniques, four poultry litter composts were prepared using litter at 12.5 and 25% with hay or sawdust (v/v). Biosolids were composted with 50% sawdust (v/v) and dairy cattle solid biomass was composted alone. Each of the above six composts were blended with 0 or 50% peat moss and further mixed with 25% perlite and 25% vermiculite to prepare a total of 12 compost-based growth media. Peat moss blended with 25% perlite and 25% vermiculite served as the control. Dwarf marigold (*Tagetes patula*) cv. Bonanza Yellow were grown in 25 by 50 cm flats containing 36 cells. Media containing poultry litter co-composted with hay had low C:N ratios, high porosity and low water-holding capacity, and produced poor quality plants with high mortality rates. Biosolids and poultry litter co-composted with sawdust produced the tallest plants and the largest dry weight accumulation. Composted dairy biomass and the peat moss control produced plants of similar growth and appearance. Biosolids, poultry litter co-

composted with sawdust, and dairy biomass were effective peat moss substitutes. Addition of peat moss to the growth media was of little benefit except when the media exhibited high porosity.
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1284. Use of composted greenhouse waste as a growing medium component will contribute to a sustainable waste management solution for vegetable greenhouses.

Cheuk, W.; Lo, K. V.; and Fraser, B.

Biological Agriculture and Horticulture 21(4): 321-335. (2003)

NAL Call #: S605.5.B5 ; ISSN: 0144-8765

Descriptors: agricultural wastes/ buffering capacity/ composting/ composts/ crop quality/ crop residues/ crop yield/ growing media/ organic wastes/ porosity/ protected cultivation/ sawdust/ soil density/ soil pH/ soil water retention/ sustainability/ tomatoes/ waste management/ waste utilization/ cultivation under glass or plastic/ farm wastes/ potting composts/ rooting media

Abstract: As part of a study in sustainable greenhouse waste management, a growing medium component made from composted greenhouse waste was investigated and compared with the conventional sawdust growing medium used in most vegetable greenhouses in British Columbia, Canada. The compost provided higher moisture retention and density, and lower porosity; for optimal growing conditions, irrigation should be adjusted to take this into account. In a commercial tomato greenhouse trial setting, a mixture of 2:1 sawdust to compost by volume was found to be suitable as a growing medium, providing similar yield, crop health and fruit quality, and additional pH buffering compared with the conventional system. Since the waste processing is carried out on site, quality and consistency of the compost can be ensured. Successful application of compost in the growing medium can help provide a more sustainable waste management strategy through on-site recycling and conservation of organic resources, and may offer the grower disease suppression benefits.

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1285. Use of fresh sawdust as a nitrogen source in sweet corn production.

Brass, T. J.; Foshee, W. G. III; and Sibley, J. L.

Journal of Vegetable Crop Production 10(2): 89-98. (2004); ISSN: 1049-6467

Descriptors: ammonium nitrate/ chlorophyll/ crop yield/ maize/ nitrogen fertilizers/ particleboards/ plant height/ sawdust/ soil amendments/ sweetcorn/ urea formaldehyde/ chipboards/ corn

Abstract: Fresh sawdust from particleboard glued with urea formaldehyde was applied as a possible replacement for ammonium nitrate (NH_4NO_3) fertilization in sweetcorn (*Zea mays*) production. The treatments consisted of two combinations of sawdust and NH_4NO_3 combinations (25% sawdust:75% NH_4NO_3 ; 50% sawdust:50% NH_4NO_3); 100% sawdust; a standard NH_4NO_3 application (296 kg/ha); and a control treatment that consisted of preplant NH_4NO_3 only. Total N applied for all treatments was 139 kg/ha of N

except for the control with 101 kg/ha of N. The elemental composition of the fresh sawdust had a high N composite (32.1 g/kg) and a low C:N ratio (15:1), making it favourable for direct use as an organic nitrogen fertilizer. Results indicated that the 25 and 50% sawdust treatments were similar to the standard NH_4NO_3 treatment in chlorophyll content at V6 and R1 stages, R1 plant height, and marketable yield. When the amount of NH_4NO_3 was increased, as is the case of the 25% sawdust, all measured responses were similar. Conversely, the use of 100% sawdust as a replacement for NH_4NO_3 fertilization resulted in decreased growth and yields. It appears that the use of sawdust from particleboard glued with urea formaldehyde has potential as a soil amendment with an aim in reducing the amount of NH_4NO_3 fertilizer needed in sweetcorn production.

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1286. Use of organic and green mulches in an apple orchard.

Hartley, M. J. and Rahman, A.

In: Proceedings of the Fifty First New Zealand Plant Protection Conference. Quality Hotel, Hamilton, New Zealand.; pp. 195-198; 1998.

Descriptors: apples/ composts/ crop yield/ cultural control/ mulches/ pest control/ sawdust/ straw mulches/ weed control/ mulching materials

Abstract: Four organic mulches, sawdust, straw, compost and wood dust and two green mulches, grass and clover were compared with herbicide for weed control in an established apple orchard (New Zealand). The green mulches Serra hard fescue (*Festuca longifolia*) and Tahora white clover (*Trifolium repens*) were established on plots previously treated with compost or wood dust. Hard fescue, established for only 3 years (1995-98) under these conditions, reduced apple yield but also reduced the proportion of small reject apples. Straw gave the most consistent weed control throughout the 6 year (1992-98) trial period. Although the mulches affected the chemical characteristics of the soil, they had little effect on the nutrient status of apple leaves or the fruit.

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1287. Use of partially-decomposed cattle and chicken manure amended with wood-ash in two South African arable soils with contrasting texture: Effect on nutrient uptake, early growth, and dry matter yield of maize.

Materechera, S. A. and Salagae, A. M.

Communications in Soil Science and Plant Analysis 32(19-20): 3207-3228. (2001)

NAL Call #: S590.C63; ISSN: 0010-3624 [CSOSA2]

Descriptors: *Zea mays* / dry matter accumulation/ nutrient uptake/ nitrogen content/ phosphorus/ nutrient content/ poultry manure/ cattle manure/ wood ash/ clay soils/ silt loam soils/ protein content/ application rate/ plant height/ growth

Abstract: The study was conducted to determine the effects of applying wood-ash to two soils amended with partially-decomposed cattle and chicken manure on the uptake of nutrients, early growth and dry matter yields of maize (*Zea mays* L.). A clay and silty loam soils were used.

Manure was applied to each soil in pots at rates equivalent to 0, 5, and 15 t ha⁻¹ while ash was applied to each of the manure treatments at rates equivalent to 0 and 2 t ha⁻¹. In both soils, the addition of chicken manure produced higher plant height, stem diameter, leaves per plant, dry matter yield and tissue concentration of protein, nitrogen (N), and phosphorus (P) than cattle manure. The responses of maize due to manure application were higher in the loam than clay soil. Application of cattle manure produced responses, which were less than control in many cases. This was presumed to be due to microbial immobilization of nutrients. Generally, wood-ash improved the responses of maize in the loam but not in the clay soil. The addition of wood-ash to manure in clay soil reduced plant height, dry matter yield, plant tissue protein and phosphorus of maize compared to the control. In both soils however, the addition of wood-ash improved responses where cattle and not chicken manure was applied. In the latter, the increases in response due to manure rate were higher without ash than with ash. Within the cattle manure rates, wood-ash produced better responses when 5 t ha⁻¹ manure was applied compared to 15 t ha⁻¹. It is suggested that higher rates of wood-ash application may have been necessary. This citation is from AGRICOLA.

1288. The use of sawdust deep litter for fattening pigs with regard to labour inputs on bedding and dung removal.

Kaczor, A and Szyndler, J.

In: Problemy Intensyfikacji Produkcji Zwierzecej z Uwzględnieniem Ochrony Środowiska i Przepisów UE VI Międzynarodowa Konferencja Naukowa. Naukowa, Warszawa, Poland.; pp. 227-234; 2000.

Notes: Original title: Warunki stosowania głębokiej ściółki trocinowej w utrzymaniu tuczników przy uwzględnieniu nakadów pracy na ścielenie i usuwanie obornika.

Descriptors: animal housing/ animal husbandry/ animal manures/ deep litter housing/ floors/ hygiene/ labour/ litter/ sawdust/ flooring/ hogs/ labor / swine

Abstract: Management of fattening pigs in pens on deep litter from sawdust is one of the more recent and ecological technologies. The present study attempted to determine the usefulness of sawdust deep litter for fattening pigs kept in standard pens about 10 sq m in area with regard to sawdust consumption, bedding method, animal hygiene and labour inputs on bedding, bed care and dung removal. The research involved Polish Large White pigs in two systems differing in pen equipment. It was concluded that the use of sawdust for pen bedding and pig hygiene were dependent on the type of bed. With management on sawdust deep litter in standard pens, the area per 1 animal is larger than under other systems. In pig management, total labour inputs were lower with deep litter from sawdust than with shallow litter from straw.

This citation is from AGRICOLA.

1289. Use of the Bom Jesus soil with organic conditioners as horticultural substrates for plants.

Fermino, M. H. and Kampf, T. N.

Pesquisa Agropecuaria Gaucha 9(1/2): 33-41. (2003); ISSN: 0104-9070.

Notes: Original title: Uso do solo Bom Jesus com condicionadores orgânicos como alternativa de substrato para plantas.

Descriptors: aeration / bulk density/ horticulture/ Inceptisols/ organic amendments/ pines/ porosity/ rice husks/ salts/ sawdust/ soil organic matter/ soil pH/ soil types/ substrates/ sugarcane byproducts/ water availability/ organic matter in soil/ Pontederiales/ rice hulls

Abstract: A field experiment was conducted in Porto Alegre, Rio Grande do Sul, Brazil, to verify the viability of a Haplumbrept soil as a component of horticultural substrate mixes, along with organic conditioners. The soil was selected due to their high total porosity, high level of organic matter and low capacity to agricultural use. The soil was mixed at volumetric proportion of 1:1 with water hyacinth (*Eichhornia crassipes*), sugarcane residues, *Pinus* sp. sawdust and carbonized rice husks. The mixes were submitted to physical (bulk density, total porosity, water availability and aeration) and chemical characterization (pH and total soluble salt concentration). Except sawdust mixture, all mixes improved soil physical characteristics, providing lower bulk density, higher porosity and higher water availability. All conditioners, but water hyacinth, increased the mixes pH, and all of them increased soluble salts contents.

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1290. Use of willow (*Salix* sp.) sawdust as a potting medium for calendula (*Calendula officinalis*) and marigold (*Tagetes erecta*) plant production.

Gariglio, N. F.; Buyatti, M. A.; Bouzo, C. A.; Weber, M. E.; and Pilatti, R. A.

New Zealand Journal of Crop and Horticultural Science 32(1): 147-151. (2004)

NAL Call #: SB99.N45N45; ISSN: 0114-0671

Descriptors: buds/ crop yield/ dry matter/ dry matter distribution/ flowers/ growing media/ growth/ nitrogen fertilizers/ peat/ perlite/ plant height/ sawdust/ biomass distribution/ potting composts/ rooting media

Abstract: The growth of 'Fiesta Gitana' calendula (*C. officinalis*) in a growth medium prepared from 75% (v/v) composted willow (*Salix* sp.) sawdust (WS), with or without additional nitrogen (N) (4% w/w) during composting, and 25% (v/v) perlite was examined. Total plant dry matter, dry matter partitioning to flowers, and plant height at 77 days after planting were similar in media containing composted WS to values achieved in the sphagnum peat:perlite (75:25, v/v) control medium. Relative to these media, non-composted WS:perlite (75:25, v/v) resulted in average reductions of total dry matter (57%), dry matter partitioning to flowers (50%), plant height (43%), flower diameter (73%), and flower buds per plant (82%). In a further study, increasing the proportion of N-enriched composted WS in perlite from 25 to 75% did not affect total dry matter, plant height, or flower number per plant of 'Fiesta Gitana' calendula or 'Perfection Gold' marigold (*T. erecta*) compared to values achieved in the sphagnum peat:perlite control medium. Since flower diameter decreased in both species when the N-enriched composted WS exceeded 50%, we suggest that this "waste" product can substitute for all the sphagnum peat, but should not exceed 50% volume in a perlite mixture.

Reproduced with permission from the CAB Abstracts database.

1291. The use of wood ash as liming and fertilising material in grasslands.

Pineiro, J.; Santoalla, M. C.; Diaz, N.; Fernandez, A.; and Merino, A.

In: Land Use Systems in Grassland Dominated Regions. Proceedings of the 20th General Meeting of the European Grassland Federation. Luzern, Switzerland.; pp. 723-725; 2004.

Descriptors: acid soils/ cation exchange capacity/ clovers/ crop yield/ exchangeable aluminium/ fertilizers/ grassland soils/ grasslands/ herbage/ limestone/ liming/ liming materials/ phosphorus/ potassium/ soil acidity/ soil pH/ soil types/ sown grasslands/ wood ash/ exchangeable aluminum/ pasture soils/ sown pastures

Abstract: Forestry industries, of great importance in Galicia (NW Spain), burn bark to generate energy, which leads to huge amounts of ash that in most cases is stored without any use. In order to develop a use in agriculture, a trial was sown in September 2001 to investigate the liming and fertilising effect of wood ash in the establishment of grass-legume pastures on acid soils. The initial soil analysis was: pH (H₂O) 5.1; P (Olsen) 28 mg kg⁻¹, K (NH₄NO₃) 79 mg kg⁻¹ and Al CEC-1 (Cation Exchange Capacity) 0.52. Eight treatments were established: (1) Control (no lime or fertilisers), (2) Fertilisers (F) without lime, (3) Limestone3 (3 t ha⁻¹ of ground limestone), (4) Limestone3+F, (5) Ash6 (6 t ha⁻¹ ash), (6) Ash6+F, (7) Ash12 (12 t ha⁻¹ ash) and (8) Ash12+F. F(kg ha⁻¹)=40N-120P₂O₅-120K₂O. Average 2002 and 2003 dry matter yields (t ha⁻¹) were 3.8, 4.9, 4.8, 6.2, 6.4, 7.3, 7.6 and 8.3, respectively. The soil pH (and corresponding exchangeable Al CEC-1) were 5.1(0.542), 5.1(0.532), 5.7(0.135), 5.7(0.164), 5.5(0.284), 5.5(0.258), 5.9(0.130), 5.8(0.129). These preliminary results show a clear effect of the ash on soil acidity and herbage yield. This citation is from AGRICOLA.

1292. Use of wood ash extract and germination to improve the feeding value of Ugandan Sekedo sorghum (Sorghum bicolor) for broiler chicks.

Kyarisiima, C. C.; Okot, M. W.; and Svihus, B.

Animal Feed Science and Technology 120(1-2): 67-77. (May 2005); ISSN: 0377-8401

Descriptors: Sorghum bicolor/ varieties/ broiler feeding/ chicks/ broilers/ wood ash/ grain sprouting/ wood extracts/ feed processing/ chemical treatment/ soaking/ nutritive value/ tannins/ metabolizable energy/ feed conversion/ animal growth/ digestibility/ dietary protein/ dietary fat/ feed intake/ liveweight gain/ Uganda
This citation is from AGRICOLA.

1293. Use of wood ash in the treatment of high tannin sorghum for poultry feeding.

Kyarisiima, C. C.; Okot, M. W.; and Svihus, B.

South African Journal of Animal Science 34(2): 110-115. (2004); ISSN: 0375-1589

Descriptors: broilers / chemical composition/ digestibility/ feed intake/ fowl feeding/ growth rate/ nutritive value/ poultry/ tannins/ treatment/ wood ash/ chickens/ domesticated birds/ nutritional value/ quality for nutrition/ tannic acid

Abstract: A study was conducted to investigate the effects of wood ash treatment on the nutritional value of high tannin sorghum. High tannin sorghum was either soaked in wood ash slurry and then germinated for four days or

soaked in wood ash extract and germinated for 28 hours or germinated after soaking in water. Chemical composition of the grain thus treated was determined. The feeding value of the wood ash extract treated grain was evaluated in a three-week experiment where sorghum replaced maize in broiler starter diets. Treatment of high tannin sorghum with wood ash extract was effective in reducing the tannin level and did not lower the nutrient content of the grain, unlike the treatment that involved the use of wood ash slurry.

There was no significant difference in feed intake between the maize based diet and the diet that contained wood ash extract treated sorghum. There was a significant improvement in growth rate of chicks that were fed on diets that contained treated sorghum. This was also reflected in the improvement of the ileal digestibility of the diets that contained treated grain. Treatment of high tannin sorghum with wood ash extract improves its nutritive value. This citation is from AGRICOLA.

1294. Using cattails (Typha latifolia) as a substrate for Pleurotus ostreatus (Fr.) Kummer cultivation.

Vetayasuporn, S.

Journal of Biological Sciences 7(1): 218-221. (2007); ISSN: 1727-3048

Descriptors: crop residues/ crop yield/ edible fungi/ growing media / sawdust/ substrates/ weeds/ Lentinaceae/ Poriales/ potting composts/ rooting media

Abstract: Different ratio of substrates combination between sawdust and cattails were used for *P. ostreatus* cultivation (in Thailand) and 3-6 flushes were obtained from these substrates. A substrate combination between cattails + sawdust or cattails alone was not accelerated the mushroom growing processes. The mycelial completed colonization, primordium initiation and fruiting body formation were delay when compare to sawdust alone (control). Less yields were revealed from all cattails cultivation substrates (112.10-289.63 g) and these yields were significantly different to those found from control (536.85 g) at a confidence level of 95%. Moreover, the percentage biological efficiency (%BE) values obtained from all cattails cultivation substrates were nearly two times less than those found in the control (95.02%). The cattails are undesirable weeds and provide economically acceptable substrates but result in low crop yields, low %BE and more time was consumed in mushroom growing processes, therefore the substrate combination of sawdust + cattails or cattails alone have shown low potential for use as a raw material for *P. ostreatus* cultivation. Reproduced with permission from the CAB Abstracts database.

1295. Using moss and sawdust as substrate components for root formation in plum and myrobalan plum cuttings.

Samoshchenkov, E. G. and Tikhomirov, V. A.

Izvestiya Timiryazevskoi Sel' skokhozyaistvennoi Akademii 2: 119-131. (2000); ISSN: 0021-342X

Descriptors: clones/ cultivars/ cuttings/ frost resistance/ peat/ perlite/ plums/ rooting/ roots/ rootstocks/ sand/ sawdust/ soil/ substrates/ variety trials/ cultivated varieties
Abstract: During 1995-97, studies were conducted with plum cultivars Evraziya 21 and Volzhskaya krasavitsa, clonal rootstock 10-3-68, and frost-resistant myrobalan

forms 13-113 and 9-114. The effect of different combinations of sawdust, peat, soil, sand and moss on rooting of green cuttings was compared with rooting in perlite + peat (control). The best rooting results were achieved when sawdust was used in combination with sand, moss and perlite. Sawdust could also be used alone. Fresh sawdust (1-year-old) resulted in better rooting than old sawdust (stored for 3 years). Moss was the most effective in combination with sawdust, sand, and perlite, as well as on its own. Peat in combination with other substrates reduced rooting, and is only recommended for use in lower pot layers to improve development of the root system of rooted cuttings. In all substrates, cuttings of myrobalan 13-113 and clonal rootstock 10-3-68 showed better rooting than both plum cultivars. Reproduced with permission from the CAB Abstracts database.

1296. Using wood ash in agriculture.

Susin, J.

SAD, Revija za Sadjarstvo, Vinogradnistvo in Vinarstvo 17(4): 25. (2006); ISSN: 0353-5711.

Notes: Original title: Uporaba lesnega pepela v kmetijstvu.

Descriptors: acid soils/ burning/ calcium fertilizers/ chemical composition/ fertilizer analysis/ fertilizers/ usage/ waste utilization/ wood ash/ flaming

Abstract: Ash from the burning of wood can be used as a mineral fertilizer in agriculture, although its chemical composition is widely variable (with the major component calcium, for example, ranging from 22 to 45%) and depends on tree species, climatic factors, age of the wood and method of burning. This article briefly examines the chemical composition of wood ash and its use as a fertilizer, particularly on acid and weakly alkaline soils.

This citation is from AGRICOLA.

1297. Utilization of phosphorus from vermicomposts by Italian ryegrass (*Lolium multiflorum* Lam.).

Kalembasa, D.

Annales Universitatis Mariae Curie Sklodowska Sectio E, Agricultura 59(4): 1905-1910. (2004)

NAL Call #: 512 L96AE ; ISSN: 0365-1118.

Notes: Original title: Wykorzystanie fosforu z wermikompostow przez zycice wielokwiatowa (*Lolium multiflorum* Lam.).

Descriptors: activated sludge/ crop yield/ farmyard manure/ phosphorus/ sawdust/ FYM/ vermicomposts

Abstract: Vermicomposts produced from waste activated sludges with sawdust, waste from meat processing and cattle farmyard manure (FYM) were used for the fertilizer application of Italian ryegrass (*Lolium multiflorum*) as the source of phosphorus. The yields of Italian ryegrass harvested from plots fertilized with vermicomposts were very similar to the yield of those harvested from plots fertilized with FYM and significantly higher than those from control. The phosphorus utilization coefficient reached the following values: 5.10% for vermicomposts produced on the basis of waste activated sludge, 9.24% for vermicompost produced from cattle FYM and 19.62% from FYM. Reproduced with permission from the CAB Abstracts database.

1298. Utilization of unused woody materials for bedding of cattle.

Oizumi, C.; Tsuchiya, H.; and Okazaki, Y.

Bulletin of the Chiba Prefectural Livestock Research Center (Japan) 5: 79-80. (Nov. 2005); ISSN: 1346-9746.

Notes: 3 tab. Citation notes: JP (Japan).

Descriptors: wood waste/ bedding/ cattle/ Japan

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1299. Variable impacts of enchytraeid worms and ectomycorrhizal fungi on plant growth in raw humus soil treated with wood ash.

Liiri, M.; Ilmarinen, K.; and Setälä, H.

Applied Soil Ecology 35(1)(Jan. 2007)

NAL Call #: QH541.5.S6 A67; ISSN: 0929-1393

Descriptors: Enchytraeidae/ earthworms/ ectomycorrhizae/ mycorrhizal fungi/ soil nematodes/ *Pinus sylvestris*/ forest trees/ seedling growth/ forest soils/ acid soils/ soil pH/ soil organic matter/ wood ash/ soil amendments/ *Cognettia sphagnetorum*

This citation is from AGRICOLA.

1300. Vegetation manifestations of pepper seedlings, grown on different mixtures.

Toskov, K.; Kanazirska, V.; and Dimov, I.

Bulgarian Journal of Agricultural Science 8(4): 353-357. (2002); ISSN: 1310-0351

Descriptors: biomass/ farmyard manure/ growing media/ nitrogen fertilizers/ peat/ perlite/ phosphorus fertilizers/ potassium fertilizers/ rice husks/ sand/ sawdust/ soil/ substrates/ vermiculite/ FYM/ phosphate fertilizers/ potash fertilizers/ potting composts/ rice hulls/ rooting media

Abstract: The effect of 12 mixtures from different combinations and ratios of organic and mineral substrata on the biomass formation rate of pricked-off pepper cv. Kurtovska kapiya 1619 seedlings was investigated in a glasshouse during 2000-01. Soil, farmyard manure, sphagnum peat (Lithuania), sawdust (composted), biohumus (organic by-products of red California worm (*Eisenia fetida*) processing), rice husk, perlite, vermiculite and sand were used for the mixture preparation. Considerable differences (from 31 to 35% compared to the control) in the biomass accumulation at the end of the growing period were recorded. The plants grown on peat mixtures accumulated the greatest biomass amount, while those grown on mixtures with rice husk as the main component accumulated the least. A high negative correlation between salt concentration of the nutrient medium and biomass accumulation was established. To improve the nutrient regime, enrichment of the mixtures containing biohumus with phosphorus and potassium fertilizers, and of the mixtures containing sawdust with nitrogen fertilizer, is necessary.

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1301. Vineyard floor management improves wine quality in highly vigorous *Vitis vinifera* 'Cabernet Sauvignon' in New Zealand.

Wheeler, S. J.; Black, A. S.; and Pickering, G. J.

New Zealand Journal of Crop and Horticultural Science 33(3): 317-328. (2005)

NAL Call #: SB99.N45N45; ISSN: 0114-0671

Descriptors: ammonia/ anthocyanins/ aroma/ chemical composition/ chicory/ cover crops/ crop quality/ crop yield/ flavour/ fruits/ grapes/ growth/ herbicides/ leaves/ mineral content/ nitrate/ nutrient content/ petioles/ plant composition/ plant nutrition/ ripening/ sawdust/ sensory evaluation/ shoots/ soil water content/ titratable acidity/ wines/ chemical constituents of plants/ flavor/ Vitaceae/ weedicides/ weedkillers

Abstract: Five inter-row soil management techniques were applied to a vigorous *Vitis vinifera* 'Cabernet Sauvignon' vineyard in Hawke's Bay, New Zealand—a permanent chicory (*Cichorium intybus* var. *sativum* 'Puna') cover crop; chicory sprayed with herbicide before veraison; incorporated pine (*Pinus radiata*) sawdust and bare soil maintained using cultivation or non-selective herbicide. Both chicory treatments significantly reduced the soil water content and shoot growth late in the season compared to the other treatments. Petiole nitrate concentration and leaf size were lowest in the sawdust and both chicory treatments. The pruning weights in the two chicory treatments were reduced to about half those found in the other treatments. No significant differences among treatments were found in yield or other viticultural characteristics examined. Both chicory treatments resulted in advanced ripening (increased soluble solids and decreased titratable acids), increased anthocyanins, and reduced ammonia content of berries compared to other treatments. Sensory evaluation of wines produced from the cultivation (bare soil) and the permanent chicory cover crop treatment were conducted after 4 years of bottle age, and showed riper fruit aroma and flavour and a higher overall quality score in the chicory treatment. Competition imposed for two seasons using a permanent chicory cover crop has resulted in improved viticultural and oenological characteristics of a highly vigorous 'Cabernet Sauvignon' vineyard in a marginal site in New Zealand. Reproduced with permission from the CAB Abstracts database.

1302. Waste wood recycling as animal bedding and development of bio-monitoring tool using the CALUX assay.

Asari, M.; Takatsuki, H.; Yamazaki, M.; Azuma, T.; Takigami, H.; and Sakai, S.
Environment International 30(5): 639-49. (July 2004)
 NAL Call #: TD169 .E54; ISSN: 0160-4120
Descriptors: animals/ Benzofurans: analysis/ biological assay/ carcinoma, hepatocellular: pathology/ conservation of natural resources/ environmental monitoring: methods/ environmental pollutants: analysis/ housing, animal/ Japan/ liver neoplasms: pathology/ Luciferases: analysis: biosynthesis/ polychlorinated biphenyls: analysis/ rats/ soil pollutants: analysis/ tetrachlorodibenzodioxin: analogs & derivatives: analysis/ tumor cells, cultured/ wood
Abstract: Animal bedding made of waste wood samples from seven different plants in Japan were chemically analyzed in terms of persistent organic pollutants (POPs) including polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/DFs), coplanar polychlorinated biphenyls (Co-PCBs), dioxin compounds, chlordane compounds and various inorganic toxic compounds (Cr, Cu, As, B, Cd and Pb) to investigate the chemical characteristics and levels of contamination. Further investigation was conducted to determine the success of applying the Chemically Activated Luciferase Expression

(CALUX) bioassay to the waste wood samples in combination with a cleanup procedure for the detection of dioxin-like compounds in order to develop the CALUX bioassay as a rapid and cost-effective screening/monitoring method and a contributive tool to risk management in the waste wood recycling process. For the cleanup procedure, crude extracts from wood samples were prepared by dimethylsulfoxide (DMSO)/n-hexane extraction, and then the extracts were processed by silica gel-44% sulfuric acid reflux treatment at 70 degrees C for 60 min to yield the bioassay fractions. The presence of POPs and inorganic toxic compounds were confirmed in most of the litter samples. In particular, Co-PCBs in one sample (litter dust) showed a high concentration level (1200000 pg/g, 240 pg TEQ/g), suggesting the potential for contamination from demolition waste. The CALUX assay-determined TEQs (CALUX-TEQs) were significantly high in the sample after DMSO/n-hexane extraction, probably due to labile aryl hydrocarbon receptor (AhR) ligands such as PAHs; however, they were remarkably reduced through a single silica gel-44% sulfuric acid reflux treatment. The ratio between CALUX-TEQ values and WHO toxicity equivalent values (WHO-TEQ) obtained by congener-specific chemical analysis ranged from 0.058 to 22 and show comparatively good agreement. Underestimation in some samples, however, was observed where WHO-TEQ values of Co-PCBs contributed greatly to total WHO-TEQ values. Reasons for this gap could be lower CALUX assay-determined relative potencies (REPs) than the WHO-TEFs for these congeners or AhR-antagonistic effects of non dioxin-like PCBs which coexist at higher concentration than Co-PCBs. The CALUX assay is proposed as a promising application in the recycling process of wooden materials. This citation is from PubMed.

1303. Water vapour emission and nitrogen balance from a sawdust deep litter system for weaned pigs.

Nicks, Baudouin; Laitat, Martine; Vandenheede, Marc; Desiron, Alain; and Canart, Bernard
Annales de Zootechnie (Paris) 49(2): 119-128. (2000);
 ISSN: 0003-424X
Descriptors: Water vapor/ emission/ nitrogen balance/ sawdust/ litter/ pigs/ swine
Abstract: Five batches of a total of 180 weaned pigs were reared successively in an experimental room on 30 cm deep litter without cleaning between the batches. The litter was a mixture of sawdust from coniferous and beech trees. Water was added to the litter every 10 days to lower the dust concentration in the room. The total amounts of sawdust and water used were respectively 21.3 kg per pig and 10.2 l per pig. The mean temperature of the litter at 20 cm depth recorded during each of the 5 periods varied from 32.5 degreeC to 41.8 degreeC. The average liveweight of the pigs at the beginning and at the end of the post-weaning period was respectively 7.9+1.2 kg and 24.5+4.2 kg. The average daily gain was 392+87 g. The temperature and the relative humidity of the air inside and outside the experimental room and the ventilation rate were continuously recorded in order to calculate the water vapour emission for each batch. The amount of water vapour produced was significantly correlated to the water consumption of the pigs and reached an average of 1732 g per pig per day. This amount is 36% greater than the reference used for pigs on slatted floors. This value may be used as a reference to calculate the minimum ventilation

rate for piggeries with pigs on sawdust deep litters. The amount of compost produced was 19.9 kg per pig with a dry matter content of 44.7%. The amount of nitrogen in the compost was 231 g per pig which is about 50% lower than the reference used for the slurry. The volatile nitrogen emissions are thus much higher from composts than from slurries.

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1304. Weed control and soil amendment effects on restoration plantings in an Oregon grassland.

Huddleston, R. T. and Young, T. P.

Western North American Naturalist 65(4): 507-515. (2005); ISSN: 1527-0904

Descriptors: forbs/ glyphosate/ grasslands/ herbicides/ integrated control/ mulches/ mulching/ nitrogen/ nutrient availability/ sawdust/ soil amendments/ weed control/ weeds/ integrated plant protection/ mulching materials/ United States of America/ weedicides/ weedkillers

Abstract: The restoration of perennial grasslands in western North America often depends on effective weed control. We took advantage of a grassland restoration site on the Nature Conservancy's Agate Desert Preserve in southern Oregon (TNC 1997), where 3 sites had been previously burned, mowed, or both. At these sites we carried out a series of controlled, replicated experiments designed to test the effectiveness of 3 weed control measures: (1) sawdust, (2) glyphosate herbicide, and (3) herbicide plus an alfalfa mulch. All plots were seeded with a mix of 3 native perennial grasses. The soils of the 3 areas differing in previous vegetation management were similar, with the exception of total available soil nitrogen, which was significantly lower in the 2 burned sites. The sawdust treatment reduced total available soil nitrogen, but only in the unburned site, and only in the first few months after application. In all 3 areas the alfalfa mulch significantly increased total available soil nitrogen. However, none of these soil nitrogen differences significantly affected the success of weeds or planted perennial grasses. The herbicide treatment reduced exotic annual grasses and forbs and greatly increased the success of native forbs and the planted perennial grasses. The herbicide increased both initial establishment of the native grasses and their absolute cover and biomass. These results suggest that neither nitrogen impoverishment nor nitrogen enrichment was a useful restoration technique at this site, but weed control by herbicides can be of considerable assistance in restoring native perennial grasses.

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1305. Weed control efficacy of organic mulches in two organically managed bell pepper production systems.

Law, D. M.; Rowell, A. B.; Snyder, J. C.; and Williams, M. A.

HortTechnology 16(2): 225-232. (2006)

NAL Call #: SB317.5.H68; ISSN: 10630198 [HORTE]

Descriptors: capsicum annuum/ compost/ corn gluten/ drip irrigation/ living mulch/ raised beds/ shallow cultivation/ straw/ trichogramma ostriniae/ wood chips/ capsicum/ capsicum annuum/ trichogramma ostriniae/ trifolium/ trifolium repens/ zea mays

Abstract: A 2-year field study in Lexington, Ky., evaluated weed control efficacy and influence on yields of several organic mulches in two organically managed bell pepper

(*Capsicum annuum*) production systems. Five weed control treatments [straw, compost, wood chips, undersown white dutch clover (*Trifolium repens*) "living mulch," and the organically approved herbicide corn gluten] were applied to two production systems consisting of peppers planted in double rows in either flat, bare ground or on black polyethylene-covered raised beds. In the first year, treatments were applied at transplanting and no treatment was found to provide acceptable season-long weed control. As a result, bell pepper yields in both production systems were very low due to extensive weed competition. First year failures in weed control required a modification of the experimental protocol in the second year such that treatment application was delayed for 6 weeks, during which time three shallow cultivations were used to reduce early weed pressure and extend the control provided by the mulches. This approach increased the average weed control rating provided by the mulches from 45% in 2003 to 86% in 2004, and resulted in greatly improved yields. In both years, polyethylene-covered raised beds produced higher yields than the flat, bare ground system (8310 lb/acre compared to 1012 lb/acre in 2003 and 42,900 lb/acre compared to 29,700 lb/acre in 2004). In the second year, the polyethylene-covered bed system coupled with mulching in-between beds with compost or wood chips provided excellent weed control and yields. When using the wood chip mulch, which was obtained at no cost, net returns were \$5587/acre, which is similar to typical returns for conventionally grown peppers in Kentucky. Net returns were substantially decreased when using compost due to the purchase cost. Results from this study indicate that shallow cultivation following transplanting, combined with midseason mulch application, resulted in high yields in an organically managed bell pepper system that were comparable to yields of most varieties grown conventionally in a variety trial conducted on the same farm.

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1306. Welfare and performance of yearling dairy heifers out-wintered on a wood-chip pad or housed indoors on two levels of nutrition.

Boyle, L. A.; Boyle, R. M.; and French, P.

Animal 2(5): 769-778. (2008); ISSN: 17517311

Notes: doi: 10.1017/S1751731108001870.

Descriptors: behaviour/ dairy/ heifer/ performance/ welfare/ animalia/ Bos

Abstract: Wood-chip pads represent a low-cost alternative to housing for cattle during the winter. Considering the negative welfare implications associated with housing indoors on concrete, they may also offer welfare benefits to replacement dairy heifers. However, these animals may not be able to withstand winter weather conditions on a grass silage diet. The aim of this experiment was to evaluate behaviour, limb injuries, dirtiness scores, performance and climatic energy demand (CED) of yearling dairy heifers on two levels of nutrition kept outdoors on a wood-chip pad or indoors in cubicles during the winter. Ninety-six 10-month-old heifers were blocked and assigned in groups of eight, to one of the following four treatments in a 2 x 2 factorial design: (a) indoors, silage only; (b) indoors, silage plus concentrate; (c) outdoors, silage only; and (d) outdoors, silage plus concentrate. There were three replicate groups per treatment. All animals were inspected for skin lesions and were weighed and body condition scored (BCS) at the beginning and end of the trial. Instantaneous scan sampling

and continuous all-occurrence behaviour sampling were used to collect behaviour data during two 24-h periods. Animals were also dirtiness scored and group feed intakes were recorded during the trial. Significantly more comfort, social and play behaviours were recorded outdoors ($P < 0.05$) while trips, slips and falls were only recorded indoors ($P < 0.001$). Groups outdoors had significantly lower limb lesion scores at the end of the experiment ($P < 0.05$) and fewer groups outdoors were affected by all categories of limb lesions. However, they were consistently dirtier than animals indoors ($P < 0.001$). Low-nutrition animals had lower feed intakes, smaller BCS changes and lower average daily weight gains than high-nutrition animals ($P < 0.01$). Heifers outdoors had significantly lower average daily weight gains and BCS changes ($P < 0.05$) explained by lower feed intakes ($P < 0.01$). However, outdoor heifers on both the high- and low-nutrition diets and indoor animals on the low-nutrition diet had lower UFL (feed unit for maintenance and lactation (Irish Republic)) intakes (-0.36, -0.35 and -0.22, respectively) than that required to meet the daily live-weight gains they achieved. Heifers indoors on the high-nutrition diet gained 0.98 kg per day but consumed 0.17 UFL more than what would be recommended to achieve a daily weight gain of 1.0 kg. The CED for outdoor heifers was higher than that of indoor heifers (6.18 v. 5.47 MJ/day per m² body surface area; $P < 0.001$, s.e.d. 0.044). However, CED did not exceed heat production in any treatment. Although animal performance was reduced outdoors, the wood-chip pad was associated with welfare benefits compared with cubicle housing. © 2008 The Animal Consortium.

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1307. Wood ash admixture to organic wastes improves compost and its performance.

Kuba, T.; Tschcell, A.; Partl, C.; Meyer, K.; and Insam, H. *Agriculture, Ecosystems and Environment* 127(1-2): 43-49. (Aug. 2008)

NAL Call #: S601.A34; ISSN: 0167-8809

Descriptors: wood ash / organic wastes/ nutrients/ micronutrients/ compost performance

Abstract: Throughout Europe, increasing amounts of wood ash are produced from biomass incineration plants. Most of these ashes are currently landfilled, despite their nutrient and micronutrient contents. The aim of this research was to find a way to return wood ash from biomass incineration plants into the natural cycle of matter. Three composts from source separated organic waste were produced with 0%, 8% and 16% ash admixture. The composting process was monitored by in situ measurements of temperature and CO concentration in the windrows. Maturation of the composts was observed through the parameters basal respiration, microbial biomass, metabolic quotient, Corg, Ntot, C/N-ratio and plant growth tests with cress. Mature composts were further analysed for potential pH, electrical conductivity as well as for nutrient (Mg, K, P) and heavy metal contents. The process indicators showed that ash admixture had no adverse effects and all legal standards were met. All produced composts met the requirements of the Austrian Compost Ordinance (Compost Quality A or even A+). In a field experiment - a recultivation trial on an alpine ski-run - we compared the effects of the three composts with an organic fertilizer and a mineral fertilizer. Best plant growth

was found on the compost amended plots, followed by the organic fertilizer. Soil respiration measurements indicated a better performance of composts amended with 8% or 16% ash as compared to compost that did not contain ash. Concluding it may be stated that up to 16% ash admixture to organic wastes does not impair the composting process but is even able to improve the product quality. However, it has to be made sure that only bottom ashes of low heavy metal contents are being used and strict quality control is implemented.

This citation is from AGRICOLA.

1308. Wood ash: An alternative liming material for agricultural soils.

Alberta. Alberta Agriculture, Food and Rural Development. Edmonton: Alberta Agriculture, Food and Rural Development; Series: Agri-facts. (2002)

NAL Call #: S663 .W66 2002

Descriptors: wood ash / liming/ agricultural soils

This citation is from AGRICOLA.

1309. Wood ash as a solution to the soil acidity problem in Alberta.

Patterson, S. J.; Acharya, S. N.; Thomas, J. E.; and Bertschi, A. B.

Canadian Journal of Plant Science 81(1): 126. (2001)

NAL Call #: 450 C16; ISSN: 0008-4220

Descriptors: wood ash / soil acidity/ Alberta

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1310. Wood ash as fertilizer and soil acidity corrector: Effects on soil quality and crop yield.

Mijangos, I.; Garbisu, C.; Aristegieta, A.; Ibarra, A.; Mendarte, S.; and Albizu, I.

In: Sustainable Grassland Productivity: Proceedings of the 21st General Meeting of the European Grassland Federation. Badajoz, Spain.; pp. 808-810; 2006.

Descriptors: acid soils/ biodiversity/ biological activity in soil/ calcium/ calcium oxide/ Cambisols/ crop yield/ gley soils/ grasslands/ lime/ liming/ meadows/ microbial activities/ microbial flora/ mineralization/ nitrogen/ nitrogen fertilizers/ NPK fertilizers/ organic fertilizers/ soil acidity/ soil enzymes/ soil fertility/ soil types/ waste utilization/ wood ash / gleys/ microbial communities/ microflora/ soil quality/ soil respiration

Abstract: Soil acidity limits soil microbial activity and biodiversity as well as crop yield. In the Basque Country (northern Spain), the forestry industry annually generates great amounts of ash, which is considered a useless waste. In this context, a field assay was established to study the effect of the application of wood ash on the acidity (pH, % Al saturation), fertility (yield, forage quality) and soil biological quality (e.g., soil enzymes, potentially mineralizable nitrogen, respiration, abundance of earthworms, and microbial community metabolic profiles) of a typical acid soil of this region. This effect was also compared with that of lime (CaO), applied at the same rate of Ca. In March 2005, three contiguous areas of *Lolium multiflorum* Lam. received the following treatments, respectively: (1) ash (15.5 t ha⁻¹ of wood ash and N fertilizer), (2) lime (1.1 t ha⁻¹ CaO and N-P-K fertilizer, in order to equal the doses of nutrients) and (3) no addition. A contiguous native meadow was also studied as absolute

control (treatment 4). Soil and herbage samplings were made in May 2005. Results showed that wood ash can be a useful alternative as an acidity corrector, and is a useful means of utilizing a waste material. This citation is from AGRICOLA.

1311. Wood chips used for weed control in organic farming.

Gruber, S.; Acharya, D.; and Claupein, W.
Journal of Plant Diseases and Protection 21(Supplement): 395-400. (2008); ISSN: 18614051

Descriptors: allelopathic effects/ mulch/ soil properties/ weed regulation/ yield/ allelopathy/ crop rotation/ erosion control/ experimental study/ germination/ grass/ herb/ mulching/ organic farming/ testing method/ weed control/ wheat/ woody debris/ *Alopecurus myosuroides*/ *Brassica napus*/ *Medicago sativa*/ *Papaver*/ *Papaver rhoeas*/ *Triticum aestivum*

Abstract: The effect of wood chips mulch on weeds and yield was tested in a long-term experiment within a crop rotation in Organic Farming. The wood chips originated from hedge-rows and trees of the Experimental Station Kleinhohenheim of the University of Hohenheim. The material consisted for 25% of bark and had a CN ratio of 47. After annual mulching of crops with 0 (control), 80 and 160 m³ ha⁻¹ in spring, any mechanical weed control was omitted. There was no effect of mulching on yield in the years 2002-2006. In the season 2007, when the investigations were intensified, winter wheat yielded 7.0-7.2 t ha⁻¹ or 607-626 ears m⁻², and had protein contents of 10.8-10.9%, all without significant differences between the treatments. N min after harvest 2007 ranged from 83 and 104 kg ha⁻¹. The water content of the soil after harvesting winter wheat 2007 was highest in the treatment with high application of wood chips. There was a quantitative effect of mulch application on weed infestation in field and model experiments. The application of wood chips significantly reduced weed infestation in lucerne/grass, and also significantly reduced volunteer lucerne in the following crop winter wheat. The highest number of annual weeds was found in winter wheat in the treatment "80 m³ ha⁻¹". A germination test with wood chips extract for an investigation of potential allelopathic effects resulted in lowest germination rates of oilseed rape (*Brassica napus*), blackgrass (*Alopecurus myosuroides*) and field poppy (*Papaver rhoeas*) seeds when the highest eluate concentration was used. As a conclusion, wood chips are suitable to contribute to weed control in Organic Farming, and they additionally close the total farm's nutrient cycle. An increase of soil organic matter and higher water storage capacity can be expected in future due to the high input of C and N by wood chips in the further run of the experiment. Wood chips application can additionally be a flexible tool to control erosion on fields with a slope, and in crops with wide inter-row distance. © Eugen Ulmer KG.

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1312. Yield evaluation of *Lentinus squarrosulus* (Mont) sing. on selected sawdust of economic tree species supplemented with 20% oil palm fruit fibers.

Ayodele, S. M. and Akpaja, E. O.
Asian Journal of Plant Sciences 6(7): 1098-1102. (2007); ISSN: 1682-3974

Descriptors: crop yield/ emergence/ growth/ mycelium/ non wood forest products/ oil palms/ sawdust/ *Brachystegia nigerica*/ *Combretodendron macrocarpum*/ *Lentinaceae*/ *Lentinus squarrosulus*/ minor forest products/ non timber forest products/ *Poriales*

Abstract: The yield of *Lentinus squarrosulus* (Mont) singer was evaluated following its cultivation on sawdust from seven economic trees (*Mansonia altissima*, *Piptadeniastrium africanum*, *Nesogordonia papaverifera*, *Combretodendron macrocarpum*, *Terminalia* sp., *Khaya ivorensis* and *Brachystegia nigerica*). The sawdust in each case was supplemented with 20% oil palm fruit fibers. Good growth was observed in all the sawdust except *Combretodendron macrocarpum*. Between the control and each sample, differences in mean mycelial density were significant (p=0.05) but differences among the different supplemented sawdust media were not. Supplementation with 20% oil palm fruit fibers advanced the time of primordial emergence and enhanced the fresh weight and number of flushes of the mushroom. The sawdust giving the highest yield was *Brachystegia nigerica* while the one with the lowest was *Combretodendron macrocarpum*. Reproduced with permission from the CAB Abstracts database.

1313. Yield of greenhouse-grown tomatoes cultivated in soil and substrates.

Fontes, P. C. R.; Novo, A. A. C.; Silva, D. J. H. da; and Cecon, P. R.

Revista Ceres 53(305): 92-99. (2006)

NAL Call #: 9.2 C332; ISSN: 0034-737X.

Notes: Original title: Produtividade do tomateiro em ambiente protegido no solo e em substratos.

Descriptors: chemical composition/ coal/ composts/ crop yield/ fertigation/ fruits/ growing media/ leaves/ nitrogen fertilizers/ nutrient content/ plant composition/ protected cultivation/ sand/ sawdust/ soil/ subsoil/ substrates/ tomatoes/ chemical constituents of plants/ cultivation under glass or plastic/ fertirrigation/ potting composts/ rooting media

Abstract: The effects of planting tomato (cv. Carmen) on soil and substrates on leaf nutrient contents and fruit yield were studied under greenhouse conditions for 133 days. The treatments were: (1) control plot, transplanting on the soil of the unheated greenhouse, as done by growers; (2) FITO-2, transplanting in plastic bags containing 9 dm³ organic compost + sand treated with micro- and macronutrients except N and K, which were applied through the drip irrigation system; (3) FITO-2 + N, similar to FITO-2 but had an additional supply of 50% N; (4) subsoil, similar to FITO-2 but the substrate used was subsoil; (5) coal + sawdust: similar to FITO-2 but the substrates used were 50% coal + 50% sawdust (v/v); and 6-commercial, similar to FITO-2 but the substrate was bought in the market. The experiment was conducted in randomized blocks with 6 replications. The nutrient contents of leaves were affected by the treatments, whereas marketable and total fruit yields were not affected. The marketable fruit yield reached 92 t and 89-112 t ha⁻¹ for plants grown on soil and substrates, respectively. The yields of plants grown on substrates and soil were on a par.

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1314. Yield of seven strains of oyster mushrooms (*Pleurotus* spp.) grown on composted sawdust of *Triplochiton scleroxylon*.

Obodai, M; Sawyerr, LCB; and Johnson, PNT
Tropical Science 40(2): 95-99. (2000); ISSN: 0041-3291 [TROSAC]

Descriptors: *Pleurotus*/ strains/ crop yield/ wet season/ dry season/ composts/ *Triplochiton scleroxylon*
This citation is from AGRICOLA.

1315. The yield response of two sweetpotato cultivars grown in bags using different soil amendments.

Seesahai, A. and Ferguson, T. U.
Tropical Agriculture 75(1/2): 29-34. (1998); ISSN: 0041-3216

Descriptors: amendments/ animal manures/ bagasse/ bulk density/ coir/ crop residues/ cultivars/ fertilizers/ husks/ incorporation/ manures/ rice husks/ sawdust/ soil amendments/ sweet potatoes/ coconut fibre/ cultivated varieties/ hulls/ rice hulls

Abstract: The effects of cattle, chicken and horse manures, sawdust, bagasse, grass, coconut coir, and coffee and rice hulls, and inorganic fertilizer, on soil physical and chemical properties and sweet potato (*Ipomoea batatas*) yield were examined. Results showed that cv. A28/7 produced a significantly higher tuber yield (254 g plant⁻¹) than cv. 049 (211 g plant⁻¹) but there were no significant differences between cultivars in response to soil amendments. Animal manures, coffee and rice hulls, and inorganic fertilizer significantly increased tuber dry matter yields (241-442 g plant⁻¹) compared to plant manures (35-240 g plant⁻¹). Bulk density was improved with the addition of both animal and plant manures and coffee hull but not with rice hull or inorganic fertilizer. Incorporation of residues with high C:N ratios resulted in reduced yields. Bagasse showed markedly reduced plant growth with chlorotic leaves. It is concluded that animal manures and coffee hulls can improve soil physical and chemical properties and can have beneficial effects on sweet potato tuber yields. Reproduced with permission from the CAB Abstracts database.

1316. Yield, size and bacterial blotch resistance of *Pleurotus eryngii* grown on cottonseed hulls/oak sawdust supplemented with manganese, copper and whole ground soybean.

Rodriguez Estrada, A. E. and Royse, D. J.
Bioresour Technology 98(10): 1898-906. (July 2007)
NAL Call #: TD930.A32 ; ISSN: 0960-8524

Descriptors: analysis of variance/ copper: metabolism: pharmacology/ gossypium/ immunity, innate: drug effects: physiology/ manganese: metabolism: pharmacology/ nitrogen: metabolism/ *pleurotus*: classification: growth & development: metabolism/ *pseudomonas*: physiology/ *quercus*/ soybeans: metabolism

Abstract: Experiments were performed to determine effects of supplementation of cottonseed hull/sawdust substrate with Mn, Cu, and ground soybean on yield, mushroom size, and bacterial blotch resistance of two commercial strains of *Pleurotus eryngii*. A basal formulation (d.w.) of cottonseed hulls (62%), aged red oak sawdust (27%), whole ground soybean (6%), corn distiller's waste (4%) and calcium sulfate (1%) was supplemented to 50, 150 or 250 microg/g Mn or Cu and to 4%, 8% and 12% whole ground soybean. The cottonseed hulls content in the basal substrate was adjusted to compensate for the addition of ground soybean. Formulated substrates were mixed, placed in 1050ml bottles, and sterilized at 121 degrees C for 90min. Mushroom yields were significantly higher from substrates containing Mn at 50 microg/g and soybean at 8% and 12% supplementation compared to the basal substrate. As the level of soybean addition to substrate increased, yield also increased. The addition of Mn at levels of 150 and 250 microg/g significantly enhanced yield as well, although less than did the 50 microg/g treatment. To assess the influence of mushroom strain and substrate composition on blotch disease severity, pilei of *P. eryngii* were inoculated with *Pseudomonas tolaasii*. Strain WC888 was more resistant to disease than WC846. Disease severity was greater when substrates were amended with Cu to 150 or 250 microg/g. There was a significant difference in inherent levels of Cu in the basidiomata of different strains, but *P. eryngii* did not accumulate Cu and disease severity was not correlated with Cu content of the basidiomata. This citation is from PubMed.

General/Mixed Industry Byproducts

1317. Application of paper mill biosolids, wood ash and ground bark on wild lowbush blueberry production.

Lafond, J.

Small Fruits Review 3(1/2): 3-10. (2004); ISSN: 1522-8851

Descriptors: bark/ blueberries/ calcium/ chemical composition/ crop yield/ fruits/ iron/ leaves/ magnesium/ mineral content/ nickel/ nitrogen/ nutrient content/ paper mill sludge/ phosphorus/ plant composition/ plant nutrition/ potassium/ soil amendments/ wood ash/ wood residues/ chemical constituents of plants

Abstract: Soils in wild lowbush blueberry production are prone to wind erosion and have very low nutrient and water storage capacities. An experiment was initiated to assess paper mill biosolids (PB) mixed with wood ash and ground bark as a soil amendment/fertilizer for wild lowbush blueberry (*Vaccinium angustifolium*) in the Lac St-Jean area, Quebec, Canada. A mixture of PB was applied during spring (mid-May) of the sprout year (1998) on 120 m² plots at a rate of 15 t ha⁻¹ (wet basis) with wood ash (1 and 2 t ha⁻¹) and ground bark (0, 3, 6, 9 and 15 t ha⁻¹, wet basis). Blueberry leaves were sampled in the first year and wet digestion and dry ashing were performed to determine foliar nutrient concentration. In 1999 and 2000, fruit yields tended to increase with PB with wood ash and ground bark application (31% in 1999 and 29% in 2000). Foliar N, P and K concentrations were increased whereas Ca and Mg were unaffected compared to control. Other nutrients were also determined and only Fe tended to increase with PB application whereas Ni tended to decrease. This study indicated that PB mixed with wood ash and ground bark is a potential nutrient source for blueberry on these poor sandy soils without short-term loss in crop yield. Reproduced with permission from the CAB Abstracts database.

1318. Cadmium content in the edible parts of vegetables depending on carbon dynamics in horticultural substrates.

Bosiacki, M. and Tyksinski, W.

Prace z Zakresu Nauk Rolniczych 95: 253-263. (2003); ISSN: 0079-4708

Descriptors: brown coal/ cadmium/ chemical composition/ crop quality/ fruits/ heavy metals/ leaves/ lettuces/ pine bark/ plant composition/ radishes/ roots/ sawdust/ straw/ substrates/ tomatoes/ wheat/ wheat straw/ Capparales/ chemical constituents of plants

Abstract: Pot experiments conducted during 199-2001 in an unheated greenhouse showed that the addition of brown coal, pine sawdust, wheat straw and pine bark in a volumetric proportion of 30% to mineral soil in the first year decreased the Cd content in the storage roots of radish, leaves of lettuce and fruits of tomato. Cd content in the edible parts of these vegetables grown in the same substrates decreased in successive years. The greatest amount of Cd was found in lettuce leaves, and the smallest was recorded in tomato fruits. The decreasing amounts of organic carbon in all studied substrates in the successive years decreased the Cd content in the edible parts of the studied vegetables.

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1319. Characterization of industrial by-products.

Miller, D. M.; Miller, W. P.; Dudka, S.; and Summer, M. E. In: Land application of agricultural, industrial, and municipal by-products/ Power, J. F.; Dick, W. A.; Kashmanian, R. M.; Sims, J. T.; Wright, R. J.; Dawson, M. D.; and Bezdicek, D.; Series: Soil Science Society of America Book Series 6. Madison, USA: Soil Science Society of America Inc., 2000; pp. 107-119.

Descriptors: application to land/ cement dust/ fly ash/ gypsum/ industrial wastes/ pulp and paper industry/ slags/ waste disposal/ waste utilization/ land application/ paper industry

Abstract: The generation and characteristics of industrial wastes and their potentials in relation to agriculture are discussed. Topics covered include the types, disposal and beneficial re-use of industrial byproducts from metal and mineral processing, coal combustion in electric utilities, pulp and paper manufacture, and gypsiferous construction wastes.

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1320. Chemical changes during composting of a paper mill sludge-hardwood sawdust mixture.

Marche, T.; Schnitzer, M.; Diné, H.; Pare, T.; Champagne, P.; Schulten, H. R.; and Facey, G.

Geoderma 116(3/4): 345-356. (2003)

NAL Call #: S590 .G4; ISSN: 0016-7061

Descriptors: analytical methods/ carbohydrates/ carbon/ carbon nitrogen ratio/ cellulose/ chemical composition/ composting/ composts/ environmental impact/ lignin/ lipids/ mass spectrometry/ microbial activities/ nitrogen content/ nuclear magnetic resonance/ paper mill sludge/ pyrolysis/ recycling/ sawdust/ soil amendments/ sterols/ analytical techniques/ environmental effects/ lipins/ saccharides

Abstract: Recycling of paper mill sludge (PMS) by composting is becoming an acceptable practice for converting these chemically complex materials into useful soil amendments, while eliminating negative environmental impacts. The organic composition of a PMS-hardwood sawdust mixture was investigated during composting to better understand the changes in main chemical components. Pyrolysis-field ionization mass spectrometry (Py-FIMS) and cross polarization-magic angle spinning ¹³C nuclear magnetic resonance (CP-MAS ¹³C NMR) were employed to characterize the organic composition of the PMS composted materials. The spectroscopic data revealed that the major components of the PMS were lipids, sterols, lignin, N-compounds, and carbohydrates. By the end of composting (at biomaturity), concentrations of carbohydrates and lignin became more prominent, while those of lipids, sterols and proteinaceous components decreased. Increases in carbohydrates and decreases in paraffinic C, proteinaceous C and C in OCH₃ groups appeared to be related to increased microbial activity. Other chemical changes observed during composting were increases in aromatic C, phenolic C, and in aromaticity. While the total C and N contents decreased by about only 12.0%, the compost lost 50% of its initial weight. At biomaturity, the compost consisted primarily of polysaccharide/carbohydrate materials, specifically

cellulose and acidic polysaccharides (uronic acids) in combination with smaller quantities of lignin.
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1321. Compost effects on soil physical properties and field nursery production.

Gonzalez, R. F. and Cooperband, L. R.
Compost Science and Utilization 10(3): 226-237. (2002)
NAL Call #: TD796.5.C58 ; ISSN: 1065-657X
Descriptors: aggregates/ biomass production/ bulk density/ cattle manure/ composts/ crop production/ ornamental plants/ ornamental woody plants/ paper mill sludge/ poultry manure/ saturated hydraulic conductivity/ sawdust/ shrubs/ silt loam soils/ soil amendments/ soil density/ soil organic matter/ soil physical properties/ soil types/ soil water content/ soil water retention/ stability/ topsoil/ woody plants/ organic matter in soil/ ornamentals/ physical properties of soil/ poultry litter
Abstract: Field production of ornamental shrubs often results in significant topsoil removal and degradation of surface soil physical properties. Building soil organic matter through compost amendments is one way to ameliorate effects from topsoil removal in woody ornamentals production. We amended field soils with three composts to evaluate their effects on soil physical properties and shrub biomass production. Specifically, we applied either duck manure-sawdust (DM), potato cull-sawdust-dairy manure (PC) or paper mill sludge-bark (PMB) composts to a Plano silt loam soil using two application methods: 2.5 cm of compost incorporated into the top 15 cm of soil (incorporated-only) or 2.5 cm of compost incorporated plus 2.5 cm of compost applied over the soil surface (mulched). We grew three shrub species from liners: *Spiraea japonica* 'Gumball', *Juniper chinensis* 'Pfizeriana', and *Berberis thunbergia* 'Atropurpurea'. Shrub species and soil amendment treatments were established in triplicate in a randomized split plot design. Total soil carbon (TC), bulk density (ρ_b), aggregate stability, soil moisture retention capacity (MRC), volumetric moisture content (θ_v), and saturated hydraulic conductivity (K_{sat}) were measured over three years (1998 to 2000). We measured above and below ground shrub dry matter production at the end of the first (1998) and second (1999) growing seasons. Mulched treatments resulted in 15%-21% higher TC than the incorporated-only and no-amendment control treatments. Bulk density decreased with increasing TC contents. Greater aggregate stability and the formation of larger aggregates were related to increased TC. Field moisture retention capacity tended to be higher in the incorporated treatments compared to the mulched and nonamended control treatments. Compost amended treatments increased saturated hydraulic conductivity (K_{sat}) sevenfold over the nonamended control. There were no compost effects on shrub biomass until the second year of growth. Barberry was the only species to respond significantly and positively to compost application. Specifically, mulched DM compost produced 39-42% greater total Barberry biomass than the other compost treatments and the nonamended control. Our findings showed that compost effects on soil physical properties differed among composts and their subsequent effects on shrub growth were species specific.
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1322. Early growth response of container-grown selected woody boreal seedlings in amended composite tailings and tailings sand.

Khasa, D. P.; Fung, M.; and Logan, B.
Bioresource Technology 96(7): 857-864. (2005)
NAL Call #: TD930.A32; ISSN: 0960-8524
Descriptors: clones/ container grown plants/ fertilizers/ fly ash/ hybrids/ increment/ peat/ seedlings/ soil amendments/ substrates/ volume
Abstract: Successful reclamation of saline-alkaline sites may be enhanced by revegetating with species that are tolerant to factors that limit normal plant growth. Boreal woody plants tested in this study have shown promise for use in saline habitats. This study was conducted to assess the effects of amendment treatments (peat, pulp waste, agriboostReg., a combination of pulp waste and fly ash, and mineral fertilizer) on the early growth of three hybrid poplar clones and three coniferous species. Twelve-week and 18-week container-grown hybrid poplar clones and coniferous species, respectively, were monitored for 12 weeks in pot culture in both composite tailings (CTs) and tailings sand (TS) materials obtained from the oil sands plant, Syncrude Canada Ltd., Ft. McMurray, Alberta. These substrates with low nutrients, organic matter, and water-holding capacities, were amended with different organic materials at different rates. Growth, as assessed by the volume increment in both substrates, was generally better for the first 6 weeks than for the last 6 weeks. Growth was reduced during the last 6 weeks due to nutrient depletion over time in these impoverished substrates. Overall, for both substrates, the mineral fertilizer, 20%, 40% and 60% peat were the best amendment treatments for poplar clones with NM-6 being the most productive clone. For coniferous species, 20% and 40% pulp or peat appear to be the best amendment treatments, with lodgepole pine being the most productive species. The inflexion point of the regression functions were found around 30% rate of the amendment materials. The results also indicated that peat and pulp waste were the best amendment treatments for both hybrid poplars and coniferous species whereas the agriboost and mix (combination of pulp waste and fly ash) were the worst.
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1323. Effect of different organic materials with fly ash in integrated plant nutrient system for groundnut (*Arachis hypogaea*).

Karmakar, S.; Mitra, B. N.; and Ghosh, B. C.
Indian Journal of Agronomy 50(2): 152-155. (2005)
NAL Call #: 22 IN235; ISSN: 0537-197X
Descriptors: application date/ crop yield/ dry matter accumulation/ fly ash/ groundnut oil/ groundnuts/ lateritic soils/ leaf area index/ nodules/ nutrient uptake/ organic amendments/ paper mill sludge/ plant nutrition/ soil chemical properties/ soil types/ yield components/ arachis oil/ chemical properties of soil/ LAI/ peanut oil/ peanuts
Abstract: An investigation was carried out during the dry season (February-May) of 1996 and 1997 in Kharagpur, West Bengal, India, to study the effect of paper factory sludge (PFS) and fly ash (FA) compared with farmyard manure (FYM) on groundnut (*A. hypogaea* cv. JL 24) and to determine their suitable time of incorporation in acid lateritic soils. The PFS and FYM were applied at 15 kg N/ha and the FA at 10 t/ha. A recommended and uniform dose of

30 kg N, 60 kg P₂O₅ and 40 kg K₂O/ha was maintained through these materials and chemical fertilizers (CF). Three dates were chosen for incorporation of the materials, i.e. 30 days before sowing (DBS), 15 DBS and at sowing. PFS+FA+CF increased the dry matter accumulation, leaf area index and nodule number per plant compared to FYM+FA+CF. The beneficial effect was also recorded in yield attributes, yield, oil content in kernel, nutrient uptake and chemical properties of soil. Their incorporation at 15 DBS or at sowing was more advantageous than that at 30 DBS. Reproduced with permission from the CAB Abstracts database.

1324. Effect of different organics and fly ash on performance of transplanted rice.

Karmakar, S.; Mitra, B. N.; and Ghosh, B. C.

Oryza 43(1): 25-28. (2006); ISSN: 0474-7615

Descriptors: application date/ application rates/ dry matter accumulation/ farmyard manure/ fly ash/ organic amendments/ panicles/ plant height/ rice/ sludges/ FYM/ paddy

Abstract: A field investigation was carried out during the wet seasons of 1995 and 1996, in Kharagpur, West Bengal, India, to evaluate the impact of different combinations of nutrient sources (farmyard manure, paper factory sludge and fly ash) and their time of incorporation on the performance of transplanted rice. Paper factory sludge at 30 kg N ha⁻¹ plus fly ash at 10 t ha⁻¹ combined with chemical fertilizers produced higher plant height and dry matter accumulation than farmyard manure at 30 kg N ha⁻¹ in similar combination throughout the growth stages of rice. A similar trend was noted in case of yield attributes, i.e. number of panicles m⁻² and grains panicle⁻¹. However, with respect to grain yield, application of paper factory sludge along with fly ash and chemical fertilizer proved to be superior (3.4 t ha⁻¹) to farmyard manure in similar combination (3.3 t ha⁻¹) during 1995 and also equally effective during 1996 (3.9 t ha⁻¹ and 3.8 t ha⁻¹, respectively). Incorporation of paper factory sludge or farmyard manure along with fly ash at transplanting (3.6 t ha⁻¹) or 15 days before transplanting proved to be more effective in increasing grain yield than in the incorporation at 30 days before transplanting of rice. Reproduced with permission from the CAB Abstracts database.

1325. The effect of mulch type for turfgrass establishment within a refined wood fiber mat over plastic.

Sorochan, J. C. and Rogers, J. N. III

Journal of Environmental Horticulture 19(2): 61-64. (2001)

NAL Call #: SB1.J66; ISSN: 0738-2898

Descriptors: composts / crop density/ establishment/ lawns and turf/ mulches/ polymers/ seed germination/ seedlings/ sowing date/ straw mulches/ wood fibres/ lawns and sports turf/ mulching materials/ United States of America

Abstract: The germination and establishment of perennial ryegrass (*Lolium perenne*) and supina bluegrass (*Poa supina*) within a refined wood fibre mat (Ecomat) placed on plastic sheeting was evaluated using seven mulches and a control with no mulch. Percent turfgrass cover (0-100%) was visually estimated as a measure of seedling density at 7, 14, 21, and 28 days after sowing. Three field experiments were initiated on 3 July 1995, 29 September

1995, and 5 July 1996 in Michigan, USA. The three sowing dates were chosen to show the effects of mulches under optimal and sub-optimal growing conditions for cool season turfgrasses. The seven mulches consisted of hydrated fibre mulch, copolymer of sodium acrylamide, crumb rubber, straw, fine grade compost, pelletized fibre mulch, and a native Capac loam soil. Percent turfgrass cover differed among species for the seven mulch treatments and the control, and the three sowing dates. Overall, perennial ryegrass achieved 25% greater cover than supina bluegrass. The straw, pelletized fibre mulch, and hydrated fibre mulch resulted in the greatest turfgrass cover regardless of sowing date. Crumb rubber performed equal to these mulches only during the 29 September 1995 sowing trial. In summary, the use of a particular mulching material will enhance turfgrass cover during seed germination.

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1326. Effect of silicon sources and fertility levels on transplanted rice.

Sudhakar, P. C.; Singh, J. P.; and Kalyan Singh

International Rice Research Notes 29(2): 61-63. (2004)

NAL Call #: SB191.R516; ISSN: 0117-4185

Descriptors: application rates/ crop yield/ dry matter accumulation/ fly ash/ nitrogen fertilizers/ phosphorus fertilizers/ potassium fertilizers/ rice/ rice straw/ silicon fertilizers/ slags/ straw/ sulfur fertilizers/ zinc fertilizers/ paddy/ phosphate fertilizers/ potash fertilizers/ sulphur fertilizers

Abstract: A field experiment was conducted during 2001 and 2002 at Varanasi, Uttar Pradesh, India to evaluate different industrial and farm wastes as a source of Si for sustained rice yields. The treatments consisted of four fertilizer levels (80-40-40-16-0.25, 120-60-60-24-0.50, 160-80-80-32-0.75 and 200-100-100-40-1.00 kg N-P-K-S-Zn EDTA/ha) and three Si sources (basic slag, fly ash and rice straw compost, 120 kg Si/ha). Si application increased dry matter production as well as grain and straw yields under both low and high fertilizer levels. All Si sources had positive effects on grain and straw yields, with basic slag giving the best results.

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1327. Effect of solid residues from the cellulose industry on plant growth.

Jordan, M. and Rodriguez, E.

Journal of Plant Nutrition and Soil Science 167(3): 351-356. (2004)

NAL Call #: 384 Z343A ; ISSN: 1436-8730

Descriptors: ash/ bark/ biomass/ cellulose/ cellulosic wastes/ fertilizers/ fly ash/ forest soils/ grit/ growth/ nutrient solutions/ organic soils/ pulp mill effluent/ rice/ sludges/ soil types/ solid wastes/ substrates/ waste management/ waste utilization/ kraft mill effluent/ paddy

Abstract: An alternative use of solid organic and inorganic residues as fertilizers from a Kraft pulp industry was studied. Residues of inorganic nature, such as ashes, fly-ashes, dregs, grits, as well those rich in organic matter, primary sludge and brown stock rejects, were examined for plant growth enhancement. These residues, all alkaline in nature, used in different concentrations together with soil, bark, organic soil or mixed with a nutrient solution, were

tested on the growth of Monterey pine (*Pinus radiata*), *Eucalyptus globulus*, rice (*Oryza sativa* cv. 'Diamante'), and duckweed (*Lemna minor*) under greenhouse and in-vitro conditions, respectively. Responses varied according to plant species, type, and waste content in combination with substrate. For Monterey pine, substrates including ash, fly-ash, and dregs promoted growth; in *Eucalyptus* seedlings dregs and fly-ash were also beneficial. Primary sludge and ash were favorable for rice growth. Duckweed increased frond number and plant biomass when grown in water containing fly-ash and primary sludge extracts, combined with nutrient salts.

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1328. Effects of additional waste paper on the pattern of composting with dairy manure.

Ichikawa, A.; Nakatani, H.; Kato, H.; Masuda, T.; Kano, M.; and Kawabe, T.

Research Bulletin of the Aichi ken Agricultural Research Center (Japan) 31: 275-279. (Dec. 1999); ISSN: 0388-7995.

Notes: 3 tables; 8 fig. Summaries (En, Ja). Citation notes: JP (Japan).

Descriptors: waste paper/ composting/ dairy manure

Abstract: We conducted an experiment to examine effects of additional waste paper (WP) and sawdust for adjustment moisture on the pattern of composting with dairy manure. The dairy manure obtained from dairy free-stall housing were mixed with WP and/or sawdust in the ratio of 1:1.5 (volume). WP used in this experiment was crushed by machines and the dairy manure contained about 86% water. Five composting treatments were prepared; 1) the dairy manure mixed with WP (1.0 : 1.5 in volume); 2) the dairy manure mixed with WP and the sawdust (1.0 : 1.0 : 0.5); 3) the dairy manure mixed with WP and the sawdust (1.0 : 0.75 : 0.75); 4) the dairy manure mixed WP and the sawdust (1.0 : 0.5 : 1.0); 5) the dairy manure mixed with the sawdust (1.0 : 1.5). These raw materials (composts) were fermented in the composting boxes (150L) maintained under aerobic condition by blowing air from the bottom during 8 weeks. Although the compost mixed with only WP had lower temperature than the other composts during initial fermentation period (1th week), it had the similar pattern of temperature change to the other composts since 2nd week. During the experiment period, the decreasing rates of piling volume, organic matter content, combustion energy and water content in composts were strengthened with increasing the rate of WP in the composting materials. These results indicated that WP mixed with dairy manure obstructed aeration for composting, but its decomposition rate was higher more than that of sawdust in the composting process. Therefore, on the using of WP to adjust moisture for composting dairy manure, it is more effective to mix with sawdust.

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1329. Effects of organic amendments on selected physical and chemical properties of rootzones for golf greens.

Cook, A. and Baker, S. W.

Journal of Turfgrass Science 74: 210. (1998)

Descriptors: bark/ bulk density/ coir/ crop residues/ fen soils/ golf green soils/ incorporation/ organic amendments/

paper mill sludge/ peat/ physical properties/ porosity/ sand/ sandy loam soils/ sewage sludge/ shear strength/ straw/ wood chips/ wood residues/ coconut fibre

Abstract: A laboratory study was conducted to examine the properties of 10 organic amendments for use in sand-dominated golf green root zones. Green waste, bark + timber + paper pulp, coir, sewage + straw, rape residues, pine wood fibre, wood chip, peat, fen soil and sandy loam soil were mixed at 10:90, 20:80, 30:70 or 40:60 ratios with two different sands [particle size distribution tabulated]. Root zone hardness values and bulk density decreased with the increase in incorporation rates of the amendments. Conversely, shear strength and loss on ignition values had a negative relationship with amendment incorporation rate. Where measured, the pH of the non-peat root zones was far greater than for the peat mixes (6.5-8.4 compared with 4.6, respectively for the 70:30 mixes) and this was identified as a possible disadvantage for some of the non-peat products. The use of organic amendment materials is discussed in the light of these results and results from an earlier phase of the work in which drainage rates and porosity were measured and compared with the US Golf Association's recommendations for the physical properties of root zone mixes.

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1330. Effects of organic and mixture media formulas on the growth of garlic sprout and its nutritional quality.

Du HuiFang; Cheng ZhiHui; Xue XiaoNa; and Zhang XueLian

Journal of Northwest Sci-Tech University of Agriculture and Forestry: Natural Science Edition 34(10): 91-95. (2006); ISSN: 1671-9387

Descriptors: chemical composition/ crop quality/ crop yield/ free amino acids/ garlic/ growing media/ growth/ mushroom compost/ nutrient content/ organic amendments/ peat/ plant composition/ plant height/ poultry manure/ sawdust/ slags/ sprouts/ chemical constituents of plants/ potting composts/ poultry litter/ rooting media

Abstract: The effects of 5 media formulas, which were mixed with mushroom culture, sawdust, slag and peat, and added with sterilized chicken droppings and organic compound fertilizers, on the growth and nutrient content of garlic (cv. G88) sprouts were investigated, using soilless culture as the control. The growth and nutrient content of the garlic sprouts cultured in the media were better than those cultured in the soil. The plants cultured in the media were taller with larger width and had higher contents of free amino acid, garlacin and nutritional elements, as well as yield. The organic culture medium formula A3 (4 portions of mushroom and one portion of peat) was the best for garlic cultivation, producing the strongest plants with the highest yield and quality.

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1331. Estimation of the possibility of application of stillage for fertilization purposes.

abetowicz, J.; Stepien, W.; and Gutowska, A.

Prace Instytutów i Laboratoriów Badawczych Przemysłu Spożywczego 57: 41-49. (2002); ISSN: 0554-9043.

Notes: Original title: Ocena możliwości zastosowania wywaru gorzelnianego do celów nawozowych.

Descriptors: agricultural wastes/ brown coal/ chemical composition/ composts/ dust/ fertilizers/ industrial wastes/ molasses/ potatoes/ rye/ sawdust/ straw/ wood residues/ farm wastes

Abstract: The fertilization value of stillage from rye, potato and molasses were estimated based on the chemical composition of stillages received for 3 years from several distilleries in Mazowsze and odz regions (Poland) or from compost heaps made of stillages and solid agricultural wastes. Aside from the three kinds of stillage, cereal straw, pine sawdust and brown coal dust were also used in the study. The results indicated that stillage may be applied as a fertilizer for plants on ploughland, permanent grassland, orchards and industrial crop plantations. Stillage may also be used for preparation of compost by adding it in suitable proportion to organic waste materials like straw, sawdust, some other wood wastes and brown coal dust. After appropriate transformation, the stillage may be used as a fertilizer in agriculture and horticulture or for ground recultivation.

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1332. Evaluation of free-stall mattress bedding treatments to reduce mastitis bacterial growth.

Kristula, M. A.; Dou, Z.; Toth, J. D.; Smith, B. I.; Harvey, N.; and Sabo, M.

Journal of Dairy Science 91(5): 1885-1892. (2008)

NAL Call #: 44.8 J822; ISSN: 0022-0302

Descriptors: bacterial count/ bovine mastitis/ cattle housing/ cows/ dairy cattle/ dairy cows/ disease control/ fly ash/ hygiene/ lime/ limestone/ litter/ mastitis/ mats/ teats/ wood shavings/ cattle sheds

Abstract: Bacterial counts were compared in free-stall mattresses and teat ends exposed to 5 treatments in a factorial study design on 1 dairy farm. Mattresses in five 30-cow groups were subjected to 1 of 5 bedding treatments every other day: 0.5 kg of hydrated limestone, 120 mL of commercial acidic conditioner, 1 kg of coal fly ash, 1 kg of kiln-dried wood shavings, and control (no bedding). Counts of coliforms, *Klebsiella* spp., *Escherichia coli*, and *Streptococcus* spp. were lowest on mattresses bedded with lime. Mattresses bedded with the commercial acidic conditioner had the next lowest counts for coliforms, *Klebsiella* spp., and *Streptococcus* spp. Wood shavings and the no-bedding control had the highest counts for coliform and *Klebsiella* spp. Compared with wood shavings or control, fly ash reduced the counts of coliforms, whereas for the other 3 bacterial groups, the reduction was not always significant. *Streptococcus* spp. counts were greatest in the control group and did not differ among the shavings and fly ash groups. Teat swab results indicated that hydrated lime was the only bedding treatment that significantly decreased the counts of both coliforms and *Klebsiella* spp. There were no differences in *Streptococcus* spp. numbers on the teats between any of the bedding treatments. Bacterial populations grew steadily on mattresses and were generally higher at 36 to 48 h than at 12 to 24 h, whereas bacterial populations on teats grew rapidly by 12 h and then remained constant. Hydrated lime was the only treatment that significantly reduced bacterial counts on both mattresses and teat ends, but it caused some skin irritation.

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1333. Evaluation of stability of compost prepared with korean food wastes.

Lee, In Bog; Kim, Pil Joo; and Chang, Ki Woon
Soil Science and Plant Nutrition 48(1): 1-8. (2002)

NAL Call #: 56.8 SO38 ; ISSN: 0038-0768

Descriptors: Agriculture/ Soil Science/ Waste Management: Sanitation/ Korean Food Waste Based Compost: Stability/ Agricultural Utilization/ Decayed Wood Dust/ Dried Paper Mill Sludge/ Nutritional Quality/ Organic Soil Amendment/ Saw Dust

Abstract: Food wastes were composted with sawdust, dried paper mill sludge, and decayed wood dust to reduce the volume of wastes and to produce a stable organic soil amendment. To determine the stability for agricultural utilization, the compost maturity was evaluated using physical, chemical, and biological parameters. Temperature of the inner compost heap remained high at over 50°C during the 80 d of composting, but the chemical and physical parameters apparently changed between 30 and 50 piling d: pH was a weakly acidic of the initial stage and neutral after 30 d of composting. The C/N ratio decreased to less than 12 after 65 d of composting, but the C/N ratio of the products was less than 0.5 time that of the initial value after 35 d of composting. Reducing sugar contents changed significantly between 40 and 45 d of composting, and the Y value that indicated color changes of the water extracts decreased and became stabilized at around 3 after 50 d of composting. Ring types and color on circular paper chromatograms showed an apparent difference before and after 40 d of composting. The content of sodium (Na), which might be one of the most harmful elements in Korean food wastes for agricultural utilization, increased from 12 to 17 g kg⁻¹ with time and Na mostly occurred in a water-soluble form. Acetic acid was the main component of volatile organic acids, and total organic acids were produced at a very high rate (500-700 mg kg⁻¹) during the first 5-30 d of composting and then the rate decreased rapidly to below 300 mg kg⁻¹ after 35 d of composting. Germination index of Chinese cabbage in water extracts fluctuated with compost pile turning to a value below 50 by 40 d of composting, due to the effects of high contents of organic acids and Na. The value exceeded 50 after 45 d of composting but did not increase further with continuous composting, which might be due to the high content of Na. Lettuce, a sensitive species, was scarcely germinated in water extracts of the food compost. Consequently, the high content of Na in Korean food waste compost, in spite of maturity, could be a limiting factor for agricultural utilization. The effects of Korean food waste compost on plant growth and soil conditions should be evaluated further at the field level.

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1334. Fertilizer nitrogen replacement value of food residuals composted with yard trimmings, paper or wood wastes.

Sullivan, D. M.; Fransen, S. C.; Bary, A. I.; and Cogger, C. G.

Compost Science and Utilization 6(1): 6-18. (1998)

NAL Call #: TD796.5.C58 ; ISSN: 1065657X [CSUTE]

Descriptors: food products/ land use/ nitrogen/ nitrogen fertilizers/ plants (botany)/ recycling/ soil conservation/ waste paper/ wood/ food residuals/ grass/ landscapes/ soil amendment/ wood waste/ yard trimmings/ composting

Abstract: Composting offers an opportunity to recycle food

waste as a soil amendment. A three year growth trial was conducted to determine the fertilizer nitrogen (N) replacement value of food waste composts for cool season perennial grass production. Six composts were produced in a pilot-scale project with two composting methods (aerated static pile and aerated, turned windrow). The aerated, turned windrow method simulated "agitated bay" composting systems, which utilize routine mechanical agitation. Compost bulking agents included yard trimmings, yard trimmings + mixed paper waste, and wood waste + sawdust. Finished composts had Kjeldahl N concentrations ranging from 10 to 18 g N/kg. For the growth trial, composts were incorporated into the top eight to 10 cm of a sandy loam soil at application rates of approximately 155 Mg/ha (about 7 yd³/1000 ft²). Tall fescue (*Festuca arundinacea* Schreb. 'A.U. Triumph') was seeded after compost incorporation, and was harvested repeatedly at a late vegetative growth stage (April to November; approx. 35 days regrowth between harvests). Grass yield and grass N uptake did not respond to compost application during the first year. During the second and third years after application, composts were a consistent source of slow-release N. They supplied the fertilizer N equivalent of 0.70 kg N/ha/day over a 140-day period (April to August) in both years. The N supplied by composts in the second and third year after application was valued at \$0.70 to \$1.90 per dry tonne (Mg) compost per year, using a fertilizer N cost of \$1 /kg N. Food waste composts with significant slow-release N properties were produced with either the aerated static pile composting method or the aerated, turned windrow method. Composts with higher N concentrations had higher fertilizer N replacement value. The slow release N supplied by food waste composts is ideally suited for urban landscapes, where a moderate, consistent rate of plant growth is highly desirable.

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1335. Guide for Industrial Waste Management.

United States Environmental Protection Agency [Also available as: EPA530-R-03-001].

Notes: Chapter 7 contains soil improvement guidelines and considerations

<http://www.epa.gov/epawaste/nonhaz/industrial/guide/index.htm>

Descriptors: industrial waste management/ land application/ soil amendment

1336. Influence of Container Mulches on Irrigation and Nutrient Management.

Altland, J. and Lanthier, M.

Journal of Environmental Horticulture 25(4): 234-238. (Dec. 2007)

NAL Call #: SB1.J66; ISSN: 0738-2898

Descriptors: containers/ mulches/ irrigation/ nutrient management/ sawdust/ crumb rubber/ hydrangea

Abstract: An experiment was conducted in 2005 and repeated in 2006 to determine the influence of mulch products and controlled release fertilizer (CRF) placement on irrigation and nutrition requirements of container-grown crops. Hydrangea (*Hydrangea macrophylla* 'Fasan' and 'Endless Summer') were grown in 2.7 L (1 gal) containers with CRF placed above or below the mulch. Non-mulched controls were also maintained. Mulch products included geotextile discs, coco discs, plastic discs, hazelnut shells, sawdust, Biotop, and crumb rubber. Hydrangea growth,

plant quality, foliar color, and foliar nutrition were measured, as well as water loss from containers. Controlled release fertilizer placed below mulch resulted in larger plants with higher quality ratings and foliar N levels compared to CRF placed above the mulch, and similar or superior size, quality and foliar N compared to non-mulched containers. After correcting for differences in plant size, there were few and minor differences in water loss from hydrangea between mulched and non-mulched containers. This citation is from AGRICOLA.

1337. Kraft mill residues effects on Monterey pine growth and soil microbial activity.

Jordan, M.; Sanchez, M. A.; Padilla, L.; Cespedes, R.; Osses, M.; and Gonzalez, B.

Journal of Environmental Quality 31(3): 1004-1009. (2002)
NAL Call #: QH540.J6; ISSN: 0047-2425

Descriptors: fly ash/ forest soils/ microbial activities/ polluted soils/ pulp mill effluent/ residual effects/ seed germination/ seedling growth/ seedlings/ soil flora/ soil pH/ soil pollution/ soil types/ soil water content/ solid wastes/ waste management/ kraft mill effluent/ microbial communities

Abstract: The production of bleached Kraft pulp generates inorganic and organic residues that are usually deposited on the soil surface or land-filled. Studies conducted to address the impact of these wastes on the environment are scarce. In this work, Monterey pine (*Pinus radiata*), an important tree for pulping, was evaluated for germination and development under greenhouse conditions in forest soils (sandy and clay soils) exposed to solid residues of the cellulose industry using the Kraft process. Soils exposed to 10 to 60% ashes, 10 to 70% fly ashes, or 10 to 30% dregs allowed substantial seed germination and seedling growth. In contrast, soils exposed to low proportions of brown rejects, grits, or a mixture of all these residues were detrimental for germination, plant growth, or both. The strongest negative effect (no germination) was observed with as low as 10% grits. The changes in pH and/or water content caused by solid wastes did not correlate with detrimental effects observed in various soil-residue combinations. No significant changes in the microbial community of soils exposed to these solid residues were observed by determination of culturable counts, or by terminal-restriction fragment length polymorphism analysis of the microbial community DNA. The presence of organic residues did not affect the ability of the soil microbial community to remove typical pulp bleaching chloroaromatics. However, inorganic wastes strongly decreased the removal of such compounds. Reproduced with permission from the CAB Abstracts database.

1338. A laboratory and glasshouse evaluation of chicken litter ash, wood ash, and iron smelting slag as liming agents and P fertilisers.

Yusiharni, B. E.; Ziadi, H.; and Gilkes, R. J.

Australian Journal of Soil Research 45(5): 374-389. (2007)
NAL Call #: 56.8 Au7; ISSN: 0004-9573

Descriptors: apatite/ application rates/ ash/ calcite/ calcium carbonate/ citric acid/ extraction/ lateritic soils/ liming/ nutrient availability/ phosphorus fertilizers/ poultry manure/ quartz/ salts/ slags/ soil types/ wood ash/ phosphate fertilizers/ poultry litter

Abstract: Standard AOAC methods of chemical analysis

have been used to characterise the industrial byproducts partly burnt chicken litter ash (CLA), totally burnt chicken litter ash (CLAT), wood ash (WA), and iron smelting slag, for use as a combined liming agent and phosphate (P) fertilizer. These materials are effective liming agents with calcium carbonate equivalence of 93-99%. Total P concentrations of CLA (3.6% P), CLAT (4.75% P), slag (0.26% P), and WA (0.44% P) indicate that they would function as P fertilizers when applied at the high rates required for liming soils. The form of P in slag is unknown; CLA and CLAT consist mostly of mixtures of the phosphate mineral apatite with calcite and quartz. WA consists mostly of calcite, quartz, and various salts. For long extraction times, total P dissolved increased in the sequence CA (citric acid) > NAC (neutral ammonium citrate) > AAC (alkaline ammonium citrate). Little apatite persisted in residues of CLA and CLAT after 120 h of CA extraction but considerable amounts of apatite remained in NAC and AAC residues. A glasshouse P-response experiment was carried out with ryegrass (*Lolium perenne*) on an acid lateritic soil with the application of various levels of phosphate as chicken litter ash, iron smelting slag, and wood ash. Monocalcium phosphate (MCP), dicalcium phosphate (DCP), and rock phosphate (RP) were included for comparison purposes. Based on plant yield data, the relative agronomic effectiveness (RE) of DCP compared to MCP was 57, 72, 73, and 94%, respectively, for 4 successive harvests, for RP was 24, 34, 70, and 56%, for chicken litter ash was 13, 16, 33, and 39%, for slag was 8, 9, 16, and 10%, for WA was 6%, 9%, and was effectively zero for the final 2 harvests. For no extraction time was the P soluble in the 3 citrate extractants a reliable predictor of the agronomic effectiveness of these materials as P fertilizers established by plant growth measurements. Reproduced with permission from the CAB Abstracts database.

1339. Land application of agricultural, industrial, and municipal by-products.

Power, J. F.; Dick, W. A.; Kashmanian, R. M.; Sims, J. T.; Wright, R. J.; Dawson, M. D.; and Bezdicek, D. Madison, USA: Soil Science Society of America Inc.; Series: Soil Science Society of America book series 6; 653 pp. pp. (2000).

Notes: Includes bibliographical references and index. Contents: Chemical, physical, and biological characteristics of agricultural and forest by-products for land application / J.H. Edwards and Arun V. Someshwar -- Description of food processing by-products / Allen V. Barker, Tara A. O'Brien, and Margie L. Stratton -- Characterization of industrial by-products / D.M. Miller .. [et al.] -- Quantities, characteristics, barriers, and incentives for use of organic municipal by-products / Richard M. Kashmanian .. [et al.] -- Soil and by-product characteristics that impact the beneficial use of by-products / Allen V. Barker, Margie L. Stratton, and Jack E. Rechcigl -- Sustainable use of by-products in land management / Leslie R. Cooperband -- Assessing the impacts of agricultural, municipal, and industrial by-products on soil quality / J. Thomas Sims and Gary M. Pierzynski -- Potential impact of land application of by-products on ground and surface water quality / William F. Ritter -- Odor and other air quality issues associated with organic and

inorganic by-products / P.D. Millner and L.L. McConnell -- Composting and beneficial utilization of composted by-product materials / Harold M. Keener, Warren A. Dick, and Harry A.J. Hoitink -- Combining by-products to achieve specific soil amendment objectives / S. Brown and R.L. Chaney -- Estimating the benefits of agricultural use of municipal, animal, and industrial by-products / Wen-Yuan Huang and Yao-Chi Lu -- Examples and case studies of beneficial reuse of beef cattle by-products / B.A. Stewart, C.A. Robinson, and David B. Parker -- Liquid dairy manure utilization in a cropping system : a case study / Deanne Meyer and Lawrence J. Schwankl -- Beneficial use of poultry by-products : challenges and opportunities / Miguel L. Cabrera and J. Thomas Sims -- Beneficial uses of swine by-products : opportunities for the future / Robert L. Mikkelsen -- Examples and case studies of beneficial reuse of municipal by-products / Nicholas T. Basta -- Beneficial uses of flue gas desulfurization by-products : examples and case studies of land application / Warren A. Dick .. [et al.] / Properties and examples of beneficial use of gypsumlike by-products / K.D. Ritchey .. [et al.] -- Beneficial use of wood ash as an agricultural soil amendment : case studies from the United States forest products industry / Eric D. Vance and Charles C. Mitchell -- Beneficial reuse of aggregate mineral fines and scrap new construction wallboard / R.F. Korcak, R. Meininger, and Peter A. Yost -- Case studies of municipal and on-farm composting in the United States of America / Lawrence J. Sikora and Dan M. Sullivan.

Descriptors: land application/ agricultural by-products/ industrial by-products/ municipal by-products

This citation is from AGRICOLA.

1340. Manipulating nitrogen release from nitrogen-rich crop residues using organic wastes under field conditions.

Chaves, B.; Neve, S. de; Boeckx, P.; Cleemput, O. van; and Hofman, G.

Soil Science Society of America Journal 71(4): 1240-1250. (2007)

NAL Call #: 56.9 So3; ISSN: 0361-5995

Descriptors: carbon nitrogen ratio/ cauliflowers/ cereal byproducts/ composts/ crop residues/ denitrification/ green manures/ leaching/ mineralization/ nitrate/ nitrogen/ nitrogen content/ organic amendments/ organic wastes/ paper mill sludge/ release/ sawdust/ silt loam soils/ soil types/ straw/ Capparales/ heading broccoli

Abstract: Following mineralization of N-rich crop residues, large amounts of mineral N can be released into the soil. Manipulating N mineralization of crop residues may be an option to reduce NO₃ in soil. The potential to manipulate the N release from vegetable crop residues by using organic wastes was tested under field conditions on a silt loam soil of East Flanders (Belgium). At the start of the experiment, cauliflower (*Brassica oleracea* var. botrytis) residues (~73 Mg fresh matter ha⁻¹) together with an immobilizer waste (~5 Mg C ha⁻¹ of straw, green waste compost, sawdust, or paper sludge) were incorporated into a silt loam soil. After 154 days, a remineralizing waste (~1 Mg C ha⁻¹ of vinasse or dairy sludge) was incorporated. During the field experiment, the mineral N content in the soil was measured at regular time intervals, and net N release, NO₃ leaching, and denitrification were simulated using a N mineralization-

immobilization model coupled to a NO₃ leaching model. Straw, green waste compost, and sawdust were able to immobilize between 54 and 68% of the N released by the cauliflower residues and reduced NO₃ leaching by 56 to 68%. Paper sludge released an extra amount of N due to its low C:N ratio. No consistent remineralization of N could be found in any of the treatments, probably due to an unsuitable composition of the remineralizer wastes. Manipulating N release of N-rich crop residues by using organic wastes may be a suitable method to reduce NO₃ leaching; however, stimulating remineralization of immobilized N by the start of the following spring may not be easy to achieve. Reproduced with permission from the CAB Abstracts database.

1341. Mixtures of paper mill sludge, wood chips, bark, and peat in substrates for pot-in-pot shade tree production.

Chong, C. and Lumis, G. P.

Canadian Journal of Plant Science 80(3): 669-675. (2000)
NAL Call #: 450 C16; ISSN: 0008-4220

Descriptors: bark/ diameter/ girth/ growing media/ organic wastes/ paper mill sludge/ peat/ plant height/ planting stock/ porosity/ shade trees/ trees/ trunks/ waste utilization/ wood chips/ woody plants/ nursery plants/ nursery stock/ Oleales/ planting materials/ potting composts/ rooting media

Abstract: There is little scientific information on substrates for pot-in-pot shade tree production. The objective of this research was to examine various organic-waste-derived substrates for growing shade trees in pot-in-pot systems. Two-year-old seedling whips of green ash (*Fraxinus pennsylvanica*), one-year-old Japanese birch (*Betula platyphylla* var. *japonica*) and one-year-old silver maple (*Acer saccharinum*) were grown for 2 seasons (1994 and 1995) in 76-litre containers. The containers were trickle irrigated and fertilized with controlled-release fertilizers. Treatments included a control nursery mix (50% by volume of pine bark:15% compost:35% topsoil) and 9 other mixes classified into 3 groups: Group I (25, 50 or 75% bark mixed with 50, 25 or 0% wood chips, and 25% paper mill sludge); Group II (25, 50 or 75% bark; 50, 25 or 0% wood chips; and 25% peat); and Group III (25, 50 or 75% peat; 50, 25 or 0% wood chips; and 25% paper mill sludge). In both years, trunk diameters of the 3 species were greatest with Group III substrates, intermediate with Group II, and least with Group I. Trunk growth was positively correlated with water retention porosity, which ranged from 42 to 57%, 38 to 42%, and 20 to 27% for Groups III, II and I, respectively. Trunk diameters of Group I were significantly less, those of Group II were similar, and those from Group III substrates consisting of 75% peat (all three species) or 50% peat (birch and silver maple) slightly exceeded those of the nursery mix. The nursery mix had a water retention porosity of 49% and generally the highest content of soluble salts. The high-peat (50 and 75%) substrates marginally but consistently produced trees with the largest trunk diameters, although with birch (not the other species), shorter trees resulted as the peat content increased. Reproduced with permission from the CAB Abstracts database.

1342. Re-use of waste paper and the mixture of it with some secondary woody and vegetable wastes as base substrata in the cultivation of *Pleurotus ostreatus* Jacq ex Fr Kummer: Atk kagtlarn cesitli bitkisel ve odunsu atk/ark substratlarla *Pleurotus ostreatus* Jacq ex Fr Kummer kultivasyonunda degerlendirilmesi.

Baysal, E.; Yalnkc, M. K.; Peker, H.; Colak, M.; Goktas, O.; Ozen, E.; and Colak, A. M.

Ekoloji cevre dergisi 12(49): 12-16. (2003); ISSN: 1300-1361.

Notes: Language of the text is Turkish.

Descriptors: crop residues/ cultivation/ edible fungi/ growing media/ husks/ leaves/ mycelium/ poplars/ sawdust/ straw/ substrates/ waste management/ waste paper/ waste utilization/ wheat/ wheat straw/ yields/ hulls/ Lentinaceae/ Poriales/ potting composts/ rooting media

Abstract: This study was conducted to investigate the possibility of cultivating *Pleurotus ostreatus* on waste paper as a base substrata and using some secondary substrates such as: wheat straw, maize stalk, grass, clover [*Trifolium*], sawdust, hazelnut husk, hazelnut leaves, poplar leaves, linden leaves and waste tea leaves mixed with waste paper (1:1; 1:3; 3:1 weight:weight). Mycelia development period and mushroom yield of *P. ostreatus* on the substrate mixture were investigated. The fastest mycelia development was observed with 22.5 days on sole waste paper substrata. In general, waste paper mixed with waste tea leaves and clover gave the longer mycelia development period and the lower mushroom yield than other substrate mixtures. The highest mushroom yield (36.3%) was recorded on waste paper+sawdust (3:1). Waste paper mixed with other substrate (3:1) ratio gave better results for mycelia development and mushroom yield compared to the other substrate mixtures.

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1343. Relationship between N, P and K application and the growth of tomato seedlings sown in sawdust-enriched substrates.

Sun ZhiQiang; Li ShengLi; and Zhang YanLing

Journal of South China Agricultural University 25(1): 25-28. (2004); ISSN: 1001-411X

Descriptors: application rates/ biomass/ calcium sulfate/ dry matter/ fly ash/ growth/ leaf area/ nitrogen fertilizers/ phosphorus fertilizers/ potassium fertilizers/ sawdust/ seedling growth/ seedlings/ soilless culture/ stems/ substrates/ superphosphate/ tomatoes/ vermiculite/ calcium sulphate/ phosphate fertilizers/ potash fertilizers

Abstract: The effects of N, P and K fertilizers on the growth of tomato seedlings on a sawdust:vermiculite:fly ash (6:2:2) substrate were studied. Seedling growth was highly affected by N, P, and N x P interaction. The values of growth parameters (stem height and diameter, fresh weight, dry weight, leaf area, and good seedling index) increased linearly with the increase in the rates of N and P. The highest values of the aforementioned parameters were obtained with 2.4 kg CO(NH₂)₂ + 29.5 kg Ca(H₂PO₄)₂.H₂O + CaSO₄.H₂O. N x P interaction also enhanced seedling growth, but the effects of P on seedling growth were dependent on the N rate. Seedling growth was adversely

affected by P at a low N rate, but was enhanced by P at a high N rate. K had no significant effect on seedling growth. Thus, in sawdust-enriched substrates, complete fertilizers can be substituted by N and P fertilizers. Reproduced with permission from the CAB Abstracts database.

1344. Screening of organic biological waste products for their potential to manipulate the N release from crop residues.

Chaves, B.; Neve, S. de; Hofman, G.; Boeckx, P.; and Cleemput, O. van

Communications in Agricultural and Applied Biological Sciences 68(3): 83-86. (2003); ISSN: 1379-1176

Descriptors: celery/ composts/ crop residues/ dairy wastes/ green manures/ leaching/ malting/ mineralization/ molasses/ nitrate/ nitrogen/ organic amendments/ organic wastes/ sawdust/ sludges/ straw/ tannins/ use efficiency/ vinasse/ Araliales/ tannic acid

Abstract: A systematic screening of several organic waste products for a potential either to slow down the nitrogen (N) release from crop residues, or to stimulate remineralization at a time when crop demand starts increasing again. To evaluate the efficiency of the first category organic waste products (cereal straw, green waste compost, sawdust, tannic acid, paper sludge) as immobilizers, the amount of N released by the control treatment 'soil + celery leaves' was subtracted from the amount of N released from the treatments amended with a particular first category waste product. The N amount released from a treatment amended with a particular second category waste products (molasses, vinasses, dairy sludge, malting sludge) minus the N amount released from the control treatments amended with water and minus the net N mineralization of the second category waste products, is the remineralization primed by the second category waste products. Results indicated that there is scope for manipulating the N release from crop residues rich in N by the addition of organic waste products, to reduce nitrate leaching risks, to better match crop N demand with soil N supply and to increase overall N use efficiency. Both the intensity of the immobilization and the time at which remineralization occurs seems to be manageable by the right choice of organic waste product.

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1345. Screening organic biological wastes for their potential to manipulate the N release from N-rich vegetable crop residues in soil.

Chaves, Barbara; De Neve, Stefaan; Boeckx, Pascal; Van Cleemput, Oswald; and Hofman, Georges

Agriculture, Ecosystems and Environment 111(1-4): 81-92. (2005)

NAL Call #: S601.A34 ; ISSN: 0167-8809

Descriptors: pollution assessment control and management/ soil science/ agrichemicals/ umbelliferae: angiosperms, dicots, plants, spermatophytes, vascular plants/ carbon to nitrogen ratio/ immobilizer waste/ remineralizer waste

Abstract: In a laboratory study, organic biological wastes (OBW) were screened for their potential to manipulate the N release from vegetable crop residues in two phases: an immobilization and remineralization phase. During the first phase, celery leaves (*Apium graveolens* L.) were mixed

with an immobilizer waste (straw, two green waste composts (GWC1 and GWC2), saw dust, paper sludge and tannic acid) in order to immobilize N released from crop residues. During the second phase, the treatments received a remineralizer waste (malting sludge, vinasses, molasses and dairy sludge) in order to stimulate remineralization of immobilized N. Straw showed the most pronounced N immobilization (on average 30.2 mg N kg⁻¹). N immobilization with tannic acid, saw dust and GWC2 was slower and less pronounced (on average 16.4, 15.9 and 8.0 mg N kg⁻¹ respectively). GWC1 and paper sludge immobilized almost no N. Only when GWC1 was mixed with vinasses, remineralization was observed (up to 55.4 mg N kg⁻¹) during a 30 days period. For all other remineralizers, positive priming effects were scarce and short-lived. Manipulating the N release of N-rich crop residues may be a suitable method to reduce the nitrate concentration in soil after incorporation of crop residues. Especially, easily decomposable waste materials (i.e. low lignin content) with a large C:N ratio seem to have a potential to immobilize N. However, stimulating remineralization of immobilized N seems not easy to accomplish. (c) 2005 Elsevier B.V. All rights reserved. © Thomson Reuters

1346. Soil and by-product characteristics that impact the beneficial use of by-products.

Barker, A. V.; Stratton, M. L.; and Rechcigl, J. E.

In: *Land Application of Agricultural, Industrial, and Municipal By-Products*; Series: Soil Science Society of America Book 6.

Madison, USA: Soil Science Society of America Inc., 2000; pp. 169-213.

Descriptors: agricultural wastes/ animal manures/ application to land/ crop residues/ fly ash/ food processing/ industrial wastes/ organic wastes/ phosphogypsum/ pulp mill effluent/ refuse/ sewage sludge/ soil amendments/ soil biology/ soil chemical properties/ soil physical properties/ tannery waste/ waste utilization/ wastes/ wood ash/ wood residues/ chemical properties of soil/ farm wastes/ kraft mill effluent/ land application/ municipal wastes/ physical properties of soil/ trash

Abstract: The physical, chemical and biological properties of soil are summarized. Different types of wastes viz., agricultural, farm manures, food-processing byproducts, municipal solid wastes and industrial byproducts are described and their interactions with soil are discussed including cautions and benefits of land application. Reproduced with permission from the CAB Abstracts database.

1347. Some living plants and some additional products useful as soil conditioners and in various technologies.

Wallace, A.

New York, USA: Marcel Dekker Inc., 1998; pp. 463-510.

NAL Call #: S661.7.H35 1998

Descriptors: aquatic plants/ bitumen emulsions/ cement/ cover crops/ green manures/ gypsum/ humates/ latex/ mulches/ peat/ permeability/ plastics/ polyacrylamide/ polymers/ reviews/ seaweeds/ sewage sludge/ soil/ soil acidity/ soil conditioners/ soil physical properties/ sulfuric acid/ trees/ urea/ usage/ wetters/ wood ash/ woody plants/ zeolites/ ammonium laureth sulfate/ asphalt emulsions/ mulching materials/ physical properties of soil/ sulphuric acid/ wetting agents

Abstract: The use of living plants (living mulches, green manure and cover crops) as soil conditioners is reviewed. Their effects on soil acidity and water permeability are discussed and the ability of trees to stabilize soils is considered. The use of peat and sphagnum moss, wood ashes, humates from oxidized lignites, zeolites and related substances, soil wetting agents and water penetrants, seaweed products, gypsum, shredded rubber tires, sewage sludge, recycled plasterboard gypsum, plastic milk from waste plastic, bitumen (asphalt) emulsions, ammonium laureth sulfate, copolymer latexes and related products, cement-type forming products, dust suppressants, and water absorbing (gel) polymers, urea-sulfuric acid adducts, water-soluble polyacrylamide as soil conditioners is reviewed.

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1348. Speciation and mobility of cadmium in straw and wood combustion fly ash.

Hansen, H. K.; Pedersen, A. J.; Ottosen, L. M.; and Villumsen, A.

Chemosphere 45(1): 123-128. (2001)

NAL Call #: TD172 .C54; ISSN: 0045-6535

Descriptors: agricultural soils/ cadmium/ chemical speciation/ fly ash/ forest soils/ groundwater pollution/ leaching/ mineral uptake/ soil amendments/ straw/ wood chips

Abstract: Two fly ashes from biomass combustion have been analysed regarding cadmium speciation and mobility. A fly ash from straw combustion contained 10 mg Cd/kg dry matter, and ~50% of the cadmium was leachable in water. The possible main speciation of cadmium in this fly ash was CdCl_2 . If his fly ash is added to agricultural soil, there is a threat for groundwater contamination and plant uptake. A fly ash from wood chip combustion had 28.6 mg Cd/kg dry matter. In this fly ash, the cadmium was bound more heavily, with only small amounts of cadmium leaching in mild extractants. The possible speciation of cadmium in this fly ash was as oxide or as CdSiO_3 . Long-term effects and accumulation of cadmium could be a problem when this fly ash is added to agricultural or forest soils.

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1349. Survey of wastes spread on land in the European Union.

Gendebien, A. H.; Davis, R. D.; Brunet, H.; Orsi, C.; and Marmo, L. Gargano, Italy.); pp. 243-248; 2001.

Descriptors: agricultural wastes/ application to land/ cement/ dredgings/ European Union/ food wastes/ industrial wastes/ paper mill sludge/ pollution/ pollution control/ slaughterhouse waste/ tannery waste/ textile industry/ waste disposal/ waste management/ wood residues/ Common Market/ EC/ EEC/ environmental pollution/ European Communities/ European Economic Communities/ farm wastes/ land application

Abstract: This paper presents some interim findings of a survey of landspreading of wastes in the European Union (EU). The survey began in December 1999 and was scheduled to run for one year. The work was funded by the Directorate-General Environment of the European Commission. It was the first comprehensive survey of

landspreading of wastes in the EU but excluded sewage sludge which is already well-documented. The survey covered industrial wastes from wood processing, food production, abattoirs, paper mills, cement works, tanneries, textile manufacture etc. as well as agricultural wastes and dredgings from waterways. The survey collected information on the quantities and quality of wastes spread on land through literature reviews and direct contact with relevant governmental organizations and departments, federations of the main industries relying on the land outlet, and landspreading contractors. The survey also noted the controls in place in the Member States (n=15) to ensure that landspreading practices are beneficial to agriculture and safe for the environment. Landspreading of wastes can be a beneficial, cost-effective and sustainable outlet and the survey was intended to indicate the extent to which these aims were achieved and whether EU-wide controls should be considered to ensure protection of the environment.

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1350. Tomato plant growth and fruit quality as affected by substrates.

Novo, A. A. C.; Fontes, P. C. R.; Silva, D. J. H. da; and Cecon, P. R.

Bioscience Journal 20(3): 75-82. (2004)

NAL Call #: 11 Ac82 QH301 .R485; ISSN: 1516-3725.

Notes: Original title: Crescimento do tomateiro e qualidade do fruto em diferentes substratos.

Descriptors: chemical composition/ coal/ composts/ crop quality/ dry matter accumulation/ fruits/ growing media/ growth/ leaves/ nitrogen/ pH/ plant composition/ plant height/ roots/ sand/ sawdust/ stems/ subsoil/ substrates/ tomatoes/ chemical constituents of plants/ hydrogen ion concentration/ potential of hydrogen/ potting composts/ rooting media

Abstract: Plant growth and fruit quality were evaluated in tomato (cv. Carmen) plants grown on unheated greenhouse soil (control) or in plastic bags containing organic compost + sand, organic compost + sand with a higher N content (by 50%), subsoil, 50% coal + 50% sawdust (v/v), or commercial substrate. The treatments did not have significant effects on plant height and fruit pH. Dry matter accumulation was greatest in fruits. The growth of leaves, clusters, stems, fruits and roots did not significantly vary among the treatments except coal + sawdust, on which plant growth was inferior. Fruit quality in terms of total soluble solids content was similar in plants grown on organic compost + sand, organic compost + sand with a higher N content, subsoil, and unheated greenhouse soil. Increasing the N content of organic compost + sand had no significant effects on the evaluated parameters.

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1351. Trace element mobility and soil chemical changes following land application of pulp mill sludge and boiler ash.

Goldemund, Herwig

Athens, GA, United States : University of Georgia, 2000.

Notes: Update: 200417

Descriptors: ash/ carbon/ dissolved materials/ effluents/ environmental effects/ experimental studies/ field studies/ geochemistry/ laboratory studies/ leaching/ lysimeters/ organic carbon/ sludge/ soils/ trace elements/ transport/ environmental geology/ Geochemistry of rocks, soils, and sediments

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1352. Treatment of drainage water with industrial by-products to prevent phosphorus loss from tile-drained land.

McDowell, R. W.; Sharpley, A. N.; and Bourke, W.

Journal of Environmental Quality 37(4): 1575-1582. (July 2008)

NAL Call #: QH540.J6; ISSN: 0047-2425.

Notes: In the special issue: the 4th USDA Greenhouse Gas Symposium Paper presented at the 4th USDA Greenhouse Gas Symposium "Positioning Agriculture and Forestry to meet the Challenges of Climate Change", February 6-8, 2007, Baltimore, Maryland.

Descriptors: drainage water/ water pollution/ water treatment/ pollution control/ phosphorus/ losses from soil/ industrial byproducts/ tile drainage/ sorption/ fly ash/ heavy metals/ dairy farming/ topsoil/ particulates/ slags/ metallurgy/ New Zealand

Abstract: Tile drained land with phosphorus (P)-rich topsoil is prone to P loss, which can impair surface water quality via eutrophication. We used by-products from steel and energy industries to mitigate P loss from tile drains. For each by-product, P sorption maximum (P_{max}) and strength (k) were determined, while a fluvium trial assessed P uptake with flow rate. Although two ash materials (fly ash and bottom ash) had high P_{max} and k values, heavy metal concentrations negated their use in the field. The fluvium experiment determined that P uptake with by-products was best at low flow, but decreased at higher flow in proportion to k. A mixture of melter slag (<10 mm) and basic slag (high P_{max}, 7250 mg kg⁻¹; and k, 0.508 L mg P⁻¹) was installed as backfill in eight drains on a dairy farm. Four drains with greywacke as backfill were constructed for controls. The site (10 ha) had P-rich topsoil (Olsen P of 64 mg kg⁻¹) and yielded a mean dissolved reactive P (DRP) and total P (TP) concentration from greywacke backfilled drains of 0.33 and 1.20 mg L⁻¹, respectively. In contrast, slag backfilled drains had DRP and TP concentrations of 0.09 and 0.36 mg L⁻¹, respectively. Loads of DRP and TP in greywacke drains (0.45 and 1.92, respectively) were significantly greater (P < 0.05) than those from slag drains (0.18 and 0.85, respectively). Data from a farm where melter slag was used as a backfill suggested that slag would have a life expectancy of about 25 yr. Thus, backfilling tile drains with melter slag and a small proportion of basic slag is recommended as an effective means of decreasing P loss from high P soils. This citation is from AGRICOLA.

1353. Use of mulches and soil stabilizers for land reclamation.

Norland, M. R.; Series: Agronomy Monograph 41

Madison, USA: American Society of Agronomy, 2000; pp. 645-666.

Descriptors: application methods/ application rates/ composts/ costs/ cover crops/ erosion/ green manures/ mulches/ peat/ plant residues/ reclamation/ reviews/ sawdust/ soil conditioners/ costings/ mulching materials

Abstract: The use of mulches and soil stabilizers to control soil erosion prior to the establishment of vegetation in land reclamation is reviewed. The benefits and uses of organic mulches, composts, and natural organic soil materials such as peat and mucks, sawdust, and recycled waste paper, are described. The use of green manures, cover crops and crop residues, and soil stabilizers are also mentioned. Mulch application methods including spreading/broadcasting by hand, pneumatic and hydraulic spreaders, liquid slurry application by sprinkler irrigation, manual and mechanical anchoring of mulch and chemical tackifiers are examined. Rates of mulch application for seed cover, erosion control and plant mulch are also discussed. The economics of adding mulches and soil stabilizers are considered.

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1354. Willamette's agricultural land application program in South Carolina.

Barfield, W. M. New Orleans, LA.); pp. 471-473; 2000.

Descriptors: bleached pulp/ boilers/ cost benefit analysis/ environmental engineering/ fly ash/ land fill/ paper and pulp mills/ agricultural lands/ contract hauler/ agricultural engineering/ agriculture/ bleached pulps/ boilers/ fly ash/ land fill/ paper mills

Abstract: Willamette's agricultural land application program in South Carolina is presented. The program objectives include no landfilling of by-products and maximization of landfill life. The permit requirements such as agronomic land application rates, storage offsets & time, application offsets, frequency of material analyses and documentation are discussed.

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1355. Wood/sludge ash effects on white spruce seedling growth.

Staples, T. E. and Rees, K. C. J. van

Canadian Journal of Soil Science 81(1): 85-92. (2001)

NAL Call #: 56.8 C162 ; ISSN: 0008-4271

Descriptors: alfisols / application rates/ application to land/ calcium/ electrical conductivity/ Luvisols/ magnesium/ nutrient uptake/ paper mill sludge/ phosphorus/ phytotoxicity/ seedling growth/ seedlings/ soil pH/ soil solution/ soil types/ wood ash/ land application/ sols lessives

Abstract: The disposal of wood ash and/or pulp and paper mill sludges is becoming increasingly more challenging as landfills are more difficult to site due to diminishing land availability and public opposition, as well as more costly to construct and operate because of increasingly stringent regulations. The most notable alternative to disposal that is receiving the attention of the forest industry is land application. The objective of this study, conducted in Saskatchewan, Canada, was to determine the influence of applying pulp mill wood/sludge ash mixture on: (1) various soil chemical properties of an orthic gray luvisol [Luvisols; Alfisols] and (2) the growth and nutrient uptake of white spruce (*Picea glauca*) seedlings. The pulp mill wood/sludge ash mixture from an olivine burner was surface broadcast at rates of 1 and 5 t ha⁻¹ around white spruce seedlings planted on disc-trenched microsites. Soil solutions from lysimeters and soil samples were analysed for exchangeable elements, soil pH and electrical conductivity while white spruce tissue samples were analysed for

various elements. Applications of pulp mill wood/sludge ash material significantly increased the soil pH from 4.8 to 6.9, resulting in increased soil extractable and soil solution P, Ca, and Mg. Soil electrical conductivity was increased from about 0.02 dS m⁻¹ to approximately 0.10 dS m⁻¹ by the heavier application rate of ash. In addition, at higher ash application rates, white spruce seedling growth was significantly decreased, suggesting salt phytotoxicity effects from the ash. These results indicate that with proper rate determination and management of salt effects, land application of this material would not appear to pose serious problems for white spruce seedling establishment. Reproduced with permission from the CAB Abstracts database.

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