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**MEMORIA  
DE LA  
28<sup>a</sup> REUNION ANUAL**

**Agosto 9-15, 1992  
Santo Domingo, República Dominicana**

**Publicado por:**

**Sociedad Caribeña de Cultivos Alimenticios y  
Fundación de Desarrollo Agropecuario**

**Santo Domingo, República Dominicana**



## **MAIZE PRODUCTION AS AND OPPORTUNITY OF DIVERSIFICATION FOR THE CARIBBEAN AGRICULTURE.**

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In 1991, in the INRA-CIRAD maize research project based in Guadeloupe, we realized a study on the trade and the maize production conditions in the Caribbean. Analysis of the production and exchange statistics and of data collected in visited countries (Guadeloupe, Trinidad and Cuba) shows that maize in the Caribbean is characterized by two distinct trades; 1) grain maize mainly for animal feeding, supplied essentially by importations and, 2) in lower proportions, fresh ears for the human consumption, satisfied essentially by the local production. This 2 millions of tons existing trade and the suitable ecological conditions suggest that maize production can be a diversification crop. However, the international exchange's liberalisation, the maize and sugar prices' evolutions and the production structures' characteristics could become restrains, Future prospects of maiziculture in the Caribbean are discussed.

## **THERESA: UN OUTIL D'EVALUATION DES STOCKS HYDRIQUES EN SOLS ARGILEUX GONFLANTS - APPLICATION A LA MAITRISE DE L'EAU AU NIVEAU DE LA PARCELLE.**

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Les sols argileux gonflants posent un double problème dans le suivi de leurs états hydriques: la forte variabilité spatiale des teneurs en eau impose un grand nombre d'échantillons pour obtenir un état hydrique moyen fiable; les mouvements de gonflement/retrait qui caractérisent ces sols sont qu'il est impossible d'utiliser les méthodes classiques de mesure non destructive de l'eau dans le sol: sondes á neutrons et

tensiomètres sont inutilisables á cause des problèmes de décollement aléatoires se produisant á la périphérie des tubes d'accés, et qui aliéent la sphère de mesure. Cette impasse méthodologique a été en partie résolue par la conception de capteurs de déplacement verticaux de sol (Système THERESA: Transferts Evalués par le Retrait Equidimensionnel des Sols Argileux, Brevet INRA, Cabidoche, 1987), permettant le calcul de l'état des réserves en eau du sol á partir d'un modèle de retrait isotrope, reliant l'affaissement vertical des couches de sol, á leur variation de teneur en eau. Cette méthode permet d'obtenir une estimation tout á fait correcte des teneurs en eau matricielles, Instrumentée depuis peu par des capteurs de déplacement potentiométriques, elle permet d'enregistrer automatiquement les changements de teneur en eau á un pas de temps horaire, ce qui est exceptionnel en hydrologie des sols. Une des applications immédiates de cette méthode concerne l'adaptation des régimes d'irrigation á la parcelle (déclenchement, rationnement et arrêt de l'irrigation). La simplicité et le faible coût des capteurs, ainsi que la possibilité d'utilisation par lecture directe, en font un outil d'aide á la gestion de l'irrigation facilement appropriable par les petits exploitants.

## **OVERVIEW OF SOIL ORGANIC MATTER RESEARCH IN PUERTO RICO.**

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There are considerable reserves of organic matter and nitrogen in the soils of Puerto Rico. Conservation and wise utilization of these resources appears to be a worthy goal for enhancing crop production while simultaneously maintaining soil fertility and addressing critical environmental concerns. The addition of low N organic matter to Oxisols and related soils for raising their organic matter content is of doubtful value, since organic matter levels remain unaffected and crop yields are not improved. However, there is a marked response to low N organic matter sources in other soils, resulting in significant increases in the soil organic matter levels. Soil-water movement and availability were favorably affected after five years of continuous organic matter build-up as contrasted to depletion processes caused

by yearly burning of crop residues. Significantly increased yields may be attributed to the increased organic matter levels of soils. The increase in yields attributable to cropping and soil management practices can be traced, in most cases, directly to the increase in nutrient availability from mineralization of soil organic matter and to the beneficial influence on soil properties such as stable soil structure, hydraulic conductivity, and available soil-water supply. The value of mulching is evident from data revealing soil losses of more than 15 and 30 Mg ha<sup>-1</sup> Yr<sup>-1</sup> from unmulched sugar cane fields and coffee groves, respectively. Under intensive agricultural use, soil carbon in the top 18 cm of the soil was about 30-37 Mg ha<sup>-1</sup>. Reduced intensity of use results in an increase of soil carbon of 0.3-0.5 Mg ha<sup>-1</sup> yr<sup>-1</sup> over a 40-year period.

### **MINERAL UPTAKE OF VEGETABLE AMARANTH AS AFFECTED BY NITROGEN SOURCES**

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A field experiment was conducted to determine the effects of different sources of nitrogenous fertilizers (ammonium nitrate (33% N); ammonium sulfate (21% N); urea (45% N) on the yield and mineral uptake of vegetable amaranth (*Amaranthus tricolor*). The average dry and fresh weights were highest for ammonium nitrate supplied plants, but these were not significantly different from urea or ammonium sulfate treated plants. The results also show that nitrogen, potassium, phosphorus, and potassium uptake were not influenced by nitrogen source. However, urea significantly influenced calcium uptake in

both the leaves and stems of vegetable amaranth. Micronutrients were not significantly affected by nitrogen source, except for molybdenum in both the stems and leaves; boron and chromium in the leaves; and manganese and barium in the stem. Generally, the application of ammonium nitrate resulted in the highest levels of uptake by both macro and micronutrients.

## BIONOMICS OF *Mirax insularis* THE IMPORTED COFFEE LEAF MINER PARASITOID: AN OVERLOOK OF A NEW PROJECT

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Coffee, *Coffea arabica* (L.), is the major agricultural crop of Puerto Rico. One of the limiting factors in coffee production is the coffee leaf miner (CLM), *Leucoptera coffeella* Guérin-Ménéville. The CLM damage reduces up to 50% of the photosynthetic activity of the leaves, causes defoliation, and reduces yield by up to 40%. Because of the negative ecological impact of the chemical control of the CLM it is extremely important to select a biocontrol approach that can lead to the suppression of this pest in the shortest time possible. Augmentation of *Mirax insularis* Muesebeck, in the field just prior the CLM population peaks seem to be the most appropriated approach. This can be achieved by mass liberations of parasitoids reared in greenhouses. This approach is possible because the braconid is adapted to the Puerto Rican coffee plantations, the biology and phenology of the host is known, and the host can be reared in the laboratory. Several studies are needed in order to establish an augmentation program for *M. insularis*. The proposed project, CBAG-48, will study the biology of *M. insularis*, the effects of temperature and relative humidity in its biology, and its pesticide tolerance. Results will have a great impact in promoting the use of *M. insularis* as a biocontrol agent of the CLM in combination with other control measures in an integrated pest management program in the Caribbean Basin. These practices will increase chances for success in the CLM population management, decreasing the use of insecticides. This could result in economic benefits and reduction of environmental pollution in Puerto Rico and other countries of the Caribbean Basin.

## DESARROLLO DE METODOS DE INOCULACION PARA INDUCIR *MUSTIA HILACHOSA* EN FRIJOL (*PHASEOLUS VULGARIS* L.)

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La mustia hilachosa es uno de los principales factores limitativos para la producción de frijol en las zonas cálidas y húmedas del trópico. Es causada por el hongo *Rhizoctonia solani* kuhn, cuyo estado perfecto lo es *Thanatephorus cucumeris* (Frank) Donk. Bajo el proyecto título XII de la Estación Experimental agrícola, se llevó a cabo la investigación para el desarrollo de métodos de inoculación en el invernadero. Los tratamientos consistieron de niveles de inóculo obtenidos por dilución y tamaño del punto de inoculación. Los niveles de inóculo de obtuvieron por medio de diluciones del macerado de la colonia en agar de papa dextrosa a 50, 100, 150 y 200 ml. de agua estéril/placa. El tamaño del punto de inoculación consistió en depositar gotas de 5, 10, 15 y 20 microlitros de inóculo en el haz de las hojas. Plantas sin inocular fueron los controles. Los tratamientos se replicaron 4 veces en el diseño de Bloques Completamente Aleatorizados. Se utilizaron como criterios de evolución, síntomas, clorosis, diámetro de la lesión y defoliación. Los datos numéricos se analizaron en forma factorial y se encontraron diferencias significativas en el tamaño de la gota y las concentraciones de inóculo. La combinación de gotas de 5 y 10 microlitros con diluciones de 150 y 200 ml. fueron los tratamientos que indujeron síntomas característicos sin provocar defoliación prematura.

### AGRICULTURAL AND ENVIRONMENTAL GEOGRAPHIC INFORMATION SYSTEM.

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J.P. Calixte, University of Puerto Rico and University of  
Florida.

AEGIS is a prototype of decision support system that integrates spatial soil, weather and landuse data bases; the Decision Support

System for Agrotechnology Transfer (DSSAT) of the International Benchmark Sites network for Agrotechnology Transfer (IBSNAT); a soil erosion model (Universal Soil Loss Equation, USLE); a simple expert system for bean production; a relational data base management system (dBASE IV); and a geographic information system (PC-ARC/INFO v3.4D). AEGIS was developed using digitized soil, weather and landuse data for three 3,800-ha areas of western Puerto Rico (Mayagüez, Isabela, Lajas). The 1:20, 000 USDA/SCS soil maps of these area differentiate 88 map units, mostly phases of 38 soil series that exemplify 7 of the 11 orders of Soil Taxonomy. The soil parameters required to run the IBSNAT crop models were derived from soil survey reports and series-specific analytical data available for 28 of the 38 series. For the remaining series surrogate data were estimated using analogue procedures. Combining the field and laboratory data, soil data files were created for each of the 67 agriculturally suitable polygons. The climate in the region range from humid to subhumid to semiarid tropical. Historical weather data (daily precipitation and maximum and minimum temperature) recorded at four representative stations were used. Long-term solar radiation data were not available but time sequences were estimated with a default procedure developed for Puerto Rico. Landuse coverage of EAGIS was generated by processing LANDSAT imagery with the Earth Resources Data Analysis System (ERDAS). AEGIS was linked to DSSAT and thus provides direct access to the functions that reside in that system. More than 250,000 runs, representing various combinations of management practices and production strategies, were made with BEANGRO v1.01. In addition, soil erosion under various conservation practices was estimated for each map unit with the USLE. The results were statistically analyzed and stored in the system for instant recall. Using these data, or information generated interactively, AEGIS can predict crop performance and soil loss, aggregate polygon attributes over space and time, estimate production and resource requirements for different agricultural strategies, assess potential environmental impact, generate tables and thematic maps, and develop a production plan for a region. AEGIS is a significant step forward in the development of a decision tool that incorporates contemporary geographic, environmental and agricultural systems technology. A novel attribute of AEGIS is that it expands the scope



of analysis of DSSAR from a site to an area by linking it to a geographic information system (GIS).

## INTRODUCIENDO LA ESPALDERA VERTICAL DE UNA CUERDA (SENCILLA) EN LA CHINOLA

(*P. edulis*, F.D.). M. Matúnez, C. García.

La chinola es una especie con algo más de tres décadas de introducida en República Dominicana que rápidamente se ha convertido en una planta casi silvestre de todos los bosques húmedos. Su cultivo y mercadeo interno y externo tienen importancia creciente; pero carecen de un seguimiento y apoyo técnico sistemáticos. En esta parcela demostrativa se proponen dos modalidades de establecimiento de espalderas verticales inspiradas en la técnica empleada por los campesinos africanos. Ubicación: Municipio "El Cacao", provincia San Cristóbal, a una altura de 350 metros sobre el mar, de la cuenca del río Nizao. Suelo: franco, arcilloso, ultisol; pendiente de 30 a 120 %; materia orgánica, 1%; pH.5. Pluviometría 1,800 mm. bien distribuidos.

Variedades: Colombiana Amarilla y Colombiana Morada. Las plantas se criaron en viveros en bolsas negras de polietileno y se plantaron el día 5-11-91 en hoyos de 40 cm. de lado rellenas con una mezcla de suelo superficial con pulpa de café del año anterior. Marcos de Plantación: 2 cm. entre hileras x 3 m. entre plantas. Las hileras se orientaron paralelas a las líneas descritas por canales de desviación construidos cada 6 m. Fertilización: Se emplea abono orgánico producido *in situ* a partir de pulpa de café, la broza de los chapeos y poda de leguminosas (*Gliricidia* e *Inga*). Plagas y Enfermedades: Se han aplicado prácticamente estándares con el máximo rigor puestos en mantener fuera los virus, eliminando de cuajo cuantas plantas resultasen sospechosas. Poda Formación: Se han dejado dos guías por planta, orientadas en direcciones opuestas sobre la cuerda o vara colocada a 2.1 m. de altura; las yemas terminales se eliminaban cada 50 cm. para estimular el desarrollo de ramillas secundarias y terciarias productivas. Resultados: Las plantas se desarrollaron bien, formando columnas verticales con buena fronda; a principios de abril comenzó

la floración y a mediados de mayo comenzaron a madurar frutos. En este momento la producción se ha estabilizado en una media de 650 frutos por semana, que vendidos en finca a \$0.30 la unidad, significan para el agricultor un ingreso bruto de \$200.00 semanales en solo 800 m<sup>2</sup> de superficie.

## **Virgin islands Pesticide Applicator Training Program**

**By Olasee Davis Extension Specialist - Natural Resources UVI  
Cooperative Extension Service**

The University of the Virgin Islands Cooperative Extension Service provides learning opportunities for pesticide users or interested persons who desire to be legal and competent applicators. The Cooperative Extension Service is the only agency in the Virgin Islands authorized to conduct pesticide applicator training for certification.

The Cooperative Extension Service works jointly with the Department of Planning and Natural Resources (DPNR) in certifying applicators after they are trained. The Federal Insecticide Fungicide and Rodenticide Act and the Virgin Islands Pesticide Control Act are the basis for the pesticide applicator training program. Besides issuing licenses to pesticide applicators DPNR also assists the United States Environmental Protection Agency in ensuring that only registered pesticides are used in the Virgin Islands.

The Department of Planning and Natural Resources is also responsible for inspecting businesses that sell or apply pesticides. They visit exterminating companies, pesticide dealers, farmers, etc. to ensure that these pesticides are being used properly and that there is no misuse of the pesticide that would endanger the public health and the environment.

To ensure pesticide applicators know how to apply pesticides correctly, the UVI Cooperative Extension Service pesticide applicator training program has two categories: private and commercial applicators. Private applicators are those persons who use or supervise the use of restricted-use pesticides on property owned or rented by themselves or their employer for the purpose of producing any

"agricultural commodity." Private applicators are trained and tested in the general use of pesticides and the handling of pesticides.

Private users of pesticides such as farmers or nursery growers are also trained how to identify pests, know the life cycle of pests and determine the best methods of controlling pest, such as cultural control, mechanical control, biological control or chemical control.

Commercial applicatorş are those persons who use or supervise the use of restricted pesticides for any purpose or on any property other than specified for private application. Commercial applicators are trained and tested in the general areas of pesticides and handling of pesticides. They also receive further training in one or more specific categories of application, such as ornamental and turf pest control or public health pest control.

Pesticide workshops are conducted throughout the Virgin Islands. These workshops are announced on the radio systems, television stations and in the local newspapers. It is very important for persons who apply or sell pesticides to attend the workshops. Also, there are pesticide companies from the mainland and Puerto Rico with whom joint workshops are conducted each year.

These pesticide workshops are free to the public. Participants purchase a study manual only for whatever workshop is being given at a particular time. For further information on UVI Cooperative Extension Service pesticide applicator training program contact us by calling 778-0246.

**EXPERIENCE IN BARBADOS WITH  
INTER-CROPPING AND ROTATIONAL-CROPPING  
WITH SPECIAL EMPHASIS ON MECHANISATION**

**Colin Hudson\***

**ABSTRACT**

The Barbados Sugar Industry has a long history of intercropping and rotational-cropping, especially with root crops like sweet potatoes and yams. As recently as 1946, 25% of the acre months were devoted to non-cane crops on sugar farms. The paper summarizes interesting aspects of this experience. Special attention is paid to mechanisation of the non-cane crops in the context of cane farm technology, mainly in Barbados.