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Nutrient Content (% Dry Matter) of Maize as Affected by Different Levels of Fertilizers in Asaba Area of Delta State

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Abstract

This study was carried out in the Teaching and Research Farm of Delta State. University, Asaba campus (Nigeria) from March 2008 to June 2010 to evaluate the nutrient content (% dry matter) of maize as affected by different levels of organic manure and inorganic fertilizer. The experiment was carried out in a Randomized Complete Block Design (RCBD) replicated three times in a factorial layout. Four different rates of poultry droppings, cattle dung and NPK 20: 10: 10 fertilizer were applied to three maize varieties sown at 75 cm x 15 cm spacing and the maize grains produced were evaluate for their nutrient content in percentage dry matter. The results obtained indicated that hybrid variety 9022-13 had the highest N, P and K contents (1.03, 1.68 and 0.26, respectively). Also, plants that received inorganic fertilizer had the highest values of 1.27% N, 1.64% P and 0.29% K. Based on rates of application, plants that received 450 kgha^{-1} NPK 20: 10: 10 fertilizer had the highest values of 1.74% N, 1.71% P and 0.49% K. The interaction effects showed that only variety, manure type and rates % application were significant ($P < 0.05$). Based on this study, it is recommended that (i) Hybrid variety, 9022-13, which was outstanding in its nutrient content be grown in the study area. Alternatively, farmers who prefer open-pollinated varieties could grow BR 9922-DMRSF^2 or Agbor local variety for people who prefer local varieties in maize production (ii) Spacing of 75 cm x 15 cm (88, 888 plants/ha) which resulted in better growth performance and yield should be adopted in maize production (iii) Farmers who prefer mineral fertilizer for increased growth and yield of maize should apply 450 kg ha^{-1} of NPK 20: 10: 10 (iv) Farmers who practice organic agriculture in Asaba agro-ecological zone should apply 30 tha^{-1} of poultry manure to enhance maize yield.

Keywords: nutrient content, maize, organic manure, inorganic fertilizer, Asaba Delta State

1. Introduction

Maize (*Zea mays* L) is one of the major cereal crops grown in the humid tropics and Sub-Saharan Africa. It is a versatile crop and ranks third following wheat and rice in world production as reported by Food and Agriculture Organization (FAO, 2002). Maize crop is a key source of food and livelihood for millions of people in many countries of the world. It is produced extensively in Nigeria, where it is consumed roasted, baked, fried, pounded or fermented (Agbato, 2003). In advanced countries, it is an important source of many industrial products such as corn sugar, corn oil, corn flour, starch, syrup, brewer's grit and alcohol (Dutt, 2005). Corn oil is used for salad, soap-making and lubrication. Maize is a major component of livestock feed and it is palatable to poultry, cattle and pigs as it supplies them energy (Iken et al., 2001). The stalk, leaves, grain and immature ears are cherished by different species of livestock (Dutt, 2005).

In spite of the increasing relevance and high demand for maize in Nigeria, yield across the country continues to decrease with an average of about 1 t/ha which is the lowest African yield recorded (Fayenisin, 1993).

The steady decline in maize yield can be attributed to:

a. Rapid reduction in soil fertility caused by intensive use of land and reduction of fallow period as reported by Directorate of Information and Publications of Agriculture (DIPA, 2006).

b. Failure to identify and plant high yielding varieties most suited or adapted to each agro-ecological zone (Kim, 1997; Olakojo et al., 1998).

c. Use of inappropriate plant spacing which determines plant population and final yield (Zeidan et al., 2006).

d. Negligence for soil amendment materials such as organic manure and inorganic fertilizers which improve soil condition and enhance crop yield.

Tolera et al. (1999) suggested that breeders should select maize varieties that combine high grain yield and desirable stover characteristics because of large differences that exist between cultivars. Odeleye and Odeleye (2001) reported that maize varieties differ in their growth characters, yield and components, and therefore suggested that breeders must select most promising combiners in their breeding programmes. Sonetra et al. (2002) suggested that subsistence farmers should apply organic manure directly to the soil as a natural means of recycling nutrients in order to improve soil fertility and yield of crops. Manures and fertilizers are the life wire of improved technology contributing about 50 to 60% increase in productivity of food grains in many parts of the world, irrespective of soil and agro-ecological zone (DIPA, 2006). Reijnties et al. (1992) and Adepetu (1997) remarked that the downward trend in food production should prompt farmers to amend the soil with different materials in order to enhance growth and yield of crops. Several organic materials such as cattle dung, poultry dropping, pig dung and refuse compost have been recommended to subsistence farmers in West Africa as soil amendments for increasing crop yield (Sobulo & Babalola, 1992; Ismail et al., 1999; Olayinka, 1996; Olayinka et al., 1998). Zougmore et al. (2006) reported that poultry dropping and cattle dung increased root growth of maize and the crop extracted soil water more efficiently for increased grain yield.

Municipal wastes reduced soil temperature, increased soil water, nutrient status and the yield of maize in temperate soils (Movahedi & Cook, 2000). Cattle dung contains 0.3-0.4% N, 0.1-0.2% P and 0.1-0.3% K (Subedi & Gurung, 1991). According to Adekunle et al. (2005) cattle dung applied at the rate of 10 t/ha to cowpea resulted to increased plant height, leaf area, pod number, pod weight as well as improved soil structure in a mixed farming system. Stefan (2003) indicated that fresh poultry dropping contain 70% water, 1.4% N, 1.1% P_2O_5 and 0.5% K_2O while dried poultry manure contains 13% water, 3.6% N, 3.5% P_2O_5 and 1.6% K_2O. Ayodele (1993) reported that inorganic fertilizer are known to influence the quantity and yield of maize.

At present, there are no recommended standards taking into consideration the different combinations of such cultural practices as varietal selection, rates of appropriate organic manure and mineral fertilizer which interplay to influence the nutrient content, yield and optimal performance of maize in Asaba area of Delta State. Against this background, the broad objective of this study, therefore, was to identify variety of maize most suited or adapted to Asaba area, the appropriate fertilizer types and rates that can improve the nutrient content of the variety.

The specific objectives were to:

(i) identify the best variety for Asaba area.

(ii) determine the effects of NPK (20:10:10) mineral fertilizer, poultry manure, cow dung on nutrient content of maize.

2. Materials and Methods

2.1 Site Description

The study was carried out in the Teaching and Research Farm of Delta State University, Asaba Campus (Nigeria) from March to December 2008 and repeated between March and December, 2009. Asaba is located at latitude 06º 14’N and longitude 06º 49’ N of the equator. It lies in the tropical rainforest zone dominated by mangrove, fresh water, swamps, humid forests and secondary vegetation (NEST, 1991). Its climate is influenced by the movement of the Inter-Tropical Discontinuity (ITD). The IDT is made up of two wind systems namely the moisture-laden South-West monsoon from the Atlantic Ocean and the dry cold North-East trade wind from the Sahara desert. The South-West Trade wind most significantly determine the climate condition of Asaba area of Delta State. Asaba is characterized by raining season between April and October, with annual mean-rainfall of 1500mm and 2000mm maximum. The distribution is bimodal with peak in July and September, coupled with a period of low precipitation in August. Mean temperature is 23.8 ºC with 37.3 ºC as maximum. Relative humidity is 77.2%, the mean monthly soil temperature at 100m depth is 20.3 ºC, while sunshine stands at 4.8 bars (Meteorological Office, Asaba, 2003).

2.2 Pre-Planting Soil Analysis

Representative surface soils (0-20 cm) were sampled with a tubular sampling auger. These soil samples were air-dried at room temperature for 5 days and crushed to pass through a 2 mm mesh sieve. Sub-samples from the bulked soil sample were further grounded to pieces to pass through 100 mm-mesh sieve for the determination of organic matter. The rest samples were then analyzed to determine the physical and chemical properties of the soil. The analysis was done at Delta State University, Asaba campus.

2.3 Analytical Procedure

2.3.1 Physical Properties

Particle size distribution: Particle size distribution was analyzed using the Bouyoucos hydrometer method in which 0.5 N Sodium hexameta-phosphate was used as dispersant (Landor, 1991).

Bulk density: The bulk density (Bd) was determined by Core-method.

Particle density: This was determined by pycometer or specific gravity bottle method as described by Bowles (1992).

2.3.2 Chemical Properties

Soil pH: This was determined in soil: water suspension (1:1) using glass electrode pH-meter as described by Mclean (1982).

Organic carbon: This was determined using the wet oxidation method of Walkley and Black (Walkley & Black, 1945).

Total nitrogen: This was determined using the modified Kjeldahl distillation method as described by Landor (1991).

Exchangeable cations (EC) and Effective cation exchange capacity (ECEC): Exchangeable cations were determined by extracting the cations with IN ammonium acetate (IN, NHOAC) as displacing solution, buffered at pH_7 as described by Brady and Weils (1999). The extract was then determined electrochemically using atomic absorption spectrophotometry. The effective cation exchange capacity (ECEC) was calculated as the sum of exchangeable bases (Ca, Mg, K and Na) and exchangeable A1 and H expressed in cmo1 kg^{-1} of soil.

Exchangeable acidity: This was determined by titration method as described by Juo (1981). The exchangeable H^+ and $A1^{++}$ were then expressed in cmo/kg^{-1} of soil.

Available phosphorus: This was determined by Bray No.1 method as described by Landor (1991).

Cation exchangeable capacity: This was determined by neutral NH_{4-} Acetate placement method using the procedure of Anderson and Ingram (1996).

2.4 Experimental Design

The study was carried out in Randomized Complete Block Design (RCBD), replicated three times in a factorial layout. The factors were three sources of nutrients: poultry manure (PM), cattle dung (CD), inorganic fertilizer (NPK 20: 10: 10). The different rates of PM were 0, 10, 20, 30 t/ha, CD were 0, 10, 20, 30 t/ha and NPK 20: 10: 10 were 0, 150, 300, 450 kg/ha.

2.5 Agronomic Practices

Among the agronomic practices carried out were land preparation/plot layout, planting, application of treatments, weeding.

2.6 Land Preparation and Plot Layouts

The land was ploughed and harrowed using tractor. Three blocks (or replicates) consisting of 36 blocks each were layout, each block will measure 2.6 m x 2.25 m and was separated from one another with a space of 0.5 m. Alley pathways of 1 m separated one block from another, and the total number of plots laid out in the entire experiment was 108.

2.7 Planting

Maize seeds were sown on the plots at the rate of 1 seed per hole at a depth of 2-3 cm, using 75 cm x 15 cm spacing.

2.8 Procurement and Application of Organic Manure and NPK 20: 10: 10 Fertilizer

Well-decomposed cattle dung was collected from cattle pen area, while poultry droppings was obtained from the battery cage system of poultry management of Delta State University, Asaba Campus. These organic manure were analyzed to determine their nutrient contents. NPK 20:10:10 fertilizer was obtained from Delta Agricultural Procurement Agency (DAPA), Ibusa. These amendment materials were incorporated into the plots according to the treatment as suggested by Olanikan (2006).

Weeding: Weeding was done three times using hoe.

Data Collection: Fourteen middle stands were used as sample population for data collection. Data collected in the laboratory was percentage dry matter contents of Ca, Mg, Na, N, P, and K of the three different maize varieties using the analytical procedures already described.

Statistical analysis: Data collected were subjected to analysis of variance (ANOVA) and means were separated with Duncan Multiple Range Test (DMRT) according to Wahua (1999).

3. Results

3.1 Soil Physico-Chemical Properties of the Experimental Site

The pre-physico-chemical properties of the experimental site are shown in Table 1. The result showed predominantly sand at the surface and this tends to decrease with depth of profile. Texturally, the soil of the experimental site is classified as sandy loam. The soil is acidic with pH of 6.2 in H_2O and 5.6 in CaCl. The organic matter content and total nitrogen were low with values of 1.22 g kg^{-1} and 0.113 g kg^{-1}. The available P was high with value of 26.5 mg kg^{-1}. The exchangeable cations (Ca, Mg, Na and K) were equally low in status with values of 2.6 cmol kg^{-1} for Ca^{2+} and 0.9 cmol kg^{-1} for Mg^{2+}. The value obtained for Na^+ was 0.57 cmol kg^{-1}, which was moderate while that for K^+ was 0.08cmolkg^{-1}, which was low. The CEC was 4.15, while ECEC was 5.6 cmol kg^{-1}, which were generally low. The exchangeable acidity was only trace for Al^{3+} and characteristically low for H^+ with a value of 1.4 cmol kg^{-1}.

Table 1. Physico-chemical properties of experimental site

Soil Property		Value	Interpretation
Particle Size Distribution (%)			
	Coarse sand	38	
	Fine sand	41	
	Silt	9	
	Clay	12	
	Texture	____	Sandy loam
pH	H_2O	6.2	Acidic
	CaCl	5.6	Acidic
Organic	Carbon gkg^{-1}	0.71	
Organic	Matter gkg^{-1}	1.22	Very low
Total	Nitrogen gkg^{-1}	0.113	Low
Available	P ($mgkg^{-1}$)	26.5	
Exchangeable bases (cmol/kg^{-1})			
	Na^+	0.57	Moderate
	K^+	0.08	Very low
	Ca^{2+}	2.60	Low
	Mg^{2+}	0.90	Low
Cation Exchange Capacity		4.15	
Exchangeable acidity (cmol/kg^{-1})			
	Al^{3+}	Trace	
	H^+	1.4	
Effective cation Exchangeable capacity (cmol/kg^{-1})		5.6	

3.2 Nutrient Content (%) of Organic Manures Used in the Study

The nutrient content of organic manures (poultry manure and cattle dung) used in the study is shown in Table 2. The values of N, P and K in poultry manure were significantly ($P< 0.05$) higher than their values in cattle dung. With respect to N, poultry manure had 1.6% against cattle dung which was 0.4%. Also, poultry manure had 0.6% P while cattle dung had 0.2% P. The values for K was 0.8% in poultry manure, while it was 0.3% in cattle dung.

Table 2. Nutrient (%) of organic manure used in the study

	Nutrient Content (%)		
Parameter	N	P	K
PM	1.6_a	0.6_a	0.8_a
CD	0.4_b	0.2_b	0.3_b

Means with the same letters(s) under the same column are not significantly different ($P < 0.05$) using Duncan Multiple Range Test (DMRT). PM = Poultry Manure, CD = Cattle Dung, N = Nitrogen, P = Phosphorus.

3.3 Nutrient Content (% dry matter) of Maize as Affected by Different Levels of Manure and Inorganic Fertilizer

The nutrient content of maize as affect by different levels of organic manure and inorganic fertilizer is shown in Table 3. These were significant differences in the nutrient contents of the maize varieties sown using various amendments and their levels. Hybrid variety 9022-13 had the highest percentage dry matter nutrient content, (0.25 Ca, 0.71 Mg, 0.25 Na, 1.03 N, 1.68 P, 0.26 K), followed by open pollinated variety BR9922-DMRSRF$_2$ (0.24 Ca, 0.57 Mg, 0.25 Na, 0.99 N, 1.68 P, 0.22 K) Agbor local variety had the lowest percentage dry matter nutrient content (0.24 Ca, 0.45 Mg, 0.28 Na, 0.79 N, 1.48 P, 0.15 K). The order of superiority in nutrient content based on variety was 9022-13 > BR9922-DMRSRF$_2$ > Agbor local. Plants that received inorganic fertilizer NPK 20:10:10 had highest level of nutrient (0.25 Ca, 0.64 Mg, 0.28 Na, 1.27 N, 1.64 P, 0.29 K), while plants that received cattle dung had the lowest level of nutrients (0.23 Ca, 0.47 Mg, 0.31 Na, 0.34 N, 1.51 P, 0.15 K). The order of superiority with respect to highest level of nutrients based on nutrient source was IF > PM > CD. Plants that received higher rates of manure or fertilizer had higher levels of nutrient than plants that received lower rates. The order of highest level of nutrient (in % dry matter of maize) based on rate of manure in tons/ha was 30 > 20 > 10 > 0 while that of fertilizer in kg/ha was 450 > 300 > 150 > 0. With respects to interaction (Table 4), Ca, Mg, Na, N, P and K values were significantly ($p < 0.05$) different based on variety, nutrient and rates of application. Except Mg, Na and P, other nutrients were not significantly ($p > 0.05$) different with respect to interactions of variety× nutrient, variety×r ate, nutrient × rate and variety × nutrient × rate.

Table 3. Nutrient content (% dry matter) of maize as affected by different levels of organic manure and inorganic fertilizer

	Ca	Mg	Na	N	P	K
Variety						
9022-13	0.25_a	0.71_a	0.30_a	1.03_a	1.68_a	0.26_a
BR9922-DMRSF$_2$	0.24_b	0.57_b	0.25_c	0.99_a	1.56_b	0.22_a
Agbor Local	0.24_b	0.45_c	0.28_b	0.79_b	1.48_c	0.15_b
Nutrient Source						
PM	0.24_b	0.63_b	0.23_c	1.21_b	1.57_b	0.18_b
CD	0.23_c	0.47_c	0.31_a	0.34_c	1.51_c	0.15_c
IF	0.25_a	0.64_a	0.28_b	1.27_a	1.64_a	0.29_a
Rates of application (tons kg/ha)						
0	0.22_e	0.53_g	0.17_f	0.25_f	1.50_e	0.04_f
10 manure (tha^{-1})	0.22_e	0.54_f	0.27_d	0.92_e	1.51_e	0.15_e
20 manure (tha^{-1})	0.23_d	0.56_e	0.26_d	1.01_e	1.56_d	0.19_{de}
30 manure (tha^{-1})	0.25_c	0.58_d	0.36_b	1.08_d	1.61_c	0.29_c
150 IF(kg ha^{-1})	0.25_c	0.63_c	0.23_e	1.47_c	1.62_c	0.26_d
350 IF(kg ha^{-1})	0.26_b	0.67_b	0.33_c	1.59_b	1.66_b	0.37_b
450 IF(kg ha^{-1})	0.27_a	0.72_a	0.43_a	1.74_a	1.71_a	0.49_q

Means with the same letters(s) under the same column are not significantly different ($P < 0.05$) using Duncan Multiple Range Test (DMRT).

Table 4. Effects of interaction showing nutrient content (% dry matter) of maize as affected by different levels or organic manure and inorganic fertilizer

Variety	Nutrient Source	Rate	Ca	Mg	Na	N	P	K
9022-13	PM	0	0.22	0.7	0.1	0.1	1.63	0.05
		10	0.23	0.71	0.25	1.66	1.64	0.22
		20	0.24	0.75	0.45	1.74	1.69	0.36
		30	0.27	0.77	0.54	1.85	1.75	0.45
		Mean	0.24	0.73	0.34	1.34	1.68	0.27
	CD	0	0.22	0.6	0.12	0.1	1.62	0.03
		10	0.23	0.61	0.14	0.51	1.63	0.18
		20	0.24	0.68	0.27	0.52	1.64	0.19
		30	0.26	0.69	0.42	0.53	1.68	0.2
		Mean	0.24	0.65	0.24	0.42	1.64	0.15
	IF	0	0.24	0.7	0.14	0.12	1.64	0.05
		150	0.26	0.76	0.3	1.68	1.68	0.35
		300	0.27	0.78	0.4	1.72	1.75	0.44
		450	0.28	0.5	0.85	1.87	1.8	0.62
		Mean	0.26	0.69	0.42	1.35	1.72	0.37
BR9922-DMRSF$_2$	PM	0	0.33	0.6	0.08	0.1	1.5	0.03
		10	0.23	0.62	0.12	1.41	1.54	0.15
		20	0.24	0.63	0.33	1.63	1.59	0.18
		30	0.25	0.64	0.42	1.68	1.63	0.24
		Mean	0.26	0.62	0.24	1.21	1.57	0.14
	CD	0	0.21	0.4	0.07	0.1	1.4	0.02
		10	0.22	0.43	0.1	0.5	1.42	0.13
		20	0.23	0.45	0.31	0.51	1.51	0.17
		30	0.25	0.47	0.37	0.52	1.57	0.51
		Mean	0.23	0.44	0.21	0.41	1.48	0.21
	IF	0	0.23	0.53	0.14	0.57	1.51	0.09
		150	0.25	0.62	0.25	1.54	1.63	0.23
		300	0.26	0.7	0.34	1.67	1.65	0.36
		450	0.27	0.75	0.45	1.75	1.71	0.47
		Mean	0.25	0.65	0.29	1.38	1.63	0.28
Agbor Local	PM	0	0.22	0.5	0.07	0.1	1.4	0.02
		10	0.23	0.52	0.09	1.3	1.45	0.12
		20	0.24	0.53	0.12	1.42	1.51	0.16
		30	0.25	0.54	0.22	1.53	1.54	0.21
		Mean	0.24	0.52	0.13	1.34	1.48	0.13
	CD	0	0.21	0.3	0.06	0.1	1.3	0.01
		10	0.22	0.32	0.08	0.15	1.4	0.11
		20	0.23	0.34	0.1	0.25	1.44	0.13
		30	0.24	0.36	0.2	0.34	1.47	0.15
		Mean	0.23	0.33	0.11	0.21	1.4	0.1
	IF	0	0.23	0.4	0.07	0.1	1.5	0.03
		150	0.24	0.5	0.15	1.2	1.55	0.19
		300	0.25	0.54	0.25	1.4	1.59	0.31
		450	0.26	0.56	0.35	1.6	1.63	0.4
		Mean	0.25	0.5	0.21	1.1	1.57	0.23
Variety			*	*	*	*	*	*
Nutrient			*	*	*	*	*	*
Rate			*	*	*	*	*	*
Variety x nutrient			ns	*	*	ns	*	*
Variety x rate			ns	*	*	*	*	ns
Nutrient x rate			ns	ns	*	ns	ns	ns
Variety x nutrient x rate			ns	ns	*	ns	ns	ns

Legend: * = significant at 0.05 level of probability, ns = not significant.

4. Discussion

The sandy loam texture of the experimental site may be attributed to the Parent Material from which the soil was formed and the climate of the area. The soil might be formed from sandstone and quartz parent materials. These impart sandy texture to the soils. The high sand content of the soil could be attributed to high content of quartz in the material (Brady & Weils, 1999). The weak acid nature of the soil of the area may be traced to the marked leaching of exchangeable bases resulting from the high rainfall associated with the environment and the dissociation of strong and functional group in the organic matter. This is in harmony with the findings of Esu (2001).

The low organic matter status of the experimental site could be attributed to the rapid decomposition of organic matter due to high solar radiation and moisture, this favours optimum microbial activities in the soil, It could also be attributed to the annual seasonal bush burning which tend to deplete organic matter accumulation in the soil (Landor, 199l). The low level of total nitrogen could be due to high temperature. It could also be attributed to leaching of nitrate by torrential rainfall prevalent in the environment (Olatunji, 2007). The high level of' Phosphorus may be attributed to either of these reasons: (i) history of land use and cultural practices associated with the land use (that is, cropping of crops that do not take much P nutrient from the soil and the application of P organic fertilizers (Nnaji et al., 2002; Nnaji, 2008). (ii) The parent material from which the soil was formed may be rich in P minerals (Brady & Weils, 1999). (iii) The soil may not be highly acidic as to cause high level of fixation (Brady & Weils, 1999, Isirimah et al., 2003; Omokri et al., 2007). The low values of exchangeable cations may be attributed to the leaching of bases from the solum due to high rainfall characteristics of the area. The low action exchange capacity could be attributed to the PM from which the soil was formed, and low organic matter (OM) content of the soil. The PM from which the soil was formed may be poor in basic nutrients. FMANR (1990) noted that soils of the study area were dominated by Fe oxide and Kaolinites. These clay minerals are low in basic cations (Brady & Weils, 1999). The exchangeable acidity was low possibly because of the cultural practices associated with the land use (that is, previous use of amendments to improve soil condition and enhance crop yield. The results, generally, are in harmony with the findings of Osaretin et al. (2006), Olatunji et al. (2007) and the results of soil fertility evaluation in the region. It is also consistent with the findings of Nnaji et al. (2002) and Nnaji (2008) *which reported that the history of land use and cultural practices* affect soil conditions and crop productivity.

4.1 Nutrient Content (% Dry Matter) of Organic Manure Used in the Study

The values of N, P and K were higher in poultry manure than in cattle dung used in the study possibly because poultry manure, especially those produced in deep litter or battery cage house, have more concentrated nutrient content compared with other types of animal manure. This is similar to the findings of Sharply and Smith (1991), Lombin et al. (1992), and Brady and Weil (1999) who reported that among the different sources of organic manure which have been used in crop production, poultry manure was found to be the most concentrated in terms of nutrient content. It is also in harmony with the findings of Subedi and Gerung (1991) and DIPA (2006) who reported that poultry manure has higher levels of N. P and K than cattle dung. It is also consistent with the findings if Ibeawuchi et al. (2007) who reported higher levels of N. P and K in plots treated with poultry manure than in plots treated with other nutrient sources.

4.2 Nutrient Content (% Day Matter) of Maize as Affected by Different Levels of Organic Manure and Inorganic Fertilizer

Hybrid variety 9022-13 had the highest percentage nutrients (% dry matter) with respect to Ca, Mg, Na, N, P, and K compared to other varieties tested possibly because it possesses higher stomatal conductance value, and higher potential for partitioning of photosynthetic materials towards quality economic yield. It could also be attributed to variations in genetic structure, mineral concentration and potential to transport photosynthates within the plant. This is similar to the findings of Costa and Campos (1990); Garner et al. (1990), and Zaki et al. (1999) who reported that the differences in maize cultivars may be attributed to variations in their stomatal conductance value and to differences between the genotypes in partitioning of photosynthetic materials towards quality economic yield. It is also consistent with the findings of Clark et al. (1997) who reported that the genotypes differences in yield and its components may be due to variations in genetic structure, mineral concentration and potential to transport photosynthates within the plant. It is also in harmony with the findings of Worku and Zelleke (2007) who reported that the local varieties of maize are inefficient in transferring assimilates to the ear sink hence they are low yielding compared to hybrid and improved varieties.

Plants that received inorganic fertilizer have higher nutrient content (% dry matter) than plants that received organic manure. This is as a result of the special attributes credited in favour of inorganic fertilizers with respect to positively influencing quality of crops produced and improving yield over 50%.

This is similar to the findings of Ayodele (1993) and Giller (2003) who reported that inorganic fertilizer influences the quality of crops produced and improve yield over 50%. Plants that received poultry manure higher percentage nutrients (% dry matter) than plants that received cattle dung possibly because poultry manure increased the water soluble and exchangeable potassium and magnesium which exchanges yield. This is similar to the findings of Jackson (1999) who reported that poultry manure increases the water soluble and exchangeable potassium and magnesium which enhances crop yield. It is also consistent with the findings of Akintoye and Olufolaji (2005) on *Cayene* pepper. Plants that received higher rates of organic manure or inorganic fertilizer obtained higher percentage nutrients (% dry matter) than plants that received lower rates probably because of increased availability of nutrients in the soil. This is similar to the findings of Olarewaju and Showenimo (2003); Aloyu and Olarewaju (1996) who reported yield increase in pepper as nitrogen and phosphorus fertilizer levels increased in the soil.

The present study provides unique information on the following:

i. Hybrid maize variety 9022-13 which had the highest nutrient content (% dry matter) of NPK is superior to other varieties tested, and should be grown in the study area.

ii. Fertilizer application rate of 450 kg ha^{-1} whick has the highest N, P and K contents in maize plant should be adopted in maize production.

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