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RESEARCH ARTICLE

EFFECTS OF VARIOUS ORGANIC MANURE ON THE GROWTH AND YIELD OF MAIZE IN ASABA AGRO – ECOLOGICAL ZONE

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ABSTRACT

A study was carried out in 2009 at the Teaching and Research farm of Agronomy Department, Delta State University, Asaba Campus, Nigeria to evaluate the effect of various rates of different organic manures on the growth and yield of maize in Asaba agro-ecological zone. Poultry manure, pig manure and compost manure applied at 0, 4, 8 and 12kg served as the treatments**:** The experiment was arranged in a randomised complete block design, replicated three times. Generally, the responses of the maize plant in terms of plant height, leaf area, number of leaves, plant girth and yield components (corn-cob, dry grain weight of 1000 grains and numbers of rows per cob were manure type dependent with the poultry manure producing the highest values in all the parameters measured at 12kg application rate, followed by plants grown in compost manure and pig manure while the control without manure treatment recorded the least valves in all the indices measured. Based an the results, it is hereby recommended to farmers in Asaba agro-ecological zone that 12kg of poultry manure be applied to soil in order to increase the nutrient level to enhance growth and yield of maize in the area.

Key words: Organic manure, growth, yield, maize, Asaba agro-ecological zone.

INTRODUCTION

Maize ranks third in the world production of cereals following wheat and rice (FAO, 2002). It is a staple food for humans and used as feed for livestock and a principal raw material for many industrial products (Agbogidi *et al*., 2006; Agbogidi *et al*., 2007). The increasing world population especially in the sub-Saharan African demands that agricultural production should be intensified to increase food production and to reduce food insecurity (Obi, 1999; Agbogidi and Egbuchua, 2010). Over the years, grain yields have depreciated drastically due to the degrading nature of soils caused by continuous cropping, pollution and other factors. The use of organic manure in modern agriculture is now gaining ground. It helps to maintain good soil structure, increase growth and yield, maintain better crop quality as well as reduce incidence of erosion in arable farming (Youdeowei *et al.,* 1999). In the humid region, the growth of maize as a grain crop is highly affected by low fertility status arising from high rainfall and leaching (Obi, 1999). The use of manure is an indispensable agronomic practice to boost the yield of maize since it is an important source of many industrial products including corn, corn oil, corn flour, starch and alcohol (Dutt, 2005). In the past, farmers in Asaba agro-ecological area have continuously cultivated on their plots without replenishing the lost nutrients by the use of organic manure hence the expected yield of maize has never been met. It is against this background that a study as this has been embarked upon. The present study was designed to evaluate the performance of maize in terms of growth and yield as influenced by three manure types applied at different concentrations with a view to increasing the nutrient level to enhance the growth and yield of maize in Asaba agro-ecological zone.

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MATERIALS AND METHODS

Study location

The study was carried out in 2009 in Asaba (latitude: 06^0c 14'N, longitude: 06^0 49' E, temperature: 28 ± 6^0 c, rainfall: 1505-1849mm, relative humidity: 69-80% and monthly sunshine: 4.8bars), located in the rainfall agro-ecological environment (Asaba Meteorological Station, 2009).

Source of planting materials

The maize seeds (improved variety – Oba super) were procured from the International Institute of tropical Agriculture (11TA), Ibadan, Oyo State.

Land preparation and field method

A total land area of $200m^z$ was used for the study. The area was cleared manually using local tools. A spacing of 1m separated each block which was divided into 10 plots of 2x2m separated by 0.5m. The experiment was arranged in a randomized complete block design with 10, different treatments which comprised 0kg organic manure, 4, 8 and 12kg poultry manure, 4, 8 and 12kg pig manure, 4, 8 and 12kg of compost manure. Each treatment was replicated three times. Two maize seeds were planted at a spacing of 25x75cm in

each of the plots and later thinned to one strong stand at seven days after sprouting. Growth parameters were measured forthrightly as from two weeks after planting (WAP) till the plants were 10 weeks of age. Parameters measured were plant height, leaf area, number of leaves, plant girth and maize yield components.

Soil analysis

Soil samples from the study area were analysed prior to experimentation after collection with the aid of auger from each block. The samples were bulked and air-dried at room temperature of between 25 and 27^0 C for five days and crushed to pass through a 2mm sieve. Particle size distribution was determined by hydrometer method using colgon solution as dispersing agent. The soil pH was measured with a glass pH electrode after 1.1 soil/ water ratio suspension (Obi, 1990). The organic carbon content was determined by the modified wet oxidation method of Wilkey and Blark and converted to organic matter by multiplying by 1.724. Total nitrogen was determined by the micro-Kjeldahl digestion and distillation method. Available phosphorus was determined by the Bray 1 Acid Fluoride solution. Exchangeable cations were extracted with 1.1m Ammonium acetate at pH 7. Na and K were measured with flame photometer while Ca and Mg were measured with atomic absorption spectrophotometer. Cation exchange capacity was measured by Ammonium acetate technique while the percentage base saturation (%B/S) was calculated as the sum of exchangeable bases divided by the cation exchange capacity and then multiplied by 100.

Plant height was measured with a meter rule at the distance from soil level to the terminal bud, leaf area determination was derived from the length and breath measurement of the longest leaf per plant and a correction factor value of 0.75 were used to multiply the value following the procedure of Agbogidi *et al*. (2007). Number of leaves was by visual counting of the leaves, plant girth was measured with venire callipers at 3cm above soil level. The yield was determined by measuring cob weight, dry grain weight of 1000 grains and numbers of rows per cob. Data obtained were subjected to analysis of variance while the significant means were separated with the least significant difference at the 5% level of probability.

RESULTS AND DISCUSSION

The initial soil physico-chemical properties of the studied area is shown in Table 1.The soil is of sandy loam textural class with 85.55% sand, 6.00% silt and 8.45% clay. The pH is acidic and the organic matter content as well as the total nitrogen and available phosphorus are low. The exchangeable cations are significantly low while the cation exchangeable capacity (C.E.C) is relatively low indicating that the soil is marginally fertile and of low productivity and it may respond positively to organic manure to improve productivity by increase yield and contribute to food availability in the area. Generally, the response of the maize plants in terms of plant height, leaf area, number of leaves and plant girth is manure type dependent with the poultry manure performing best in all the parameters measured (Tables 1, 2, 3 and 4). In the same vain, the performance of the maize plants subjected to 12kg of poultry manure was significantly higher ($P \leq 0.05$) when compared to those grown in 4 and 8kg (Tables 1, 2,3 and 4) and when compared to maize exposed to pig manure and compost manure. For example, while the height of maize plant grown in 12kg of poultry manure at 2, 4, 6, 8 and 10WAP were 26.33, 84.67, 149.00, 183.67 and 217. 00cm, maize plants which were subjected to 4kg of poultry manure recorded 24.00, 80.33, 133.00, 169.33 and 205.33cm respectively as plant height values (Table 1). The same trend was followed with respect to other parameters viz: leaf area, number of leaves and plant girth. Compost manure also showed an appreciable performance in the growth indices measured when compared to the value obtained in pig manure (Tables 1, 2, 3 and 4).

With respect to the yield parameters, maize plants grown in soils treated with poultry manure showed significant differences ($P \leq 0.0S$) as regard corn-cob, dry grain weight, weight of 1000 grains and numbers of rows per cob when compared with those grown in soil treated with compost manure and pig manure (Table 6). Similarly, maize plants in compost manure performed better in their yield attributes when compared with those grown in pig manure. It is also evident from the result that maize plant that received no manure treatment performed poorly showing that manure is needed in the studied area to improve growth and yield of crops including maize as this had a fertilizer effect on the plant studied. The observed acidic nature of the studied area as well as the low nitrogen content could be attributed to the regular farming practices predominant in the area which is characterised by slash-and-burn agriculture, continuous cropping and non-incorporation of organic residuals into the soil. It could also be due to the high erosive effect stemming mainly from the topography of the soil. The low phosphorus content may not be unconnected to the high fixation of phosphorus by Fe^{2+} and Al^{3+}. The marginal fertility of Anwai soil has been reported by Agbogidi and Ejemete (2005) and Egbuchua (2007).

The observed significant growth of the maize plants grown in the manure treated soils over those grown in soil without manure treatment demonstrated that Anwai soil needs supplementation of nutrients for the crop growth for them to do well and have increased yield to assist the inhabitants of the area and its environs as regards food security. Besides, poultry manure at 12kg will give the optimum in terms of growth development and yield followed by compost manure. This finding supports the report of Olaturiji *et al*. (2006) that poultry manure gives the greatest increase in growth and yield in okra and tomatoes. In conclusion, this study evaluated the performance of maize plants as influenced by three manure types viz poultry manure, pig manure and compost manure at different application rates (4, 8 and 12, kg) including the control (0kg) without treatment. Poultry manure produced the highest values in terms of plant height, leaf area, number of leaves, plant girth and yield components (corn-cob, dry grain weight, weight of 1000 grains and number of rows per cob) when compared to pig manure and compost manure. It is hereby recommended to farmers in Anwai and its environs that 12kg of poultry manure be applied to soil in order to increase the nutrient level to enhance growth and yield of maize in Anwai/Asaba agro-ecological zone.

Table 1. Physico-chemical properties of the soil prior to experimentation

Characteristics	Value obtained
Particle size distribution %	
Sand	85.55
Silt	6.00
Clay	8.45
Textural class	Sandy loam
Soil pH (H_2O)	5.8
Organic Carbon (g/kg^{-1})	0.59
Organic matter (g/kg^{-1})	1.02
Total Nitrogen (g/kg^{-1})	0.062
Available Phosphorus (Mg/Kg^{-1})	7.12
Exchangeable Cations ($cmoKg^{-1}$)	
Ca	2.40
Mg	2.08
K	0.05
N	0.06
CEC ($cmoKg^{-1}$)	8.65

Table 2. Plant height (cm) of maize as influenced by various treatments

		Weeks after planting				
Application Rate		2	4	6	8	10
	0Kg	17.67	70.33	91.67	130.33	160.33
PoM	4Kg	24.00	80.33	133.00	169.33	205.33
	8 Kg	26.00	83.33	141.67	175.33	211.33
	12 Kg	26.00	84.67	149.00	183.67	217.00
PiM	4Kg	20.33	75.33	122.00	158.33	198.33
	8 Kg	20.67	75.67	125.67	160.67	201.33
	12 Kg	21.00	76.67	129.67	146.67	205.00
Co	4Kg	22.00	75.67	132.33	165.33	204.67
	8 Kg	22.33	78.00	133.33	174.00	209.67
	12 Kg	22.67	80.67	138.00	180.00	211.67
LSD (0.05)		2.06	2.65	4.19	0.09	4.06

Key: PoM = poultry manure, PiM manure =pig manure, Co = compost manure

Table 3. Leaf area of maize as influenced by various treatments (cm^2)

		Weeks after planting				
Application Rate		2	4	6	8	10
	0Kg	31.5	61.24	84.82	109.44	129.52
PoM	4Kg	39.04	71.54	95.26	125.13	143.80
	8 Kg	40.78	73.71	67.50	126.29	145.62
	12 Kg	42.81	77.11	99.60	129.76	149.47
PiM	4Kg	33.21	64.94	92.58	120.76	136.20
	8 Kg	34.80	67.01	93.54	121.98	137.95
	12 Kg	40.24	69.86	94.79	126.15	140.92
Co	4Kg	37.17	68.40	95.41	122.74	139.08
	8 Kg	39.46	70.33	96.11	123.82	142.14
	12 Kg	41.40	70.58	98.19	127.73	146.52
LSD (0.05)		2.87	1.61	1.38	1.62	1.89

Key: PoM = poultry manure, PiM manure =pig manure, Co = compost manure

Table 4. Number of leaves of maize as affected by various treatments

		Weeks after planting				
Application Rate		2	4	6	8	10
	0Kg	5.33	6.33	7.33	7.67	8.33
PoM	4Kg	6.33	7.33	8.33	9.33	10.33
	8 Kg	6.67	8.00	9.33	10.33	11.33
	12 Kg	7.00	8.33	10.00	11.00	12.33
PiM	4Kg	6.33	7.33	8.33	9.33	10.33
	8 Kg	6.67	7.67	9.00	10.00	11.00
	12 Kg	6.67	7.67	9.33	10.67	11.67
Co	4Kg	6.00	7.33	8.67	9.33	10.67
	8 Kg	6.33	7.33	8.667	10.00	11.00
	12 Kg	7.00	8.00	9.33	11.00	11.67
LSD (0.05)		NS	NS	1.13	0.99	0.85

Key: PoM = poultry manure, PiM manure =pig manure, Co = compost manure

Table 5. Plant girth of maize as influenced by various treatments (g)

		Weeks after planting				
Application Rate		2	4	6	8	10
	0Kg	1.28	1.52	2.12	2.33	2.78
PoM	4Kg	1.35	1.80	2.33	2.67	3.08
	8 Kg	1.40	1.83	2.42	2.72	3.18
	12 Kg	1.45	1.97	2.52	2.78	3.53
PiM	4Kg	1.30	1.75	2.32	2.62	3.03
	8 Kg	1.35	1.85	2.38	2.68	3.12
	12 Kg	1.38	1.93	2.45	2.72	3.22
Co	4Kg	1.35	1.83	2.33	2.63	3.20
	8 Kg	1.38	1.93	2.43	2.70	3.23
	12 Kg	1.42	1.98	2.48	2.77	3.34
LSD (0.05)		0.06	0.09	0.07	0.06	0.11

Key: PoM = poultry manure, PiM manure =pig manure, Co = compost manure

Table 6. Yield components of maize as influenced by various manure

		Weeks after planting			
Application Rate		Corn-cob (tones	Drive grain weight (tones)	Weight of 1000 grains (g)	Number of rows per/cob
	0Kg	1.38	0.99	25.00	12.67
PoM	4Kg	1.88	1.26	32.33	18.33
	8 Kg	2.07	1.52	38.33	20.67
	12 Kg	2.58	1.82	47.00	24.33
PiM	4Kg	1.68	1.17	26.67	16.33
	8 Kk	1.89	1.28	32.33	19.00
	12 Kg	2.08	1.56	39.00	20.67
Co	4Kg	1.83	1.23	31.00	17.33
	8 Kg	2.04	1.42	37.67	21.00
	12 Kg	2.35	1.74	43.67	22.67
LSD (0.05)		0.12	0.38	2.27	1.41

Key_ PoM = poultry manure, PiM manure, Co = compost manure

REFERENCES

Agbogidi, O.M. and Egbuchua, C.O. (2010). Heavy metal concentrations of soil contaminated with spent engine oil in Asaba, Delta State. *Acta Agronomica Nigeriana* (10 (1): 65 – 69.

Agbogidi, O.M. and Ejemete, O.R (2005). An assessment of the effects of crude oil pollution on soil properties, germination and growth of *Gambaya albida* (L.) *Uniswa Research Journal of Agriculture, Science and Technology* 8 (2): 148 – 155.

Agbogidi, O.M., Akparobi, S.O. and Eruotor, P.G. (2006). Yields of maize (*Zea mays* L.) as affected by crude oil contaminated soil. *American Journal of Plant Physiology* 1 (2): 193 – 198.

Agbogidi, O.M., Eruotor, P.G. and Akparobi, S.O. (2007). Effects of crude oil levels on the growth of maize (*Zea mays* L.) *American Journal of Food Technology* 2 (6): 529 – 535.

Asaba Meteorological Station (2009). National Meteorological Bulletin 2008 Lagos, Nigeria.

Dutt, S. (2005). A Handbook of Agriculture A.B.D Publisher India. Pp 116-118.

Egbuchua, C.N. (2007). Pedogenetic characterization and evaluation of some Wetland Soils in Delta State. Ph.D Thesis of Delta State University.

FAO (2002). World agriculture: towards 2015/2020. Summary report Rome

Gee, G.W. and Bauder, J.W. (1986). Maize research and production in Nigeria. Institute of Agriculture University of Ife Moor Plantation, Ibadan Nigeria.

Obi, I. (1991). Maize, its agronomy, disease, pest and food values Optimal Computer Solution Limited Enugu. Pp 106 – 108.

Obi, M.E. (1990). A laboratory manual for soil physics. University of Nigeria Press, Nsukka 153 p.

Olatunji, U.S., Ayuba, A. and Oboh V.U. (2006). Growth and yield of okra and tomatoes as affected by pig dung and other organic Measure.

Rouant, G. (1992). Maize production. Macmillan. Hong Kong. Pp 1 – 95.

SAS User's guide. Statistics. Raleigh, N.Y. (1996) 956p.

Youdeowei, A.F., Ezedinma, O.C. and Onazi, O.C. (1999). Introduction to tropical agricultural. Longman Publisher, 344p.

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