EFFECT OF POULTRY MANURE ON PERFORMANCE OF MAIZE IN MINNA, SOUTHERN GUINEA SAVANNA OF NIGERIA.

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ABSTRACT
This experiment was aimed at measuring growth and yield indices of maize as influenced by poultry manure. The experiment was a factorial experiment laid out in a randomized complete block design (RCBD), which was replicated four times. Four treatments of 0, 4, 8 and 12 tons of poultry manure plus NKP 15:15:15 (rates of 120kgN: 60kgP: 60kgK). The study was carried out at the Federal University of Technology Teaching and Research Farm, Gidan Kwano Campus, Minna. data on growth parameters (plant height, leaf area index and stem diameter) was collected at 9 weeks after planting using a meter rule to measure and data on yield parameters (grain yield, stover yield, cob weight and 100-seed weight) was collected when the maize was fully mature and was harvested then measured using a weighing balance. Data collected were subjected to analysis of variance and least significant difference was use to separate means. The results showed treatments with poultry manure plus NPK produced higher values of plant height, leaf area index, stem diameter, grain yield, stover yield, cob weight and 100-seed weight over the control plus NPK. The 12tha-1 plus NPK treatments was observed to affect the growth attributes of maize while the grain yield and cob weight of maize produced highest with 8tha-1 plus NPK treatments, 12tha-1 plus NPK produced the highest stover yield and 100 seed weight. Since 8tha-1 of poultry manure plus NPK gave the highest grain yield, it is recommended that this treatment should be use in this Minna region for maximum production of maize.
KEY WORDS: poultry manure; growth and yield of maize; Minna area.

INTRODUCTION

Maize is a cereal stable food in Nigeria and the world at large which is use for so many purposes. It originated from a direct domestication of a Mexican annual grass known as *Zea mays.* Maize is widely cultivated throughout the north, south, west, east and middle belt of Nigeria (Ojo, 2004). According to Khawar *et al*. (2007), maize has a variety of uses. Its grain is a rich source of starch, vitamins, proteins and minerals. The starch extracted from maize grain is used in making confectionary and noodles. Corn syrup from maize contains high fructose and act as sweetener and retains moisture when added to certain foods. Edible oil is extracted from seeds, which is an all purpose culinary oil. Levulinic acid, a chemical derived from stovers of maize, is used as ingredient in anti freeze and is capable of successfully address many performance related issues attributed to petroleum based chemicals and materials for example, its flexibility in feedstock, ingredients use in cosmetic compositions for perfuming. But due to the fact that maize has a high inorganic nutrients requirement in order to obtain good quality and high yields and also because of competition for maize by both man and animal, there is the need to increase the supply level of the grain. Additionally, other factors like low or poor soil fertility, price fluctuation, diseases and pests, poor storage facilities have been associated with low maize production in the country (Ojo, 2000). Studies in maize production in different parts of Nigeria have shown an increasing importance of the crop amidst growing utilization by food processing industries and livestock feed mills (Khawar *et al*., 2007; Abdurrahman and Kolawole, 2008). While the average yield of maize in developed countries can reach up to 8.6 ton/ha, production per hectare in many Sub-Sahara African countries is still very low (1.3 ton/ha) (IITA, 2007). Kimani *et al*. (2004) study the effect of organic manure and found that it has a 92% increase in maize grain yields after applying manure compared to the control.

Poultry manure also improves soil tilt, aeration, water holding capacity and stimulates micro-organisms in the soil that make plant nutrients readily available (Lal, 1997). The fertilization of soils with poultry manure can affect enzymatic activities inside the soil profile (Yang *et al*., 2008; Zhu *et al*., 2008). Proper application of organic fertilizers can increase the activities of soil micro-organisms and soil available nutrient contents (He and Li, 2004). He and Li (2004) suggested that combined use of organic and inorganic fertilizers can increase the activities of soil inverters and available nutrient content. In addition, use of poultry manure could improve the soil quality and is more profitable in environment protection when compared with application of chemical fertilizer alone (Reginald, 1995). The soil with organic manure continually applied had lower bulk density and higher porosity values, and buffering capacities (Edmeades, 2003). Poultry manures affect soil physical and chemical properties giving the soil darker colour; increases soil aggregation and aggregate stability, increases Cation exchange capacity (CEC), lowering soil pH, increasing soil microbial activity and enhance the availability of N, P and other nutrients. Organic matter takes longer time for decomposition due to presence of lignin in it that is why the addition of

organic manure trend into the soil is increasing. In recent years the focus of soil fertility research has been shifted towards the combined application of organic manure and fertilizers as a way to arrest the ongoing soil fertility decline in Sub-Saharan Africa (Vanlauwe, *et al*., 2001c). The organic sources can reduce the dependency on costly fertilizers by providing nutrients that are either prevented from being lost (recycling) or are truly added to the system (biological N-fixation). Therefore, specific objectives are to; Measure growth and yield indices of maize. Determine the influence of poultry manure on growth and yield of maize.

METHODOLOGY

Study Area: The field experiment was carried out in the Federal University of Technology Teaching and Research Farm, Gidan Kwano Campus, Minna (latitude 9° 41' N and longitude 6° 31' E; 258.5 m above sea level), in the southern Guinea savanna zone of Nigeria (Afolabi *et al*., 2014). The climate of the study area is sub-humid with a mean maximum temperature of 33.5^0C particularly in March and June. However the lowest minimum temperature occurs between December and January when the influence of tropical continental air mass blows from the north. The cropping season starts with the unset of the raining season from April to October, (Ojonuga 2006). Dominant soils of the study area include the basement complex rocks, characterized by granitic rock out crops or inselbergs which can be found in the vast topography of rolling landscape. The vegetation of study area is characterized by tall grasses interspersed with tall sparse species of Shea butter trees and locust bean trees.

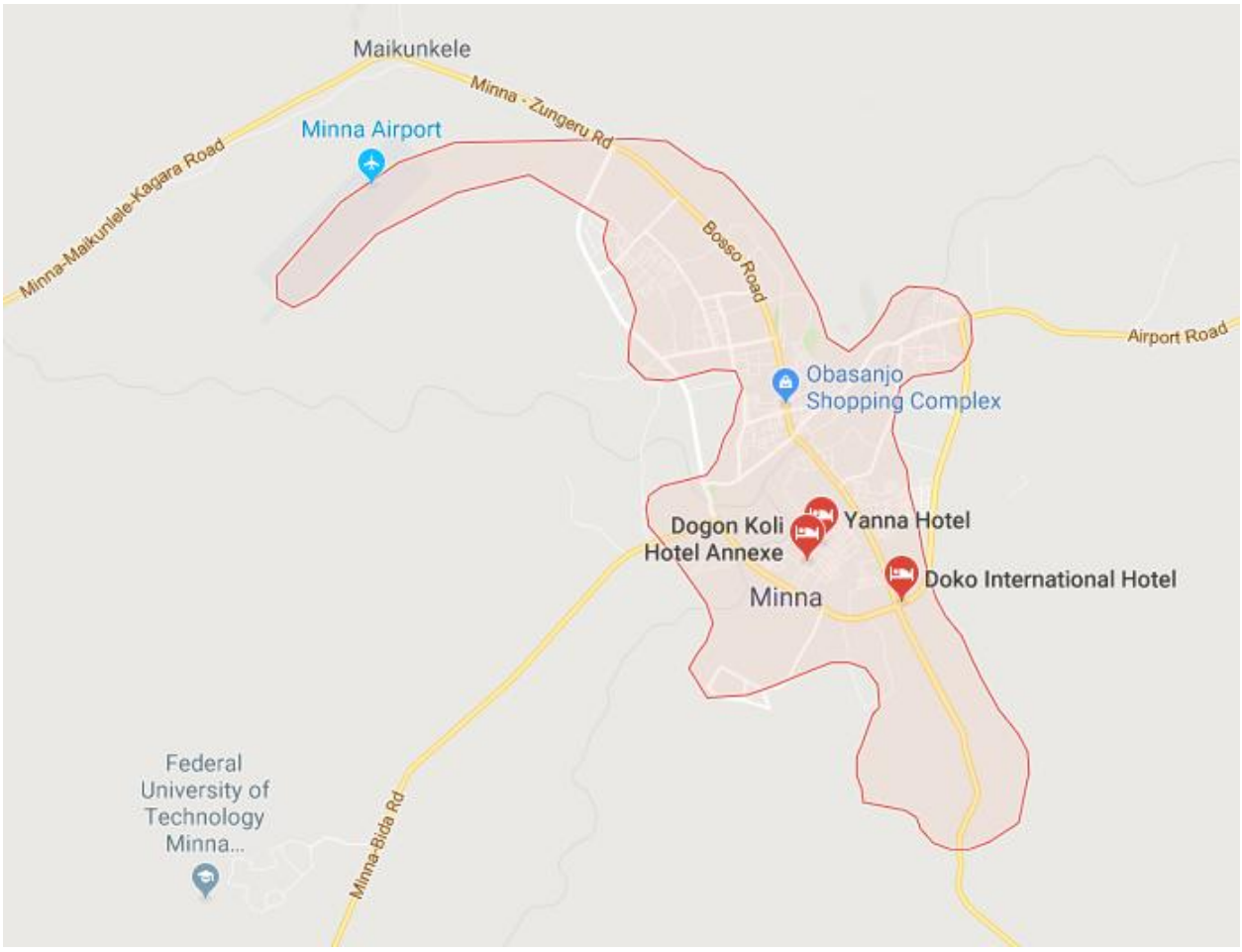

Figure1: map of Minna showing the study area

Treatments administration: The experiment was a factorial experiment laid out in a randomized complete block design (RCBD), which was replicated four times. the method of organic manure application is surface application with rates of 0, 4, 8 and 12 t/ha of poultry manure for each plot and was applied before planting. 120:60:60 kg ha^{-1} of NPK 15-15-15 was use. The dose of NPK 15-15-15 was split in two; the first dose was applied 2 weeks after planting (WAP) while the second dose was applied 6WAP. In each case the fertilizer was applied by single band about 5 cm deep, made along the plant stand, 5-8 cm away from the plant stand and covered immediately after putting the fertilizer.

Planting: The sowing method that was applied is drilling. The seeds planted was Uba Super 2 and was

planted at the rate of 3-4 seeds per hole and was later thinned at 2WAP to 2 healthy plants per stand with inter row spacing of 75cm and intra row spacing of 50cm. Weeds was handpicked for plots that are flat while for other plots (ridges and mounds), manual weeding was done using a small hoe.

Harvesting and processing: the crop was harvested at maturity or when they are fully mature (105 days after planting).the selected maize samples from the net plot was air dried and threshed for further analysis of the yield parameters.

Data collection: data for growth parameter (plant height, leaf area index and stem diameter) were collected from ten healthy plants stands from the net plot at 9 weeks after planting while the data for yield parameter of maize (Stover yield, grain yield, cob weight, 100 seed weight and cob length) were collected when the maize was fully matured and harvested.

Data analysis: Data collected were subjected to analysis of variance (ANOVA) for randomized complete blocked design (RCBD) was used to compare the effect of poultry manure on growth and yield of maize and soil physical properties. Least significant difference at 5% probability level ($LSD_{0.05}$) was used to separate means.

Table 1 Nutrient status of the poultry manure and chemical fertilizer

PARAMETER	POULTRY MANURE	CHEMICAL FERTILIZER
OC (g kg^{-1})	19.83	19.36
OM (g kg^{-1})	34.29	33.47
TN (g kg^{-1})	0.98	2.10
AP (mg kg^{-1})	26.22	4.00
K (cmol kg^{-1})	44.10	112.31
Ca (cmol kg^{-1})	135.00	183.00
Mg (cmol kg^{-1})	48.00	25.00
Na (cmol kg^{-1})	87.39	81.74

OC=organic carbon, OM=organic matter, TN=total nitrogen, AP=available phosphorus, K=potassium, Ca=calcium, Mg=magnesium, Na=sodium.

RESULTS AND DISCUSSION

Effect of poultry manure on growth attributes of maize

Plant height

The result of plant height at 9 weeks after planting (WAP) as affected by different rates of poultry manure is presented on Table 2 below. Plant height at 9WAP was observed to have no statistical ($p<0.05$) difference between the rates of poultry manure applied and control. But treatments with $12tha^{-1}$ and $8tha^{-1}$ performed better over control plus NPK. Treatment with $12tha^{-1}$ recorded the highest plant height at 9 WAP. The highest plant height at 9WAP observed might be due to highest poultry manure rate of $12tha^{-1}$ which enables adequate supply of moisture and availability of nutrient that resulted in the stimulation of the rapid growth of crop. This observation is I accordance with the result of IFA (2000) and that of Tisdale and Nelson (1990) who reported good plant growth which was attributed to adequate to good nutrient supply in poultry manure plots particularly nitrogen phosphorus and potassium.

Leaf Area Index (LAI)

The result of Leaf area index at 9 weeks after planting (WAP) as affected by different rates of poultry manure is presented on Table 2 below. Treatment with poultry manure plus NPK performed better than control plus NPK. Though, no statistically difference was observed. The treatment with the highest mean was observed from 12 tha^{-1} plus NPK followed by $8tha^{-1}$ plus NPK, $4tha^{-1}$ plus NPK and control plus NPK had the lowest LAI. This simply means that the integration of poultry manure with 120, 60, and 60 NPK gives a better LAI compare to just control plus NPK. This high LAI observed could be due to the variety (UBA SUPER 2), poultry manure use and management practices involved in this study. This is in accordance with Mulebo et el (1983) who reported a LAI of 4.4 with tropical maize using organic manure as treatments. But contrary to this, Boateng et el (2000) reported a low LAI of 2.6 with the use of $6tha^{-1}$ of poultry manure.

Stem diameter at 9 WAP

The result of stem diameter at 9 weeks after planting (WAP) as affected by different rates of poultry manure is presented on Table 2 below. Treatments with poultry manure had the highest stem diameter of maize compared to control plus NPK. The highest stem diameter was observed from the plot with 8 tha^{-1} followed by those with 12 tha^{-1}, $4tha^{-1}$ and finally the control. This result might be due to the availability of nutrients (poultry manure) which has led to the availability of reasonable moisture content and low soil bulk density in the study site. 8 tha^{-1} plus NPK seems suitable to perform better and higher than other. This corresponds with the result of Shiyan *et al*. (2015) who reported an increase in stem diameter as poultry manure increased.

Table 3: Effect of poultry manure on growth attributes of maize

TREATMENT(cm)	Plant Height 9WAP	Leaf Area Index 9WAP	Stem Diameter 9WAP
Poultry Manure			
0 (tha^{-1})	194.00b	3.66b	4.11a
4 (tha^{-1})	203.65ab	4.99a	4.20a
8 (tha^{-1})	212.63a	5.19a	4.28a
12 (tha^{-1})	213.03a	5.30a	4.21a
S.E.M (0.05)	6.59	1.56	0.09

S.E.M= standard error mean, 0.05= probability level, WAP= weeks after planting.

Effect of poultry manure on yield attributes of maize

From table 3 below, means with the same letter have no significant difference. The results show that there was no significant difference in the grain yield for the rates of poultry manure used in the study. 8 t ha^{-1} was observed to have the highest grain yield, followed by 4 t ha^{-1}, 12 t ha^{-1} and the lowest was control (0 t ha^{-1}). The observation was that all treatments with poultry manure had the highest grain yield. This implies that poultry manure (8 t ha^{-1}) integrated with NPK dose has an important role to play in achieving maximum yield of maize. This is in accordance with Boateng *et al* (2006) who reported also that poultry manure had a significant effect on the grain yield of maize compared to control.

Stover yield from table 3 was observed to be influenced by poultry manure plus NPK compare to control plus NPK. The order is 12 tha^{-1} > 8tha^{-1}> 4tha^{-1}>0tha^{-1}. 12and 8 t ha^{-1} plus NPK was observed to be statistically different with 4tha^{-1} and control plus poultry manure. This result implies that increase poultry manure at rates 4, 8 and 12tha^{-1} had the ability to increase the stover yield of maize. This is in accordance with Vasanthi and Kumar (2000) who reported that integrated application of organic and inorganic fertilizers might be desirable than either one of the fertilizers alone and that poultry manure and chemical fertilizer rates yielded significantly greater amounts of stover yield.

The cob weight of maize was observed to be influenced by poultry manure plus NPK compared to the control plus NPK. From the table3, poultry manure rates of 8$tha^{-1}$and 4tha-1 and 12$tha^{-1}$was observed to be statistically not different but were observed to be statistically different compared to the control as means with the same letter are significantly not different while means with different letters are statistically different. This implies that poultry manure integrated with NPK at 4tha^{-1} or increased to 8tha^{-1}+NPK perform better to give a maximum cob weight of maize. These observations are in accordance with Shiyam *et al* (2014-2015), who reported that cob weight and 100-seed weight of maize increases with increase in poultry manure rates.

100-seed weight of maize was observed to be affected by poultry manure. From table3, the results show that treatments with poultry manure plus NPK affect the 100-seed weight of maize compared to the control plus NPK. 12tha^{-1}, 8tha^{-1} and 4tha^{-1} (27.21a & 27.09a & 25.99ab) were observed to be statistically not significant while 8tha-1 and control (25.99ab & 24.54b) were also not significantly different. This means that increase in poultry manure rates from 4tha^{-1} and 12tha^{-1} plus NPK had the tendency to increase the 100-seed weight of maize. Shiyam *et al* (2015) also reported that any increments in poultry manure will results to increases in 100-seed weight of maize.

Table 2: Effect of poultry manure on yield parameter of maize

TREATMENT	Stover yield (Kg)	cob weight (Kg)	Grain yield (Kg)	100 seed Weight (g)
Poultry Manure				
0 (tha^{-1})	2.94b	1.96b	1.57a	24.54b
4 (tha^{-1})	3.36b	2.50a	2.16a	27.09a
8 (tha^{-1})	4.16a	2.53a	4.48a	25.99ab
12(tha^{-1})	4.43a	2.39ab	2.06a	27.21a
SEM (0.05)	0.28	0.16	1.22	0.84

S.E.M=standard error mean, 0.05= probability level

CONCLUSION

The study indicates that poultry manure is a valuable fertilizer whose use needs to be encouraged. From this study, it is safe to conclude that 12tha-1of poultry manure plus NPK is suitable for maximum growth attributes (plant height, leaf area index, and stem diameter) of maize. Also it is observed that the grain yield of maize perform best with treatments who received 8tha-1 of poultry manure,12tha-1plus NPK gave the best stover yield and stem diameter

performed best with treatments receiving 12tha-1 of poultry manure plus NPK. Since 8tha-1 of poultry manure plus NPK gave the highest grain yield, it is recommended that this treatment should be use in this Minna region for maximum production of maize.

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