

EFFECT OF ORGANO -MINERAL FERTILIZER ON GROWTH AND YIELD OF MAIZE (ZEA MAYS. L) AT IGBARIAM, SOUTHEASTERN, NIGERIA.

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ABSTRACT:

The effect of organo-mineral fertilizer on the growth and yield of maize (*Zea mays. L*) was studied in field trial at Igbariam between July and October 2012 farming season. The experiment was a randomized complete block design with four replicates. A 12kg pig manure (pm), 319g urea (equivalent to 150kg/ha), 6kg pig manure + 196g urea (PMU-organo-mineral fertilizer) and no treatment (control) were evaluated. Data collected were subjected to an analysis of variance test based on randomized complete block design (RCBD) and treatment means were separated using least significant difference (LSD = 0.05). The application of organo mineral fertilizer significantly ($P=0.05$) increased plant height, leave area index at 90DAP, number of maize cobs, maize ear length and maize grain yield over other treatments. Though its effect was not significant in leave area index at 45DAP. The result showed that the maize grain yield increased relative to the control by 0.30t/ha, 0.18t/ha, 0.09t/ha respectively for PMU (organo-mineral), urea (U), pig manure (PM) and control (CO). The study indicated that untreated plot showed least performance values in all the parameters measured. Based on the result of the study the organo mineral fertilizer has performed competitively better than all the other treatments applied and therefore can be used for effective maize production.

Key words: Pig manure, Urea, Organo Mineral, Crop Growth, Grain Yield.

INTRODUCTION:

Maize (*Zea mays. L*) is an important cereal crop in Nigeria and in the world after wheat and rice with regard to cultivation areas and total production. It is a very source of calories for man and livestock in tropical countries. The grains are raw material for brewing industry, while the starch is used in textile industry and baby weaning food. Maize is widely adopted crop, capable of production during the appropriate season in almost all parts of the world where farming is done (Akande and Lamidi, 2006). However, the maize production in tropical soils such as Nigeria and many African countries are constrained by the nutrients deficiency problems as a result of soil erosion, crop

harvesting and prevailing environmental conditions (Ayoola, 2006, Donovan and Casey, 1998). With this trend soil nutrients that will boost crop growth and yield decline progressively unless the nutrients are replenished through the use of organic manure or mineral fertilizers. The impact of organic manure and mineral fertilizers on soil nutrient however, differ when they are surface applied or are incorporated into the soil (Steinhardt, 2001). Due to high cost and scarcity of chemical fertilizer, most farmers cannot afford the use and under intensive cultivation it is often associated with soil acidity and nutrient imbalance (Ojeniyi, 2000). Organic manure which is cheap, readily available and environmentally friendly can be used as an alternative to chemical fertilizer to maintain sustainable crop yield and soil fertility. Its application has shown to sustain crop yield better nutrient recycling and soil productivity (Belay et al., 2001; Mutuo et al., 2000; El-Shakweer et al., 1998; Lai 1998).

However, the organic manure release nutrients rather slowly and they are rarely available to small scale farmers in the required quantities (Nyathi and Cambell, 1995). Therefore, there exist the needs for more attention on the integrated nutrient supply involving organic and inorganic fertilizers. Hence the essence of this study was to investigate the effect of organo-mineral fertilizer on the growth and yield of maize at Igbariam Anambra State Southeastern Nigeria.

MATERIAL AND METHODS.

The experiment was carried out at the teaching and research farm of the department of crop science and Horticulture in the faculty of Agriculture, Anambra State University, Igbariam Campus, Anambra State of South Eastern Nigeria, between July and October, 2012.

The experimental site lies between latitude $06^{\circ} 14'N$ and longitude $06^{\circ} 45'E$. The rainfall pattern is bimodal between April and October, with a mean annual rainfall of 1268.4mm. The dry season falls between November and March. The relative humidity (RH) of the study area is moderately high all the year round with the highest RH of 85% during the wet season and the lowest 64% occurring during the dry season. The temperature range is between $21^{\circ}C - 35^{\circ}C$. The soil

is of the sandy clay loam textural class and poorly drained, classified as Ultisol (FDALR, 1985).

Experimental Design and Treatment Allocation.

The experiment was laid out in a randomized complete block design (RCBD), with four (4) replicates to give 16 plots, each measuring 3m x 4m. Plots were separated from each other by 0.5m path and each block was separated by 1m alley. The study area was cleared of the natural vegetation and cultivated using hoe. Treatment consisted of the appropriate rate of pig manure and urea fertilizer, the detail are as follows:

12kg/ plot pig manure (PM), this was applied evenly on the plot and incorporated into the soil one week before sowing to allow mineralization of nutrients in the fertilizer.

391g/ plot Urea (U) equivalent to 150kg/ha, was applied two weeks after planting using ring method.

6kg pig manure (PM) +196g/ plot Urea equivalent to 75kg/ha (PMU), was mixed thoroughly and applied using ring method at two weeks after planting.

0kg/plot was a control that received no treatment application.

The treatment summaries are:

12kg/plot pig manure (PM)

391g/plot urea (U)

6kg pig manure + 196g urea (PMU=Organo-mineral fertilizer)

0kg/plot control (Co)

Each treatment was replicated four (4) times. Soil samples were collected from the four blocks with an auger drilled at 20cm depth and were bulked together and analyzed for the physical and chemical properties of the soil. Two maize seeds were planted per hole at the spacing of 75cm x 25cm and at a depth of about 2cm. This was done one week after the incorporation of the pig manure. The seedling was thinned down to one plant per stand two weeks after germination. Empty stands were supplied. Weeding was done manually with hoe at 2 weeks interval till harvest.

Agronomic Parameter Studied

10 maize plants/plot were measured for height at the end of the study with a meter rule. Leaf area index at 45 and 90days after planting was

measured and calculated using the length x width summed over the land area x 0.75 (Watson 1947). Data were also collected on number of cobs per plant ear length at 90days after planting using calibrated meter rule. At maturity the grain from the tagged plants/plot were harvested and dried to 14% moisture content. The grain harvested from the tagged plant was weighed to get its yield per plot in tons/ha.

Data Analysis

Data collected from the study were subjected to the analysis of variance procedure for a randomized complete block design according to Steel and Torrie (1980), LSD at 0.05 was used to compare mean differences.

RESULTS AND DISCUSSION

Initial properties of the soil:

Table 1 show that the soil of the experimented site is a sandy clay loam with values of 42.20%, 22.0% and 22.0 of sand, silt and clay respectively. The table equally shows low contents of organic matter % (1.62) and carbon % (0.94). While available P (2.62 mgkg⁻¹) was below the medium range and the soil acidic with pH value of 4.9 according to the ratings and pH range classification of Landon (1991). The soil of the experimental site was found to contain low level of the major plant nutrients.

Effect of organo-mineral fertilizer on maize height.

The result in Table 2 indicated that organo-mineral fertilizer significantly affected the maize height. The tallest plant was recorded from PMU (organo-mineral fertilizer), this was followed by the value obtained from PM (Pig manure) and the least value was recorded from control. The order of the treatments influence on plant height are CO<U<PM<PMU. The differences in the plant height could be as a result of differences in plant nutrients applied. Increase in plant height following organic and inorganic amendment was reported by Obi and Ebo (1995b). Ahmed et al., (2007), also reported same in sorghum while Ayoola and Makinde (2009) from their studies reported better height of maize when treated with mixture of organic and inorganic fertilizer.

Table1 Soil physical and chemical properties of the experimented site before planting:

Parameter	Unit	Value
Coarse Sand	gkg ⁻¹	14.2%
Fine Sand	“	42.2%
Clay	“	22.0%
Silt	“	22.0%
Texture		Sandy Clay loam
PHCH ₂ O	“	4.9

OM%	“	1.62
C%	“	0.94
Total N%	“	0.20
Exchangeable Cat ions		
Na ⁺	CMol(+)kg ⁻¹	0.25
K ⁺	“	0.26
Ca ⁺	“	1.6
Mg ⁺	“	1.8
Avail P.	Mgkg ⁻¹	2.80

Effect of organo-mineral fertilizer on the number of cob/plant.

The data in Table2 showed that PMU had significant effect on the number of maize cobs compared to the other treatments applied.

The highest number of cobs of 1.70 was obtained from plots treated with PMU, and the least value of 1.10 was gotten from control plot. The order of increase in the number of maize cobs obtained from the treatments are PMU>U>PM>CO. However the numbers of maize cobs recorded in PMU, and Co are statically similar. The increased number of maize cobs in PMU may be attributed to more photosynthetic activities of the plant on the account of adequate supply of nitrogen in the PMU. Nitrogen is an essential requirement of cob growth and cob serve as temporary storage organ and a conveyor of nutrient to the development of kernels (khan et al., 2008). This increase in number of maize cobs was equally reported by Rajeswari et al., (2007) and khan et al., (2008) with increasing rate of nitrogen fertilizer from different sources and a mixture of inorganic fertilizer inclusive.

Table 2 Effect of the organo-mineral fertilizer on maize height, Number of Cobs/plant and ear length.

Treatment	Height(CM)	Number of Cob/plant	Ear length(CM)
PM	169.20	1.18	20.80
U	123.70	1.53	24.40
PMU	192.20	1.70	26.30
Co	120.30	1.10	18.20
LSD0.05	24.80	0.37	2.57

PM= Pig manure, U= Urea, PMU= Pig manure + Urea, Co= Control.

Effect of organo-mineral fertilizer on Ear length.

The value recorded for ear length indicated that PMU gave the highest value of 26.30 cm and this value was very significant when compared to PM and Co treatments. Though there was no statically difference between PMU and U values as well as PM and CO values the result showed that PMU>U>PM>CO. Ear or cob length is an index of better economic yield of maize, that is, it is an important yield contributing parameter of maize. It contributes to grain yield per cob and grain size. Rajeswari et al., (2007), and khan et al (2008) reported significant increase in maize ear length with increasing rates of fertilizer from different sources.

Effect of organo-mineral fertilizer on the leave area index of maize plant at 45 and 90DAP.

The Leaf area index measured at 45 showed no significant effect among the treatments applied. However the result in table3 showed that PMU had more broad leaves than the other treatments. The trend of differences is the values obtained from the treatment plots are

PMU>U>PM>CO. The effect of organo-mineral fertilizers was not noticed on the leaf area index at 45DAP, as organic fertilizer needed some period of decomposition in order to release nutrients that help in the formation of dark green color of the leaf. Zsolany and Gorlitz (1994) made similar report in their work on the effect of drought and long term fertilization.

The leaf area index at 90DAP was significant (P=0.05). The plot treated with PMU gave the highest value of the leave area index with a value of 49 though the value at the leave area index obtained from PM and U are statistically similar, the results indicated that there was an increase in value of the leave area index relative to the control plot.

Similar observation was made by Olawuyi et al., (2010) and Makinde (2007), who reported highest leaf area per plant and leaf area index on the combined rates of compost with inorganic fertilizer.

Effect of organo-mineral fertilizer on the grain yield of maize

The grain yield result of a crop is the out put effect of all the complex morphological and physical processes that occur throughout the growth and development of a crop. Hence the importance of yield results in crop experiments. The grain yield in table 3 was significant ($P=0.05$). The highest grain yield of maize of 0.3ton/ha was obtained from combined rates of pig manure and Urea. The plot differs significantly from every other plot. The plots treated with urea fertilizer increased maize grain yield over control plots and pig manure plots though there was no statistical significant difference between the plots treated with pig manure and plots treated with Urea. The trend of the grain yield increase relative to control was $PMU>U>PM>Co$. The increase in maize

grain yield could be attributed to better growth and yield attributing factors better nutrient use efficiency and better grain development. There is a synergistic effect in the combination of organic and mineral fertilizer which improved nutrient release and uptake by maize crop leading to an increase in the grain yield. Mugendi et al. (1999) reported an increase in the grain yield in a *Leucaena* biomass combined with mineral fertilizer as compared to sole use of mineral fertilizer or Sole *Leucaena* biomass. Yield increases in Mushroom cultivation with the application of combination of organic and mineral fertilizers were also reported by Adeoye et al., (1998).

Table 3 Effect of organo-mineral fertilizer on the Leaf area Index at 45 & 90 DAP and grain yield tons/ha

Treatment	45DAP	90DAP	Grain yield tons/ha
PM	14.66	40.53	0.11
U	17.01	41.06	0.18
PMU	20.28	50.49	0.30
Co	9.35	33.08	0.09
LSD	NS	4.71	0.04

PM= Pig manure, U= Urea, PMU= Pig manure + Urea, Co= Control, DAP= Days after planting.
NS= Non significant.

CONCLUSION

This study has shown that in Igbariam agro ecological Zone of south East Nigeria, that a complementary use of organic manure like pig manure and mineral fertilizer like Urea otherwise called organo-mineral can boost the yield of maize crop. The organo-mineral fertilizer significantly increased maize yield relative to control and therefore has been suggested to maintain better yield of maize on sustainable basis than using inorganic manure. Also it improves and maintains soil fertility and more friendly to the environment than Sole inorganic fertilization.

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