Effect of poultry dropping and inorganic fertilizer on the growth and yield of maize (*Zea Mays*)

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ABSTRACT.

A field experiment was conducted at the Teaching and Research Farm of Crop Production Department, Federal University of Technology Minna, Gidan Kwanu Campus to determine the effect of organic manure (poultry dropping) and inorganic fertilizer (NPK) on performance of maize. The Samaru 13 maize cultivar, which is extra early, yellow in colour was used. The experiment was arranged in a randomized complete block design with three replications. The treatments consisted of 6t/ha of poultry dropping , NPK 15: 15: 15 at the rate of 100kgN, 60kg P_2 0_5, and 60kg K_20 and combination of poultry dropping plus inorganic fertilizer. Application of poultry dropping, poultry dropping plus inorganic fertilizer did not show any significant ($p>0.05$) difference in plant height at 3WAS. However, significant ($p<0.05$) difference was observed in plant height at 6 and 9 WAS respectively. Application of poultry dropping plus inorganic fertilizer recorded highest plant height while lowest plant height was recorded when poultry dropping and inorganic fertilizers were applied. There was significant ($p<0.05$) difference in leaf length at 3 and 6 WAS, however, no significant ($p>0.05$) difference was observed at 9WAS when poultry dropping, poultry dropping plus inorganic fertilizer were applied. There was no significant ($p>0.05$) difference in the number of leaves at 3WAS, but significant ($p<0;05$) difference was at 6WAS. Application of poultry dropping, poultry dropping plus inorganic fertilizer resulted in highest number of leaves at 9WAS. Also, The result shows that application of poultry dropping, plus inorganic fertilizer resulted in highest grain weight while lowest was observed when inorganic fertilizer was applied.

Key words: poultry dropping, Inorganic fertilizer, Plant height, Number of leaves, Grain yield.

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INTRODUCTION

A number of factors are responsible for the low yield of maize with inappropriate crop nutrient management and poor soil fertility being the most important factors. Nitrogen plays an important role in the growth and yield of maize, (Arshad, 2003) . Nitrogen in tropical Africa has usually been a limiting factor of production due to its largely taken-up mostly by all plant, nitrate is mobile in soil, which can be leached beyond effective root zone of most crops and washed away after high intensity of rainfall. In tropical countries high cost and scarcity of inorganic fertilizers have effect on the level being applied to crops (Akande *et al,* 2007). The use of mineral fertilizer is the most effective and convenient way to improve soil fertility, there is presently a serious negative balance in the nutrient budget of soil in the country posing a major constraint to sustainable soil management for increased crop growth and yield (Akande, 2005).

Bahrani *et al.,* (2007) reported that the use of organic fertilizer together with chemical fertilizer compared to the addition of organic fertilizer alone had a higher positive effect on microbial biomass and hence soil health. Application of organic manure in combination with chemical fertilizer has reported to increase absorption of N ,P and K in sugarcane leaf tissue, guinea corn, and maize plant and raton crop compared to chemical fertilizer alone (Sakurai and Kokhkar, (2005).

The use of organic inputs such as crop residues, manures and compost has great potential for improving soil productivity and crop yield through improvement of the physical, chemical and microbiological of the soil as well as nutrient supply (Malaiya *et al.,* 2004). If sustained productive agriculture is to be achieved , practices which maintain or increase soil organic matter in tropical soil must be adopted. The use of organic fertilizer has not been sufficiently explored. The extent to which organic fertilizer could increase the efficiency of applied mineral fertilizers in sustaining soil and crop productivity has not received much research attention. Integrated plant nutrition increases crop yields more than either use alone (Quansah, 2000). As human population grows, soil nutrient is gradually depleted when farmers are unable to sufficiently compensate losses by returning nutrients to the soil via crop residues ,manures, fallowing and mineral fertilizers (Feng and Liv, 2009). Increasing pressures in agriculture result in much higher nutrient outflows and the subsequent breakdown of much traditional soil fertility maintain strategies. The traditional fertility strategies such as fallowing, intercropping cereals with legumes, manuring, producing mixed cropping with livestock farming.

Fianu (2001) reported that soil nutrient replenishment is a prerequisite for halting soil fertility decline through mineral and organic fertilizer application. The objectives of this research was to determine the effect of poultry dropping and NPK fertilizer on the performance of maize.

MATERIALS AND METHODS

The field experiment was conducted at the Teaching and Research Farm of the Federal University of Technology Minna, Gidan Kwanu Campus(longitude 6.30^{o}E and latitude 9.30^{o}N) with average annual rainfall of 1219mm, mean temperature range between 26^{o}C - 39^{o}C. The treatments consisted of poultry droppings, inorganic fertilizer (NPK), and poultry droppings plus inorganic fertilizer. Each treatment was in a gross plot area of 9m^2 (3m x 3m) containing six ridges of maize and laid out in single factorized experiment with pathway of 1m apart. Plot size used for the experiment was 24m x 15m (360m^2).

Soil samples were taken at random for soil analysis at the depth of 0-20cm form top soil and 20-40cm for sub-soil. The organic fertilizer (poultry droppings) was applied by broadcasting method and incorporated into the soil after two weeks of application. The inorganic fertilizer was applied at the rate of 100kgN, 60kg P_2 0_5, and 60kg K_20 in split application. First dose was applied at the rate 60kg N, 60kg P_20_5, 60kg K_20 at 2 weeks after plating and top dressed with 40kgN of urea at 6 weeks after planting.

The variety of maize used in this experiment was sammaz 13. This variety is yellow in colour and matures within 80 days . Four plants were randomly selected from the net plot and tagged Data collected include plant height, number of leaves, leaf length, cob length, cob weight and grain weight.

Data collected were subjected to analysis of variance (ANOVA). Mean comparison for significant difference was done using Duncan's Non Multiple Range Tests at 5% level of significance.

RESULTS AND DISCUSSION

Application of poultry dropping, poultry plus inorganic fertilizer showed no significant ($P>0.05$) difference in plant height at 3WAS, however, application of inorganic fertilizer showed significant ($P<0.05$) difference at 3WAS (Table 1). The highest plant height was observed when poultry dropping plus inorganic fertilizer was applied. Significant

(P<0.05) difference was observed in leaf length at 3and 6WAS, however, no significant (p>0.05) difference was observed at 9WAS when inorganic fertilizer, poultry dropping plus inorganic fertilizer was applied. This is in line with the findings of Corrcia *et al*.,(2005) who confirmed that manure provide maize with nitrogen requirement for optimum vegetative and reproductive growth. Pool *et al*.,(2005) also reported that the positive effect of changes in K, Ca, and Mg levels upon application of poultry manure had improve maize growth in height, leaves length, and number of leaves.

Table 1: Effect of poultry dropping and inorganic fertilizer on plant height and leaf length.

	Plant height (cm)			Leaf length (cm)		
Treatment	3WAS	6WAS	9WAS	3WAS	6WAS	9WAS
Poultry dropping	32.85a	72.33b	189.33b	32.92a	61.25bc	93.58b
Inorganic fertilizer	27.07b	73.00b	198.07ab	26.50b	63.66b	94.75a
Pd + Inorganic	31.83a	85.17a	206.07a	29.40ab	67.91a	94.08a
Control	27.83b	45.42c	77.55c	26.50b	57.73c	80.08c
SE±	0.83	4.42	15.85	0.96	1.10	1.92
	*	*	*	*	**	*

The mean followed with different letters indicated in column was significantly different at 5% and 1% level of probability recorded using Duncan Multiple Range Test.

Pd = poultry dropping

SE ± = Standard error

* = Indicate it is significant at 5% (P < 0.05)

** = Indicate it is significant at 1% (P < 0.01)

Table 2: Effect of poultry dropping and inorganic fertilizer on leaf diameter (cm) and number of leaf

	Leaf diameter (cm)			Number of leaves		
Treatment	3WAS	6WAS	9WAS	3WAS	6WAS	9WAS
Poultry dropping	3.67a	8.17a	10.85b	4.40a	8.72b	13.04a
Inorganic fertilizer	3.82a	8.43a	11.78a	3.55a	10.04a	11.90b
Pd + Inorganic	3.86a	8.37a	11.70a	4.07a	9.91a	12.3a
Control	2.9b	6.69b	9.93c	3.37E9b	7.35c	10.73c
SE±	0.117	0.208	0.241	8.3422E8	0.351	0.256
	*	*	*	N/S	**	*

The mean followed with different letters indicated in column was significantly different at 5% level of probability recorded using Duncan Multiple Range Test.

Pd = poultry dropping

SE± = Standard Error

NS= No significant difference (P> 0.05)

* = Indicates it is significant at 5 %(P <0.05)

** = Indicate it is significant at 1% (P<0.01)

There was no significant (p>0.05) difference in number of leaves at 3 WAS, however significant (P<0.05) difference was observed at 6 and 9WAS (Table 2). Application of poultry dropping, inorganic fertilizer, poultry dropping plus inorganic fertilizer did not show any significant difference in leaf diameter at 3and 6 WAS ,but significant difference(p<0.05) was observed at 9WAS. Table 3 shows that there was a significant difference (P<0.05) among the treatment with respect to 100grain weight. Application of poultry dropping recorded highest 100grain weight ,while the lowest 100grain weight was recorded where no fertilizer was applied, these was in agreement with Sharif *et al.* (2004) who reported that 1000-grain weight was significantly affected by recommended dose of fertilizer in combination with FYM in maize varieties. There was a significant difference (P<0.05) in gross grain weight per plot, highest grain weight was observed where poultry dropping was applied followed by where poultry dropping plus inorganic fertilizer was applied while no fertilizer application recorded lowest grain weight. There was significant difference (P<0.05)

in net grain weight per plot; highest grain weight was obtained where poultry dropping was applied while lowest grain weight was observed at zero fertilizer application. These results were similar to the findings of Nagassa *et al.* (2005) who revealed that grain yield was significantly improved by N fertilizer in combination with farm yard manure. Research by Zhao *et al*. (2003) showed that dry weight of plants obtained on fertilizer treatment was lower than the poultry manure, cow manure and barley mulch plots experiment carried out for three years.

Table 3: Effect of poultry dropping and inorganic fertilizer on 100grain weight, Gross grain weight

	1	2	3
Treatment	100 grain wt. (g)	Grain wt. in gross plot (kg)	Grain wt. in net plot (kg)
Poultry dropping	26.69a	3.70a	1.54a
Inorganic fertilizer	22.79ab	2.80b	1.35b
Pd +Inorganic	26.14a	3.55ab	1.50a
Control	22.64	0.92bc	0.52c
SE±	1.44	0.25	0.13
	*	*	*

The mean followed with different letters indicated in column was significantly different at 5% level of probability recorded using Duncan Multiple Range Test.
Pd = poultry dropping

SE ± Standard Error

* Indicate it is significant different at 5% ($P < 0.05$)

Table 4 Shows that there was a significant difference ($P<0.05$) among the treatment with respect to cob length (cm) ,application of poultry dropping resulted in highest cob length while the lowest cob length was obtained where no fertilizer was applied.

There was a significant difference ($P<0.05$) in cobs weight before shelling; highest cob weight was obtained where poultry dropping was applied, while the lowest cob weight was observed where no fertilizer was applied. There was significant difference among the grain weight recorded after shelling; highest grain weight was recorded where poultry dropping was applied while lowest grain weight was obtained where no fertilizer was applied. Bahrani

et al., (2007) reported that the incorporation of plant residual and manure not only improved the soil physicochemical properties but increased the yield of crop significantly.

Pool *et al*. (2005) reported positive effect of changes in K, Ca, and Mg levels upon application of poultry manure had improved maize growth in height, leaves length, number of leaves. At 3WAS there was no significant difference (P>0.05) in number of leaves..

Table 4: Effect of poultry dropping and inorganic fertilizer on cob length (cm), cob weight before shelling (kg) and grain weight after shelling.

	1	2	3
Treatment	Cob length (cm)	Cob wt. before shelling (kg)	Grain wt. after shelling (kg)
Poultry dropping	18.64a	0.73a	0.19a
Inorganic fertilizer	15.23c	0.45b	0.154b
P d + inorganic	17.16b	0.65a	0.177ab
Control	10.69d	0.23c	0.093c
SE±	0.92	0.60	0.01
	*	*	*

The mean followed with different letters indicated in column was significantly different at 5% level of probability recorded using Duncan Multiple Range Test.

SE ± Standard Error

Pd = poultry dropping

* Indicate it is significant different at 5% (P<0.05)

The result obtained with respect to cob length shows that poultry dropping plots gave the longest cob length (18.64cm) while the lowest cob length was recorded where no fertilizer applied. Coerrcial *et al*. (2005) confirmed that manure provides nitrogen requirement for optimum vegetative and reproductive growth for maize. The half poultry dropping plus one half rate of inorganic fertilizer yielded higher than those with full dose of NPK alone, this implies that integrated application of organic and inorganic fertilizer might be more productive than either type of inorganic fertilizers alone, which supply nutrient slowly, reduce leaching and last in productivity of the soil. This is in agreement with the findings of Vasanthi and Kumaraswamy, (2000) who reported that poultry manure plus one-half rate chemical fertilizer rate gave higher yield in the amount of green fodder of corn than full rate

of NPK alone.

Rasool *et al.* (2008) observed that grain yield and uptake N, P and K by maize were higher with application of manure and inorganic fertilizer. Bahrani *et al*., (2007) showed that the incorporation of plant residual and manure not only improved the soil physicochemical properties but increased the yield of crop significantly. From the result recorded in this study, the use of poultry dropping produced highest maize grain yield.

The result showed that plant height was positively correlated with application of poultry dropping plus inorganic fertilizer. This result was supported by many researchers; Corrcia *et al.* ,(2005) who confirmed that manure provide maize with nitrogen requirement for optimum vegetative reproductive growth. Pool *et al*., (2005) also reported that the positive effect of changes in K, Ca and Mg levels upon application of poultry manure had improve maize growth in height, leaf length, and number of leaves. The result also shows that application of poultry recorded highest grain 100 grain weight which is in line with the work of Sharif *et al.*, (2004) who reported that 100g weight was greatly affected by recommended dose of N fertilizer in combination with FYM in maize varieties. These results were similar to the findings of Nagassa *et al*., (2005) who observed that grain yield was significantly improved with by N fertilizer in combination with farm yard manure. The maize cob length was also significantly affected by the application poultry dropping which was also in line with the findings of Bahrani *et al*.,(2007).The authors reported that the incorporation of plant residual and manure not only improved the physicochemical properties but also increased the yield of the crop significantly. Corrcia *et al.,*(2005) also observed that half poultry dropping plus one half rate of inorganic fertilizer yielded higher than those of NPK alone, this implies that integrated application of organic and inorganic fertilizer might be more productive than either type of fertilizer alone. This is in agreement with the work of Vasanthi and Kumaraswamy (2000) who reported that poultry manure plus one- half rate of chemical fertilizer gave higher yield in the amount of green fodder of corn than full rate of NPK alone. The integrated use of poultry dropping and inorganic fertilizer resulted in higher maize grain yield . This also agreed with the findings of Rasool *at al.,* (2008) that grain yield and uptake of N, P and K by maize were higher when manure and inorganic fertilizer were applied. From the result recorded from this study, the integrated use of poultry manure and inorganic fertilizer produced high grain yield of maize.

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