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Growth and Yield Characteristics of *Abelmoschus Esculentus L.* (Okra) Influenced by Application of Poultry Manure and Npk Fertilizers on the Jos Plateau

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Abstract:- This experiment was conducted at Federal College of Forestry demonstration farm Jos, to determine the influence of Poultry Manure and NPK fertilizer on growth and yield of *Abelmoschus esculentus L.* during the 2018 growing season. A randomized complete block design (RCBD) with four treatments that were replicated three times was used. Characters assessed are germination percentage, plant height, number of leaves, number of branches, days to 50% flowering, number of fruit per plant, fruit length, fruit diameter, fresh fruit per plant weight and yield of okra. Results obtained indicate significant differences of growth and yield of *Abelmoschus esculentus L* between the treatments. Combine application of poultry manure produces the highest germination percentage (82.0%), plant height (53.2cm), number of leaves (27.3), number of branches (17), days to 50% flowering (41.5), number of fruit per plant (65.8), fruit length (13.4cm), fruit diameter (3.3cm), fresh fruit per plant weight (10.7g) and yield (3.3 tons/ha). It could be deduced from the findings of the experiment, that combine application of poultry manure and NPK fertilizer may be recommended to the farmers of *Abelmoschus esculentus L.* for better yield in the study area.

Keywords:- *Okra, Growth, Yield, Source, Organic Manure, Inorganic Fertilizer.*

I. INTRODUCTION

Abelmoschus esculentus (L.) Moench. Popularly called Okra is found to be an important vegetable crop in both tropics as opined by Ojo et al. (2012). This crop is widely cultivated in West Africa, particularly Nigeria, where it is used as a result of its high nutritional value in diets (Smith and Ojo, 2006). Okra is mainly cultivated for its fruits and can be consumed, raw, cooked or fried in virtually all West African countries. It is also an important ingredient of soups (Molik et al., 2016). The fruits can be conserved for long when dried. The roasted seeds are taken as coffee substitutes; the broad leaves and flower buds can be eaten as cooked greens (Ajari et al., 2003). The fresh fruit serves as a good source of vitamins, minerals and plant protein (Eke et al., 2008). Tiamiyu et al. (2012) stated that okra fruit contains about 20% edible oil and protein, while its mucilage is utilized for medicinal purposes. The mature stem contains crude fibre which is used in paper industries and for making ropes (Ojo et al., 2012).

According to Economic Commission for Africa (2001), soils of the tropics are greatly affected by a series of decline in soil fertility and erosion, resulting in nutrient depletion and reduced soil organism populations (Akande et al., 2003). This poses a major production constraint in West Africa, particularly Nigeria, and is becoming increasingly critical to secure sustainable soil productivity (Oladotun, 2002), as a result of inadequate supply of inputs, resulting in relatively low fruit yields, (Ibrahim et al., 2012). Even in situations where high yielding cultivars are grown, the inherently low soil fertility status, associated with inadequate application of fertilizers, remains the key factor to the production okra, in the guinea savannah regions of Nigeria (Ibrahim et al., 2014). The use of fertilizers according to research can improve crop yield, soil pH, total nutrient content, and nutrient availability, but its usage is limited due to scarcity, high cost, nutrient imbalance and soil acidity. The use of manures as a means of maintaining and increasing soil fertility has been advocated by Akande et al. (2003).

Due to inadequate or non availability of inorganic manure coupled with its high cost, arable crop production in Nigeria becomes a problem (Ibrahim et al., 2014). In the past, farm yard manure, composts or domestic wastes have been used in order to improve and supplement the depleting soil nutrients (Adeleye et al., 2010). The use of organic manure and inorganic fertilizer has increased over the years by farmers as a source of plant nutrients and soil nutrient amendments because of its relative ease of application and quick results.

According to Senjobi (2010), was of the view that growth and yield parameters of crops would be improved when organic manures are used. The application of organic and inorganic fertilizer is an issue to peasant farmers in trying to identify which of them will give better yield.Therefore, this

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research work is carried out to determine the influence of poultry manure and NPK fertilizer on the growth and yield of *Abelmoschus esculentus L.* **(**okra) on the Jos Plateau.

II. MATERIALS AND METHODS

This research work was carried out during the 2018 growing season at Federal College of Forestry demonstration farm located in Jos, Plateau state. Jos, plateau is a region of the middle belt of Nigeria and located between latitude 7° and 11° North, longitude 7° and 25° East at an altitude of about 1200km above sea level. The area lies in the northern guinea savanna of Nigeria with an annual rainfall of 1460mm and a temperature of 19°C to 32°C, (Olowolafe et al., 2004). Soil samples from the study area were collected randomly at a depth of 0cm to 15cm to determine its physical and chemical properties. Soil analysis was carried out at ASTC (Agricultural Services and Training Center) KASSA, VOM, Jos, Plateau sate.

Sample	PH	N (%)	P PPM	K PPM	Ca PM	MgPPM	O.M(%)	H+ mMol/ 100g	Al^{1+} mMol/ 100g	Clay (%)	Silt (%)	Sand (%)	Textural Class
15cm	5.78	0.033	6.2	97.9	532	102	115	157x10	Nil	10.88	12	77.12	Sandy loam

Table 1:- Physical and Chemical Properties of the Soil in the Study Area (Source: - Agricultural Services and Training Center KASSA/VOM, 2018.)

The physical and chemical properties of the soil as presented in table 1, showed that 10.88% clay, 12% silt, and 77.12% sand. The soil can be classified as sandy loam. The percentage composition of sand, silt and clay confirms that the presences of organic matter, which make the soil good for crop production. The soil PH was 5.78 which is slightly acidic. It is the preferred soil PH range for good growth and development of crop. Organic matter had an average value of 115%, while the respective nutrient constituents of nitrogen, phosphorus, potassium, calcium and magnesium were 0.033%, 6.2, 7.9, 532 and 102 were in average quantities for optimum production of most crops.

The okra seeds (*Abelmoschus esculentus (L.) Moench.*) were obtained from the nursery, Federal College of Forestry, Jos. The field was ploughed and 4tons/ha of Poultry manure incorporated before sowing the okra seeds. The research was laid out in a Randomized Complete Block Design (RCBD) with four treatments replicated three times. The seeds were treated before sowing to protect them against soil borne pathogens and pest attacks. Sowing was done at a spacing of 30cm x 50cm. Two seeds per hole were directly sown at a depth of 2cm. After germination, seedlings were thinned to one plant per stand at 3weeks after sowing. 175Kg/ha of NPK (15:15:15) obtained from Plateau Agricultural Development Programme (PADP) was applied.

Data was recorded on germination percentage, plant height, number of leaves, number of branches, days to 50% flowering, number of fruits per plant, fruit length, fruit diameter and fresh weight of fruits per plant. Data collected was subjected to Analysis of Variance (ANOVA) at 5% level of significance. Mean separation was used using the Duncan's Multiple Range Test (DMRT) were significance was declared.

III. RESULTS AND DISCUSSIONS

- *Germination Percentage*

The result from table 2 below indicates that the combine application of poultry manure and NPK fertilizer gave the highest mean germination percentage (82.0%), NPK fertilizer (69.8%), 67.3% for poultry manure while the control (no application) gave the least (46.3%) germination percentage.

- *Plant height*

The result from table 2 also shows that the combine application of poultry and NPK fertilizer has the highest mean (53.2cm) plant height, NPK fertilizer and having 51.5cm and 49.8cm respectively. While the control (no application) has a plant height of 37.3cm.

Treatment	Germination Percentage (%)	Plant Height (cm)	Number of Leaves	Number of Branches
Control	46.3a	37.3a	11.5a	7.0a
Poultry Manure	67.3b	51.5c	19.2b	12.8b
NPK Fertilizer	69.8c	49.8b	23.8c	14.5c
P. Manure + NPK	82.0d	53.2d	27.3d	17.0d
SE±	2.12	0.52	0.8	0.70
LSD	*	*	*	*

Table 2:- Influence of Poultry Manure and NPK Fertilizer on the Growth Characteristics of Okra

Means within a column having same letters are not significantly difference at $P \leq 0.05$
LS = level of significant at 0.05
* = Significant

- *Number of Leaves*: The result from table 2 also indicates that the application of a combination of poultry manure and NPK fertilizer shows that higher (27.3) number of leaves, 23.8 leaves for NPK fertilizer, 19.2 for poultry manure and 11.5 leaves for the control.
- *Number of Branches*: Table 2 shows that the application of a combination of poultry manure and NPK fertilizer gave the highest (17.0) branches, 14.5 branches for NPK fertilizer, 12.8 for poultry manure and 7 branches for the control.

These results corroborates with the findings of Antoinette *et al*. (2013) that the combine application of poultry manure and NPK fertilizers, results in an increases of plant height, number of leaves per plant and number of fruits per plant of okra. Similar studies revealed that combined treatments with poultry manure and NPK fertilizer produces the highest levels of growth characteristics of some crops as compared to the sole applications of either of the two inputs (Busari et al., 2008; Efthimiadou et al., 2010). Such results might be attributed to the complementary effect of the combine application of organic and inorganic fertilizers. Ajari et al., (2003) opined that organic manure, especially poultry manure could increase plant height of crops when compared with other sources of manures. Thus, application of organic fertilizer (poultry manure) and inorganic fertilizer (NPK) in the research carried out enhances growth characteristics of plat when compared to controls (no application).

- *Days to 50% Flowering*: Table 3 shows that the mean days for 50% of the plants to flower for the control is 48.8 days, poultry manure takes 44 days, NPK fertilizer takes 40.5 days and combination of poultry manure and NPK takes 41.5 days to reach 50% flowering. This indicates that the combine application of organic and inorganic fertilizers takes the least number of days to attain 50% flowering, showing significant difference between the treatments at $P \leq 0.05$ level of probability.
- *Number of Fruits per Plant*: Significant differences was declared (table 3) with respect to number of fruits per plant. The combine application of poultry manure and NPK fertilizer gave the highest (65.8) number of fruits per plant followed by poultry manure (60.0), then NPK fertilizer (57.5) and the control has the least (40.5).

Treatment	Days to 50% Flowering	Number of fruits pervPlant	Fruit Length (cm)	Fruit Diameter (cm)	Fresh weight of Fruit per Plant (g)	Yield (tons/ha)
Control	48.8c	40.5a	8.1a	1.6a	6.5a	1.5a
Poultry Manure	44.0b	60.0c	10.3b	2.4b	8.9c	2.8c
NPK Fertilizer	40.5a	57.5b	10.6b	2.6b	7.7b	2.6b
P. Manure + NPK	41.5a	65.8d	13.4c	3.3c	10.7d	3.3d
SE±	0.84	0.53	0.21	0.08	0.2	0.07
LSD	*	*	*	*	*	*

Table 3:- Influnce of Poultry Manure and NPK Fertilizer on the Yield Characteristics of Okra

Means within a column having same letters are not significantly difference at $P \leq 0.05$.
LS = level of significant at 0.05
* = Significant

- *Fruit length*: The length of the fruit from table 3 revealed that significant differences between the treatments exists. Although, individual application of poultry manure and NPK fertilizer showed no significant differences, combine application of poultry manure and NPK fertilizer gave 13.4cm, NPK fertilizer gave 10.6cm, poultry manure and control gave 10.3cm and 8.1cm respectively.
- *Fruit Diameter:* There was significant difference between the four treatments in terms of fruit diameter with combine application of poultry manure and NPK fertilizer having the highest (3.3cm) followed by NPK fertilizer application (2.6cm), 2.4cm for the application of poultry manure and the control having the least (1.6cm) as shown in table 3. Single application of poultry manure and NPK fertilizer showed that there was no significant difference between them.
- *Fresh Fruit Weight per Plant*: The mean fresh weight of fruit per plant shows that significant differences exist between the treatments. Combine application of poultry manure and NPK fertilizer gave 10.7g, poultry manure has 8.9g, NPK fertilizer gave 7.7g, and control gave 6.5g
- *Yield*: The highest yield of 3.3 tons/ha was obtained as a result of the combine application of poultry and NPK fertilizers followed by the application of poultry manure which produces 2.8 tons/ha of okra. The application of NPK fertilizer and the control respectively produces 2.6 tons/ha and 1.5 tons/ha respectively.

The increase yield of okra due to Poultry manure and NPK fertilizer application corroborates with the findings of Firoz (2009). Dennis et al. (1994) indicated that the combination of organic and inorganic fertilizers does not only

improve the physical status of the soil, but also improves crop yield. The combined application rates of 75kg NPK and 3 tons/ha organo mineral fertilizers gave the best okra performance compared to other treatments (Olaniyi et al., 2010).

IV. CONCLUSION

The findings of this research work showed that the combine application of poultry and NPK fertilizer increases the growth and yield characteristics of okra better than the single application of individual fertilizers (manure). The combine application was also more economically beneficial not only to the farmer but also improves the soil fertility. Thus, combine application of poultry manure and NPK fertilizer can be recommended to the farmers for better yield of *Abelmoschus esculentus L.* okra in the study area.

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