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Effect of Two Fertilizer Types on Performance of Okra (*Abelmoschus esculentus* (L.) moench) IN Jos, Plateau State, Nigeria

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Abstract

Field experiment was conducted at the Federal College of Forestry, Jos Plateau to evaluate the performance of okra as influenced by inorganic fertilizers and liquid organic manure. The treatments consisted of factorial combinations of three levels of NPK fertilizer combinations (25:25:25, 50:50:50 and 75:75:75 Kg/ha) and four application rates of liquid organic manure (0, 20, 40 and 80 L/ha). The experiment was laid out in Randomized Complete Block Design with three replicates for a period of twelve weeks. Parameters evaluated included plant height, number of leaves, collar girth, number of flowers, weight of fruits/plant/plot and yield in kg/ha. The data obtained were subjected to analysis of and the least significant difference was used to separate the means at 5% level of probability. The results obtained indicated that there was no significant effect of the treatments (NPK and Liquid Manure) on both the growth and yield parameters. This could have resulted from low levels of liquid organic manure used in the study or from low nutrients concentrations of the manure. It was however observed that NPK 50:50:50kg/ha and 80 litres/ha liquid manure recorded higher means values for growth and yield parameters throughout the sampled periods It is however recommended that higher levels of liquid organic manure be considered in treatments for further studies.

Keywords: *NPK Fertilizer, liquid organic Manure and Okra*

Introduction: Popular vegetable okra (Abelmoscus esculentus (L.) Moench) is produced in most of Nigeria and other tropical and subtropical nations. According to Folorunso and Ojeniyi (2003), Ibrahim, Haruna, and Labele (2018), Isa, Ogunsola, and Jayeoba (2018); Nyong, *et al*.,2023) and Mshelia and Muhammad (2018), it belongs to the Malvaceae family. In tropical and subtropical regions of the world, including Africa, Turkey, India, and other nearby nations, okra is widely grown. Okra is one of the most popular vegetables exported from India due to its excellent nutritional content, delicious flavor, and long shelf life. It accounts for 60% of vegetable exports and has great potential as a crop that generates foreign cash. In terms of global okra output, India leads the pack. In 2021, Nigeria ranked second with 1,917,406.63 million tons of okra produced, while India accounted for 59.75% of global okra production with 6.47 million tons produced. Mali, Sudan, and Pakistan make up the remaining nations, making up 89.07% of it. 10.8 million tons of okra were produced worldwide in 2021, according to estimates (FAOSTAT, 2022).

Nigerians typically cultivate the crop because of its mucilaginous nature. Depending on the cultivar, the pods differ in length, color, and smoothness. Rich, well-drained soils are ideal for growing okra. According to Tindale (2004), the crop has a high fiber content. The uncooked fruits have 90% water, 7% carbohydrates, 2% protein, and 1% minerals, including 1.7% fiber and 0.2% ash (Babatunde, Omotesho, and Sholoton (2007) and Nyong, *et al*.,2023) . A good source of calcium and other elements that are necessary for body building, okra promotes a healthy lifestyle. Although okra can be grown in a variety of soil types, the ideal soil is loose, friable, loam that is rich in organic matter and devoid of hard pans. It can tolerate some acidity in the soil, and a pH of 6 to 6.8 is ideal for growing it. The crop is a heavy feeder of nutrients, and depending on the fertility level, different locations have different dosages of manures and fertilizers (Kumar, Dagnoko, Haougui, Ratnadass, Pasternek, and Kouame (2019).

An extremely important input in crop production is fertilizer; applying it improves the nutritional status of the soil and boosts crop yield. Inadequate levels of essential nutrients cause the crop to perform poorly, affecting growth and producing a low yield (Shukla and Nalk (1993) Nyong, *et al*.,2023) and In the future, using organic manure to meet crop nutrient requirements will become essential for sustainable agriculture. This is because organic manure improves the physical, chemical, and biological properties of soil while retaining its capacity to hold moisture, which boosts crop yield and preserves crop quality. According to Tadesse, Dechassa, Bayu, and Gebeyeh (2013), organic manure improves soil phosphate availability, water holding capacity, cation exchange capacity, fertilizer usage efficiency, and soil microbial population. It also decreases nitrogen losses resulting from slow nutrient release.

Low input supply systems, the use of low yielding cultivars, low input supply systems, the productive gap caused by a combination of technical deficiencies and the depletion of soil fertility and natural resources due to inappropriate intensive management practices, have all had an impact on Nigeria's okra production efficiency Nyong, *et al*.,2023) and (Ibrahim & Hamma, 2012, as cited in Muhammad, Kutawa, Tadda, Muhammad, and Adamu (2020). Furthermore, maintaining soil productivity is an important challenge to tropical agriculture. Erosion and subpar soil fertility negatively impact the soils, degrading their nutritional status and altering the populations of soil organisms (Akande, Oluwatoyinbo, Makinde, Adepoju, and Adepoju (2003), as cited in Muhammad et al., 2020) Nyong, *et al*.,2023) and . It is on this premise that this experiment was conducted to determine the performance of okra as influenced by NPK fertilizer and liquid organic manure in Jos North area of Plateau State.

Materials and Methods: The Study Site: The experiment was conducted at the experimental field of the Federal College of Forestry, Jos in the northern part of the Jos Plateau. The Jos Plateau is in the central part of the country. The Jos Plateau lies between latitude 8^0 50'N and 10^0 10'N and longitude 8^0 22'E and 9^0 30'E (Kareem, 2007) and has a tropical continental climate (Owonubi, 2017). It has an average elevation of about 1,250 meters above sea level and stands at a height of about 600 meters above the surrounding plains.

Soil Analysis: Soil samples were collected at random from various parts of the experimental plot at the depth of 0 – 15cm for laboratory analysis. Soil samples were analyzed in the laboratory for particle size distribution, organic matter, nitrogen, available phosphorus, soil reaction, and exchangeable cations (Ca, Mg, K,) using methods described by Haluschak (2006).

Agronomic practices: The site was cleared and cultivated manually to a fine tilt with a digging hoe. The beds were constructed 2 m x 2 m and each bed was separated by an alley of 0.5m between replications. Planting was carried out at a spacing of 40-45 cm. Three seeds (Clemson spineless) were sown per hole and later thinned to two plants per stand at two weeks after sowing (WAS). Weeding was done manually using small hoes at four weeks after sowing and supplementary weeding was also carried out throughout by hand pulling before the maturity of the crops. The agro-bloom liquid organic fertilizer (1ml of liquid manure per 200ml of water) was applied directly on the soil surface around the growing crop using the ring method of fertilizer application. The dose (liquid organic fertilizer) applied for each plot varied in quantity depending on the treatment.

Experimental Design: The experiment was laid out in Randomized Complete Block Design (RCBD) under a factorial experiment, involving a total number of twelve (12) treatment and three (3) replicates for a period of Twelve (12) weeks. Data were collected on leaf count, collar girth, plant height, number fruit per plot, number of flowers per plot, and weight of fresh fruit respectively. Data collected were subjected to Analysis of Variance (ANOVA) and least significant difference (LSD) was used to separate the means at 5% level of probability

Table 1: 3 x 4 factorial treatment combinations of three (3) levels of NPK fertilizer and four levels Liquid Manure (LM)

Liquid organic manure (Liters/ha)

NPK (kg/ha)	*0 (B1)*	*20 (B2)*	*40 (B3)*	*80 (B4)*
25:25:25 (A1)	A_1B_1	A_1B_2	A_1B_3	A_1B_4
50:50:50 (A2)	A_2B_1	A_2B_2	A_2B_3	A_4B_4
75:75:75 (A3)	A_3B_1	A_3B_2	A_3B_3	A_3B_4

Results and Discussion

Table 2: Soil Composition of Experimental Site

Texture	*Sand**	*Silt**	*Clay**	*OM**	*N**	P^a	Ca^b	Mg^b	K^b	*H*	AL^{3+}	*pH*
Sandy Loam	79.12	12.00	8.88	1.90	0.07	2.4	4.01	0.89	0.66	1.69	NIL	6.49

Note: OM = organic matter, *: units in %; ^{a}: units in mg/kg; ^{b}: units in cmol/kg

Table 3: Mean effects of NPK and Liquid Manure on Plant Height

Treatments	4WAA	8WAA	12WAA
NPK kg/ha			
25:25:25	22.9a	41.3a	65.4a
50:50:50	24.7a	43.9a	66.9a
75:75:75	22.9a	41.3a	61.3a
LSD	NS	NS	NS
Liquid manure L/Ha			
0	24.4a	43.6a	65.6a
20	23.6a	42.7a	60.8a
40	23.8a	37.6a	64.8a
80	24.4a	44.7a	66.9a
LSD	NS	NS	NS
Interactions			
NPK X Liquid manure	NS	NS	NS

Means in a column sharing a letter are not significant
NS= Not significant., WAA= Weeks after application

Table 2 shows soil characteristics of the study site while the effects of NPK and liquid manure on plant height is presented in in Table 3**.** The results show that there was no significant difference (p≥0.05) among the treatments on plant height across and within the trends. However, at 4, 8 and 12 weeks after application NPK 50:50:50kg/ha recorded the highest mean value compared to the other treatments. Similarly, 80 liter/ha did better compared to other treatments. There was no positive interaction among the treatments.

Table 4: Mean effects of NPK and Liquid Manure on Leaf Count

Treatments	4WAA	8WAA	12WAA
NPK kg/ha			
25:25:25	7.8a	7.1a	23.6a
50:50:50	8.4a	7.1a	24.7a
75:75:75	8.2a	6.4a	22.9a
LSD	NS	NS	NS
Liquid manure L/Ha			
0	8.4a	7.1a	23.2a
20	7.4a	6.4a	23.6a
40	7.9a	6.6a	23.8a
80	8.9a	7.3a	24.4a
LSD	NS	NS	NS
Interactions			
NPK X Liquid manure	NS	NS	NS

Means in a column sharing a letter are not significant

NS= Not significant., WAA= Weeks after application

The effects of NPK and liquid manure on leaf count are presented in Table 4. The results indicated that no significant difference (p ≥ 0.05) was observed with the treatments across and within the trends. Observations however showed that at 4, 8 and 12 weeks after application NPK 50:50:50 kg/ha recorded higher mean values throughout the sampled periods. Similarly, 80 liter/ha of liquid manure also did better compared to the others. No positive interaction was observed among the treatments. The effects of NPK and liquid manure on the collar girth are presented in Table 5. The results show no significant difference was observed among the treatments at both 4, 8 and 12 weeks after application. Higher mean values were observed on both NPK 50:50:50kg/ha and 80 liter/ha liquid manure compared to other treatments. No significant interactions were observed among treatments.The effects of NPK and liquid manure on yield parameters and yield is presented in Table 6. The result indicated that no significant difference (p>0.05) was recorded for both NPK and liquid manure respectively. However, higher mean values on number of flower, number of fruits, average weight of fruits, and weight of fruit in kg/ha was recorded for NPK (50:50:50kg/ha) likewise, 80 lit/ha liquid manure recorded the highest mean values of 48.6, 48.6, 18.6 and 816.7 for number of flowers, number of fruits, average weight of fruits and weight of fruits respectively, Nyong, and Nweze,, 201

Table 5: Mean effects of NPK and Liquid Manure on Collar Girth

Treatments	4WAA	8WAA	12WAA
NPK kg/ha			
25:25:25	0.8a	1.7a	7.8a
50:50:50	0.8a	1.7a	8.4a
75:75:75	0.8a	1.7a	8.4a
LSD	NS	NS	NS
Liquid manure L/Ha			
0	0.9a	1.7a	8.4a
20	0.8a	1.6a	7.4a
40	0.8a	1.7a	8.4a
80	0.9a	1.8a	8.9a
LSD	NS	NS	NS
Interactions			
NPK X Liquid manure	NS	NS	NS

Means in a column sharing a letter are not significant
NS= Not significant., WAA= Weeks after application

Table 6: Mean effects of NPK and Liquid Manure on Yield Parameters

Treatments	No. of flower	No. of Fruits	AV. Wt of fruits	Wt of fruit
NPK kg/ha				
25:25:25	41.8a	41.8a	16.5a	692.6a
50:50:50	47.3a	47.3a	18.9a	795.3a
75:75:75	39.8a	39.8a	16.9a	730.0a
LSD	NS	NS	NS	NS
Liquid manure L/Ha				
0	43.0a	43.0a	16.3a	766.2a
20	44.9a	44.9a	17.2a	723.6a
40	35.3a	35.3a	17.7a	650.6a
80	48.6a	48.6a	18.6a	816.7a

LSD	NS	NS	NS	NS
Interactions				
NPK X Liquid manure	NS	NS	NS	NS

Means in a column sharing a letter are not significant
NS= Not significant., WAA= Weeks after application

Discussion: Soil Characteristics of Study Site: The particle size distribution analysis indicates that soil has a coarse medium texture with a textural class of sandy loam with proportion of Clay, Silt and Sand being 8.88%, 12% and 79.12% respectively. Implying that the soil is well drained but has low available water holding capacity. Rich, well-drained soils have been noted to be ideal for growing okra (Kumar et al., 2019). Also Eke, *et al*., (2008), observed that, okra grow on a wide range of soil types, though it was found to thrive best in a moist friable, well-drained loamy soil. The organic matter content of the study site is 1.90% which is low according to ratings provided by Enwezor, Udo, Usoroh, Ayotade, Adepetu, Chude, and Udebge (1989). Organic matter contributes to plant growth through it effect on the physical, chemical, and biological properties in the soil. It serves as a nutrient reservoir for plant and improves the soil properties, such as, bulk density, soil structure and texture, cation exchange capacity (CEC) as well as infiltration capacity (Brady and Weil, 1999). According to Enwezor *et al*., (1989), classification for soil nitrogen and available phosphorus, the percentage of soil nitrogen and available phosphorus is low as it is less than 0.15% and 10 mg/kg respectively. Nitrogen is the primary macro nutrient for plant vegetative growth and development. However, the soil pH is 6.49. Nyong, and Nweze,, 2012); Kumar et al., (2019) noted that a pH range of 6.00 to 6.80 is ideal for growing Okra. It was further noted that okra has some capacity to tolerate soil acidity. In a nutshell, the fertility status of the soils is very low.

Growth and Yield Parameters: The results on the growth parameters (plant height, leaf count, collar girth) and yield parameters as obtained from the experiment indicated that there was no significant effect of the treatments (NPK and liquid manure) on the parameters. It is speculated that the quantities of applied liquid manure and or nutrient concentrations were not sufficient to boost the fertility status of the soil so as to have a positive effect on the growth and yield of okra. This is most noteworthy as Kumar et al., (2019) remarked that okra is a heavy feeder crop. Studies by Ajari, Tsado, Oladiran and Salako (2003) indicated that organic manure at higher quantity applied in the presence of NPK could improve the growth characteristics of okra plant significantly. Also, Nyong, and Nweze,, 2012; Ufera, Kanayo, and Iwuagwu (2013), noted that the application of higher volume of organic manure has capacity to improve the leaf canopy of okra. Furthermore, Premshekar and Rajashree (2009) observed that higher yield response of crop is a function of organic manure application and results in improved physical, chemical and biological properties of the soil resulting in better supply of nutrients to the plants.

Conclusion: Results of the study indicated that no significant effect NPK fertilizer and liquid organic manure was recorded on both growth, yield parameters. Though insufficient levels of applied NPK and liquid manure could have been a consequence of theses observations. For further studies, it is recommended that higher levels of liquid organic manure be considered in order to obtain more significant effects.

References

Ajari, O., Tsado, I. E. K., Oladiran, J. A. and Salako, E. A. (2003). Plant height and fruit yield of okra affected by field application of fertilizer and organic matter in Bida. *Nigerian Agricultural Journal*. Vol. 34, page 74-80

Akande, M. O., Oluwatoyinbo, F. I., Makinde, E. A., Adepoju, A. S., & Adepoju, I. S. (2010). Response of Okra to Organic and Inorganic Fertilization. *Nature and Science. 8*(11): 261-266.

Babatunde, R. O., Omotesho, O. A., & Sholoton, S. (2007). Socio-Economic characteristics and Food Security Status of farming Household in Kwara State, North Central Nigeria. *Pakistan Journal of Nutrition 6*(1): p.16

Eke, K. A., Essien, B. A., & Ogbu, J. U. (2008). Determination of optimum planting time of okra (Abelmoschus esculentus) Cultivars in the Derived Savannah. Proceedings of the 42nd Annual Conference of Agricultural Society of Nigeria (ASN) October 19th - 23rd at Ebonyi State University.

Ewezor, W.O., Udo, E. J., Usoroh, N. J., Ayotade, K. A., Adepetu, J., Chude, U.O., & Udebge, C. I. (Eds). (1989). Fertilizer use and management practices for crops in Nigeria. Fertilizer Procurement and Distribution Division, Federal Ministry of Agriculture, Water Resources and Rural Development, Lagos.

FAOSTAT (2022). Food and Agricultural Organization Statistics. https://www.fao.org

Folorunso, O. O., & Ojeniyi, S. O. (2003). *Effect of sole and amended plant residence on soil content yield of okra. Dept. of Crop Soil and Nutrition*. Federal University of Agriculture Akure

Haluschak, P. 2006. Laboratory methods of soil analysis. Canadian-Manitoba Soil Survey; pp. 7 – 124

Ibrahim, A. J., Haruna, I.M., & Lebele, W. O. (2018). Crop-Weed Relationships in Okra (*Abelmoschus esculentus* (L.) Moench) as Influenced by Duration of Weed Interference in Lafia, Nasarawa State. In: Ajayi, F.A., Haruna, I. M and Jayeoba, O. J (2018). Horticulture for Improved Food Security, Sustainable Environment and National Economic Growth. *Book of Proceedings of the 36th Annual Conference of Horticultural Society of Nigeria, Faculty of Agriculture, Nasarawa State University, Shabu-Lafia. 18th – 22nd November, 2018, pp.163-169.*

Ibrahim, U., & Hamma, I. L. (2012). Influence of farmyard manure and weeding regimes on growth and yield of okra (*Abelmoschus esculentus L. Moench*) in Zaria. *World Journal of Agricultural Sciences*, 8(5), 453-458.

Isa, U. A., Ogunsola, O. A., & Jayeoba, O. J. (2018). Growth and Yield Response of Okra (*Abelmoscus esculentus* (L.) Moench) to Organic and Inorganic Fertilizer in Lafia, North Central Nigeria. In: Ajayi, F.A., Haruna, I. M and Jayeoba, O. J (2018). Horticulture for Improved Food Security, Sustainable Environment and National Economic Growth. *Book of Proceedings of the 36th Annual Conference of Horticultural Society of Nigeria, Faculty of Agriculture, Nasarawa State University, Shabu-Lafia. 18th – 22nd November, 2018, pp.273-278.*

Kareem, I. A. (2007). Rattle tree (Albizia lebbeck) effects on soil properties and productivity of irish potato (Solanum Tuberosum) on the Jos Plateau, Nigeria. Unpublished PhD Thesis, University of Jos.

Kumar, S., Dagnoko S, Haougui, A, Ratnadass A, Pasternek D, Kouame C. (2010). Okra (*Abelmoschus esculentus*) West and Central Africa: Potential and progress on its improvement. *African Journal of Agricultural Research*, 25, 3590-3598.

Mshelia, J. S., & Muhammad, I. S. (2018). Performance of Different Varieties of Okra (*Abelmoscus esculentus* (L.) Moench) Grown under Irrigation in Kashere, Gombe State. In: Ajayi, F.A., Haruna, I. M and Jayeoba, O. J (2018). Horticulture for Improved Food Security, Sustainable Environment and National Economic Growth. *Book of Proceedings of the 36th Annual Conference of Horticultural Society of Nigeria, Faculty of Agriculture, Nasarawa State University, Shabu-Lafia. 18th – 22nd November, 2018, pp.48-53.*

Muhammad, M., Kutawa, B. A., Tadda, A.S., Muhammad, A., & Adamu, M. (2020). Productivity of okra (*Abelmoschus esculentus*) as influenced by NPK fertilizer and poultry manure in Northern Sudan savannah region of Nigeria. *International Journal of Forest, Animal and Fishery Research* (IJFAF), 4(6), 75-82.

Owonubi, A. (2017). Pedogenic characteristics of basement complex soils on the Jos Plateau. Unpublished PhD Thesis, University of Jos, Jos, Nigeria; pp. 1 – 24.

Premsheer, M and Rajashree, V. (2009). Influence of organic manures on growth, yield and quality of okra. *American Eurosian Journal of sustainable Agriculture.* Vol. 3 (1); 6-8

Shukla, V., & Nalk, L. B. (1993). Agro-Technique for *Malvaceae* Vegetables, In: Ifovance in horticulture (5). Malhotra publishing house, New Delhi, India, Pp. 399-425.

Tadesse, T., Dechassa, N., Bayu, W. and Gebeyeh, S. (2013). Effects of farmyard manure and inorganic fertilizer application on soil physico chemical properties and nutrient balance in rain fed lowland rice ecosystem. American Journal of Plant Sciences. Vol. 4:309-316

Tindale, H. D. (2004). Vegetables in the Tropics. Macmillan Publishers. Hounds Mills

Ufera, N. U., Kanayo, S.C. and Iwuagwu, M. (2013). Relative effect of organic and inorganic fertilizer on the growth of okra. (Abelmoschus esculentus L.). *Journal of Agricultural Sciences*. Vol. 58(3). 24-25