

Effects of Poultry Manure and NPK Fertilizers on Growth and Yield of Okra Plant

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ABSTRACT

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Okara has gained more importance in every community on the globe due to its nutritional value. This study examined the effect of organic and inorganic fertilizers on the growth and yield and of okra on the on farm level. Organic form of fertilizer used was poultry manure and while the inorganic was NPK fertilizer. The experiment was laid out in a Randomized Complete Block Design during the raining seasons of 2019. Four treatments with three replications were used. Treatments are arranged as control T1 (Without fertilizer + No Poultry Manure + No compost), T2 (NPK full dose (150 kg ha⁻¹N, 75 kg ha⁻¹P and 60 kg ha⁻¹K), T3 (full dose of poultry manure (PM) 30 ton ha⁻¹), T4 (50% NPK+50% Poultry Manure). Plants growth and yield parameters were determined like the total number of leaves per plant, plant height, the total number of fruits per plant, fruit yield and total yield increase. No significant increase was observed in the yield and growth of okra under control and full NPK fertilizer treatment. Application of poultry manure as well as its mixture with full NPK considerably increased the growth and total yield attributes of Okra. The joint use of 50% NPK+50% PM also showed the most significant effect on okra growth and yield of the crop.

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I. INTRODUCTION

Okra (*Abelmoschus esculentus*) has significant nutritional value and contributes maximum value in fulfilling the proper nutrition requirement in Borno State of Nigeria. Okra is of African origin where it has been cultivated for more than 4000 years. The fruit is now grown widely in most of the tropical and warm areas of the world like Greece, Iran, Egypt, India, Japan, southern United States, Turkey, Philippine (Abbas *et. al.*, 2019). The 100g of edible portion

contains 88.6g water, 8.20g carbohydrate, 2.10g protein, 200mg fat, 1.70g fibres, 84 mg Calcium, 90 mg phosphorous, 1.20mg iron, 47mg ascorbic acid as well as riboflavin, carotenes in considerable quantity is present (Benchasri, 2012). The scarcity and high cost of inorganic fertilizer in the world call for concerted efforts by all stakeholders to encourage the production and usage of the organic fertilizer (Adewole and Adeoye, 2008). Additionally, organically fertilized okra is like any other food crop

is much more suitable than the chemically cultivated counterpart (Taiwo *et. al.*, 2002).

Poultry manure is abundantly available in many poultry farms in Borno state but unfortunately it is not utilized due to lack of awareness. The adverse effect of chemical fertilizer is hazardous to consumers of the farm produce as well as soil health and environment (Savci, 2012). It is envisaged that the soil fertility status and crop production can be increased or sustained by the addition of organic fertilizer in the soil as it is the only alternative for this problem (Ali and Talukder, 2008). Proper maintenance and sustainability of agricultural land is prerequisite and addition of organic sources like poultry manure and kitchen compost can play a vigorous part in the sustainability of fertility status of soil and crop production (Shahariar *et. al.*, 2013). Proper use of organic amendments is an environment-friendly, economical and ergonomically sound practice which has already been established by many researchers (Van der Vossen, 2005). Therefore, to increase the production of Okra and to meet the demand for food the use of organic amendments as a fertilizer source is getting prime importance day by day.

II. METHODS AND MATERIAL

This research work was conducted on-farm during the raining season of 2018 (from July to October) within 777 Housing Estate in Maiduguri Borno State of Nigeria located on altitude 326m above sea level and approximately on latitude 11.84 and longitude 13.06. Ojanuga (2006) described the climate zone as dry sub humid with a mean temperature ranging between 23.6°C and 34.8°C and the soil is Typic Ustipsamment in nature (Mustapha 2012).

The research was laid out in a Randomized Complete Block Design (CRBD) with four treatments and three replications in a plot area of 2 m × 2 m. Seeds were dipped in water and use the floating method to check the viability of seeds. Three to four seeds were

dibbled on ridges at the distance of 15 cm plant to plant while row to row distance was 40 cm and proper thinning was done after 15 days of sowing and healthy plants were maintained. All management practices were done as recommended in production technology. The doses of inorganic and organic fertilizers were fixed by standard practices as approved by Soil Science Society of Nigeria.

Description of treatments as: T1= Control (Without fertilizer); T2= NPK full dose (150 kg ha⁻¹); T3= Full poultry manure (PM) (30 ton ha⁻¹); T4= 50% NPK+50% Poultry Manure. The plant growth data were collected after 15, 30, 45, 60 and 75 days of seedling germination. The edible portion or fruits were harvested in portions. The number of leaves, the plant height, the number of fresh fruits per plant, fruit fresh weight per hectare and percentage yield increase were examined. The data was analyzed using ANOVA in Randomized Complete Block Design was applied using Statgraphics 8.0 Software.

III. RESULTS AND DISCUSSION

Total number of leaves per plant

From the results it was observed that the total number of leaves per plant which 119 leaves was maximum in combined organic amendment 50% NPK+50% Poultry Manure (T4) during the recorded period as compared with the control treatment (T1) where the total number of leaves per plant was lowest as indicated in table 1. In comparison to the control (T1), the other treatment containing full Application of NPK in (T2) did not significantly enhance the total number of leaves per plant while at 30 and 45 DAYS. The use of full PM (T3) considerably increased total number of leaves per plant. At 30, 45, 60 and 75th-day maximum increase in some leaves per plant with 50 % NPK+ 50% PM (T4) was observed as compared to control treatment (T1) and a full dose of NPK fertilizer (T2).

Table 1: Effect of Poultry Manure and NPK on the total number of leaves per plant

	15 DAYS	30 DAYS	45 DAYS	60 DAYS	75 DAYS
T ₁	11 ^b	36 ^c	40 ^{cd}	59 ^d	75 ^c
T ₂	13 ^{ab}	39 ^{bc}	43 ^c	78 ^{bc}	79 ^{bc}
T ₃	14 ^a	43 ^{ab}	62 ^b	82 ^b	84 ^b
T ₄	14 ^a	46 ^a	75 ^a	98 ^a	119 ^a

Plant height: In 15 Days, 30 Days, 45 Days, 60 Days, and 75th days of plants the variation on plant height occurred from 22 cm (T₁) to 30 cm (T₃), 70 cm (T₁) to 100 cm (T₃), 110.00 cm (T₁) to 140 cm (T₄), 155 (T₁) to 180 cm (T₃) and 190 cm to (T₁) to 227 cm (T₄) respectively. As shown in table 2, the results it was revealed that the minimum plant growth was constantly observed in control treatment (T₁) while the maximum was obtained with the treatment containing full dose of the poultry manure (T₃) at 15, 30 and 60 Days and at 45 and 75 Days the maximum growth was observed at treatment (T₄) containing 50% NPK+50% PM.

Table 2 : Effect of Poultry Manure and NPK on the plant height of okra

	15 DAYS	30 DAYS	45 DAYS	60 DAYS	75 DAYS
T ₁	22 ^c	70 ^{bc}	110 ^d	155 ^c	190 ^c
T ₂	28 ^b	75 ^b	130 ^c	175 ^{ab}	198 ^b
T ₃	30 ^{ab}	100 ^a	140 ^b	180 ^a	225 ^a
T ₄	32 ^a	98 ^a	155 ^a	178 ^a	227 ^a

The present study also revealed that during the period of 15, 30, 45, 60 and 75 there is no significant variation in the height of plant in no fertilizer (control) and full NPK fertilizer although the addition of poultry manure in T₃ significant variation on plant height was observed.

Number of fruits per plant: Among all yield parameters, as in table 3, the total numbers of fruits per plant were found to be the most important factor contributing to the yield of okra. A total number of fruits per plant vary from 17 to 37. The minimum numbers of fruit per plants were obtained with control treatment T₁ while the highest yield was obtained from T₄ comprising on 50% NPK and 50% compost.

Table3: Effect of Poultry Manure and NPK on the number of fruits per plant

T ₁	T ₂	T ₃	T ₄
17 ^{cd}	20 ^c	35 ^{ab}	37 ^a

Statistically there is no significant difference among T₃ and T₄ while there is significantly higher yield than control treatment. Statistically T₁ and T₂ treatments are similar to each other and significantly different from T₃ and T₄.

Fresh fruit yield: As indicated in table 4 the highest fresh fruit yield was recorded in T₃ (8.8 tons/ha) while the lowest fresh fruit yield was in control treatment T₁ which was 5.3 tons/ha.

Table 4: Effect of Poultry Manure and NPK on the fruits yield per hectare

T ₁	T ₂	T ₃	T ₄
5.3 ^b	5.8 ^b	8.8 ^a	8.6 ^a

T3 containing full poultry manure and T4 containing 50% PM and 50% NPK showed significantly higher yield than control while both these treatments are statistically similar to each other. At T2 fresh fruit, yield was 5.8 tons /ha was recorded which is not significantly higher than control.

Total yield increase: From the results as shown in table 5 it was clear that the minimum yield increase or no significant increase was observed in control. While in T3 and T4 a significant increase in total yield was observed as compared to all other treatments. Statistically T3 and T4 were similar to each other. Organic Manures or organic amendments play a fundamental role in maintaining the soil fertility status as well as crop production being the core requirement for long term sustainable agriculture ([Ewulo, 2005](#)).

This comparison was carried out and results revealed that the combination of compost and poultry manure with inorganic fertilizer increases the yield as compared to the control (where no source of fertilizer used). The treatment containing full poultry manure increases the yield 78% as compared to control.

Table 5: Effect of Poultry Manure and NPK on the percentage yield increase

T1	T2	T3	T4
0 ^c	12.5 ^b	75 ^a	78 ^a

Boateng *et al.* (2006) described that the chemical fertilizers can be replaced with Poultry manure and kitchen compost which is one of the best alternates. Soil fertility status could be enhanced by the application of Poultry manure being the best source of essential plant nutrients. Plant height, root length, biomass accumulation are increased by increasing the organic fertilizer in combination with the inorganic fertilizer (Full NPK). Number of leaves and of fresh fruit weight fresh fruit yield was increased significantly by using the poultry manure and compost with the combination of NPK fertilizer. These findings are in line with Asai *et. al.*, (2009) who described that amendments of organic nature could help in improving the porosity and soil's water holding capacity which results in more root growth, this, in turn, enhances the nutrient uptake from soil and as a consequence enhance biomass production.

Yield attributes are also given significant variation in total yield parameters like a total number of fruits per plant, fresh fruit weight and total yield under the combined use of organic and inorganic fertilizers. Verma *et. al.*, (2014) reported in an

experiment that chemical fertilizer along with organic fertilizer produced the highest yield of cabbage. [Hammoda \(2001\)](#) mentioned that both compost and poultry manure led to an increase in carbohydrate percentage and some macronutrients. These increases might be related to the positive effect of compost and microorganisms in increasing the root surface area per unit of soil volume, the water use efficiency and photosynthetic activity, which directly affects the physiological processes as well as the use of carbohydrates and ultimately on the fresh biomass of the plants.

IV. CONCLUSIONS AND RECOMMENDATIONS

Application of organic sources of fertilizer can enhanced the vegetable yield alone as well as in combination with NPK sources. Farmers with and less fertile soil can enhance their yield using poultry manure and their kitchen wastes on okra production. This will also ensure less environmental pollution.

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