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EFFECTS OF POULTRY MANURE AND NPK ON THE GROWTH AND YIELD OF OKRA (*Abelmoschus esculentus* L. Moench) IN DAWAKIN-KUDU AND BAGAUDA SAVANNAH ZONE NIGERIA

[1*]Suleiman N. I. and [1]Abubakar U. M. K.

[1]Department of Crop Science, Kano University of Science and Technology, Wudil, Kano State.

***Corresponding Author's** E-mail: nuradogodawaki@gmail.com, +2348038762892

ABSTRACT

Field trials were conducted in 2018 wet season at two locations, Dawakin – Kudu location (Latitude 11^0. 762238N and Longitude009^0.04805E) and Bagauda location (latitude 11^0 – 22N and longitude 180^0 22E and 500 m above the sea level) both sites are located in savannah zone of Nigeria. The aim of the research was to determine the effect of poultry manure and N.P.K fertilizer on the growth and yield of Okra (Abelmoschus esculentus L. Moench). The treatment consist three levels of poultry manure at the rate of 0, 2, and 4 ton ha^{-1} and N.P.K (15:15:15) fertilizer at 90kg/ha the treatment were laid out in split plot design and replicated three times. The data collected was subjected to Analysis of variance (ANOVA) procedure for split plots Design using Gen-Stat software. F-test was used to test for the level of significance, mean separation was carried out using Student New Kurt (SNK) at 5% level of significance. Result of the study indicated that both mineral (NPK) and the organic manure (Poultry dropping) improved the growth and yield of Okra (Albelmoschus esculentus), but varying in degree, Organic fertilizers were better than the NPK mineral fertilizer in the growth and yield of Okra plant in both locations with 4 ton ha^{-1} of poultry manure which produced plant height with mean value of (23.87 cm), followed by 2 ton $ha^{-1}$with mean value of (21.12 cm) and N.P.K fertilizer at 90 kg/ha produced high number of plant with mean value of (19.44 cm), crop canopy, number of branches treated with poultry manure significantly produced higher number of branches per plant with mean value of (4.06) at Dawakin kudu location, application of NPK alone produced number of branches with mean value of (4.19), number of leaves and fresh shoot weight., highest fresh fruit weight, application of 4 tons of poultry manure produced high number of fruits per plant with mean value of (24.29) which is statistically similar with 2 ton ha^{-1} of poultry manure produced mean value of (16.27) of number of fruits per plant in both locations. However, the finding of the study indicated that, application of both organic and inorganic fertilizers improved the growth and yield of Okra (Abelmoschus esculentus L. Moench) but varying in degree. Organic fertilizers are more effective than the inorganic fertilizer e.g. N.P.K the used of organic manure in the production of vegetables like Okra should be encouraged. The research recommended that, application of 4ton ha^{-1} of poultry manure in increase fruit yield of Okra in both locations.

Keywords: Poultry manure, N.P.K, Growth, Yield, Okra

INTRODUCTION

Okra (*Abelmoschus esculentus* L. Moench) is a popular vegetable in tropical and sub-tropical countries of the world; it is grown for its pod. It is a member of the hibiscus family, Malvaceae and has the typical floral characteristics of that family originating from Africa (Omotoso and Shittu, 2007). It is an important

vegetables crop occupying a land area of 277,000 hectare with a production of 731,000 metric tons worldwide.

The world leading producers of the crop India, leading in production with 70% Nigeria 15 % Pakistan 2% Ghana 2 % Egypt % (FAO STAT, 2012). In Nigeria, Okra is grown basically in all the states of the Federation both rain and irrigated crop because of the highlighted values. Also, it serves as a source of income to its producers, laborers and marketers (Alimi, 2004). Production of vegetable, especially okra as a small scale enterprise can financially empower the farmers especially those with little capital, limited access to land and working under labor constraints (Haruna, 2003).

The approximate nutrient content of edible okra pod is as follows: 88% protein, 2.1% fat, 0.2% carbohydrate, 8.0% fibra, 1.7% ash (Adeyemi et al., 2008). In Nigeria the limiting factors in okra production and other vegetable among others include weed management, fertility soils, tillage practices, low yielding varieties and sub-optimal planting destiny (Iyagba, 2016). The nutritional quality of Okra can be influenced by the application of organic fertilizer, such as cow dung, droppings of sheep and goat, slaughterhouse wastes and poultry drop (Zodape *et al*., 2008).

In Nigeria the limiting factors in Okra production and other vegetables among others include weed management, fertile soils, tillage practices, low yielding varieties and sub-optimal planting density (Iyagba *et al*., 2016). Fertilizer application among the various agronomic practices also influenced the growth and green pod yield in Okra Babatola, (2006) recorded an increased yield in Okra due to NPK fertilizer application and further recommended that rates of NPK fertilization for Okra vary greatly depending on the variety and environment. Omotoso and Shitu (2007) reported that NPK fertilizer application significantly increased growth parameters (Plant height, Leaf area, Root length, number of leaves). Application of chemicals fertilizers alone can supply only one or two nutrient elements to the crop. On the other hand, supplying only organic inputs can improve soil physical and biological environment but suffers from drawback of low content of plant nutrients.

The production of vegetable in Nigeria (Okra inclusive) is on decline Abubakar, 2015, yield obtained by farmers are often very low (Adigun, 2001). The yield of Okra could reach as high as 30t ha^{-1} in most of the developing countries it is very low 1.77t $^{ha-1}$ as compared to the yield of other agriculturally developed countries of the world (Whitehead and Singh, 2000). Okra production and productivity is seriously affected due to the use of low yielder local varieties, sub – optimal plant density, inappropriate planting date, soil fertility, heavy attack of various insect pests and weeds (Katung, 2007). Use of organic fertilizers can improve crop yield and soil pH, total nutrient content, and nutrient availability, but is limited due to scarcity, high cost, nutrient imbalance and soil acidity. Use of organic manure as a means of maintaining and increasing soil fertility has been advocated (Smil, 2000). Animal manures, when efficiently and effectively used, ensure sustainable crop productivity by immobilizing nutrients that are susceptible to leaching. Nutrient contained in manures are released more slowly and are stored for a long time in the soil ensuring longer residual effects, improved root development and higher crop yield (Abou El magd *et al*., 2005).

Okra responsds very well to organic manure application Kurtz, 2004, demonstrated an excellent use of animal dung and plant residues to improve soil fertility, fruit nutrient composition, root growth and fruit weight of Okra plant. Poultry manure is a typical source of nutrient for plant growth, used commonly in the tropics due to high nutrient content, lack of weed seeds cheapness and availability (Aliyu, 2000). According to Adams *et al*. (2004), poultry manure increases plant height. For tropical countries like Nigeria, high cost and scarcity of chemical fertilizer prohibit their use by most small holding farmers; hence attention has shifted to use and research on organic sources of plant nutrients. Most studies on the use of animal wastes dealt with cattle and poultry dropping and their fertilizing value has been confirmed for many crops.

The aim of the research was to determine the effect of poultry manure and N.P.K fertilizer on the growth and yield of Okra (*Abelmoschus esculentus* L. Moench).

MATERIAL AND METHODS

Experimental site

Field trial were conducted in 2018 wet season at Dawakin-Kudu Location (Latitude 11^0. 762238N and Longitude 009^0.04805E) and Bagauda Location (latitude 11^0 – 22N and longitude 180^0 22E and 500 m above the sea level) both in Kano state Savannah zone of Nigeria the soil of the experimental site is well drained sandy loam. Moreover, treatments consisted of poultry manure at the rate of 0 ton ha^{-1}, 2 ton ha^{-1} and N.P.K 15:15:15 fertilizer at the rate of 90kg/ha. The research were laid out in split plot design and replicated three times.

Experimental Design

The field experiment was laid out in split plots design with treatments arranged in all possible factorial combinations given a total of 24 treatments and replicated three times given the total of 72 plots. The plots size was 2m x 2m the discard and border was taken at a space of 0.5m.

Description of the variety

Clemson spineless: The variety with medium dark green, angular pods. The fruits are a little bit longer in size than in the other varieties, with small diameter. The plants is also a short variety with broad leaves at the edge, it requires a sunlight of 6 hours daily, warm hot, growing temperature 65F and days to maturity 52-64 with the average yield of 6 ton $ha^{-1.}$

Land Preparation

The land was cleared, ploughed and prepared basin beds was made on a fine till for better root penetration.

Seed treatment

The seed was treated with seed dressing chemical Apron star (20% w/w Thimethoxan 20% w/w Metalaxyl-m and 2% w/w difenoconazole) at the rate of 10g per 5 kg of seed.

Sowing

Seeds were sown at the rate of three seeds per hole, with the spacing of 30cm x 50cm inter and intra row spacing, the seeding were thinned two plants per stand at two weeks after sowing.

Manure and Fertilizer Application

Poultry manure was applied 2 weeks before planting to allowed proper incorporation of nutrient into the soil at rate (0 ton ha^{-1} 2 ton ha^{-1} 4 ton ha^{-1}) and N.P.K Fertilizer at the rate of 90kg/ha was applied in split plot form one at sowing and second at 2 weeks after sowing.

Pest and Disease Control

The Okra plants was sprayed against beetles and caterpillars by applying Cyperforce which has a systemic and contact action at the rate of 0.5 liter per hectare 30 mls per 15 liter of water three time during plant growth, at seven days intervals. Spraying starts from 3 weeks after seedling emergence, and stopped before the plant stars fruiting.

Data collection

Five plants were randomly selected from each plot in the field and all the plants were tagged for observation on growth and yield.

Plant Height

This was carried out by measuring the heights of the five (5) tagged plants with a meter ruler from the top soil to the tip of the terminal buds at 3, 5, and 7 WAS. The average was recorded for each of the treatment.

Number of leaves per plants

This was taken by counting all fully expanded leaves of the (5) tagged plants 3, 5, and 7WAS. The average value was also being recorded for each of the treatment.

Number of Branches per plant

This was determined by counting all the development lateral branches on each five (5) tagged plants at 3, 5, and 7WAS. The mean value was recorded for each of the treatment.

Shoot Fresh Weight (g)

Plants from the discard of each plot for the field trial was uprooted and shoots were separated from the roots and measured using Digital scale and mean was recorded for each of the treatment.

Number of fruit per plant

Harvesting of the fruits from five 5 tagged plants in the experiment plots was done at five 5 days interval, counted and recorded on per plant basis. Values were summed up from first to last harvest and recorded as per treatment.

Fruits Yield (Kg/ha^{-1})

Fresh fruits harvested from the five tagged plants at 5 days interval, the weight of the fruit were determined in gram (g) using Digital scale and results were summed up from first to last harvest and recorded as per treatment converted to kilogram per hectare kg/ha^{-1}

Number of seeds per Pod

This was determined from five randomly selected fruits harvested within each plot. The pod dried, the seeds were counted and average recorded for each treatment.

100 Seed Weight (g)

100 seeds from pods of the five tagged plants were dried in the field and randomly sampled, counted, weighted in grams and was recorded for each treatment.

Data Analysis

The data collected was subjected to Analysis of Variance (ANOVA) procedure for Split-Plots Design using Gen-stat software. F-test was used to test for the level of significance, mean separation was carried out using Student New Man Kurlt (SNK) at 5% level of significance.

RESULT AND DISCUSSION

Plants Height

The effect of poultry manure and N.P.K on the growth and yield of okra on plant height is presented in table 1. Application of different rates of poultry manure and NPK fertilizer produced significant effect on performance of okra (P≤ 0.05) on plant height in both locations. In Dawakin kudu location, there were no significant difference in plant height at week (7) after sowing, the significant differences was observed only in plots treated with 4 ton ha^{-1} of poultry manure which produced high number of plant height with mean value of (23.87) followed by application of 2 ton ha^{-1} of poultry manure which produced (21.12 cm) and N.P.K fertilizer at the rates of 90 kg/ha produced mean value of (19.44). However, at Bagauda location there were significant differences among the treatments rates of poultry manure in plant height at 3, 5, and 7 week after sowing. Plant height was observed in plot fertilized with 4 ton ha-1 of poultry manure with mean value of (20.64) followed by other rates of poultry manure then NPK. Student New Man Kurtz, (2004)

Table 1: Effect of different rate of Poultry Manure and NPK fertilizer on Plant Height of Okra at Dawakin kudu and Bagauda during the 2018/19 wet season

Treatment	Dawakin kudu		WAS			Bagauda
Poultry manure	3	5	7	3	5	7
0	5.9	12.8	17.6d	6.1b	16.2b	23.6b
2	6.2	14.6	21.1b	6.8ab	17.8b	24.0b
4	6.3	14.7	23.9a	8.0a	20.7a	26.2a
NPK 15:15:15	6.5	14.7	19.5c	7.0a	17.5b	23.5b
SE±	0.57	14.7	1.39	0.54	0.90	1.17
Significance level	NS	NS	*	*	*	*

Means with the same letter (S) in the same column of any set of treatments are not significantly different ($P \leq 0.05\%$) using SNK (Student New Man Kurtz, 2004)

Number of Branches

The effect of poultry manure and N.P.K on the growth and yield of Okra on number of branches is presented in table 2. Application of all rates and combination of different of fertilizers produced significant treatments effect in number of branches per plant across locations. Application of 4 ton ha^{-1} of poultry manure significantly produced higher number of branches per plant with the mean value of (4.06). At Dawakin kudu location, application of NPK alone statistically produced high number of branches with mean value of (4.19) while plots with zero 0 tons ha^{-1} of poultry manure produced least number of branches. Plots fertilized with 2 tons ha^{-1} of poultry manure statistically produced similar number of branches with mean value of (3.06) and (3.52) respectively. However, at 5 week after sowing no significant differences were observed among the treatments. But at 7 week after sowing, significant differences were observed, plot fertilized with 4 tons ha^{-1} of poultry manure statistically produced high number of branches per plant with mean value of (6.96) then plot fertilized with 2 tons ha^{-1} of poultry manure with mean value of (5.92). Meanwhile, plots fertilized with NPK alone almost similar trend were observed with mean value of (5.84). (Student New Man Kurtz, 2004)

At Bagauda location, application of 4 tons ha^{-1} of poultry manure significantly produced high number of branches at 3 and 5 week after sowing, at seven 7 week after sowing no significant differences were recorded.

Table 2: Effect of different rate of Poultry Manure and NPK fertilizer on Number of Branches of Okra at Dawakin kudu and Bagauda during the 2018/19 wet season

Treatment	Dawakin kudu			WAS		Bagauda
Poultry manure	3	5	7	3	5	7
0	3.06	4.69	5.33c	2.26b	4.59b	6.30
2	3.52b	4.69	5.92b	2.26b	4.82b	6.52
4	4.06a	4.95	6.96a	2.52a	5.20a	7.25
NPK 15:15:15	4.19a	4.81	5.84b	2.18b	5.10b	6.64
SE±	0.22	0.27	0.22	0.39	0.64	1.32
Significance level	*	NS	*	*	*	NS

Means with the same letter (S) in the same column of any set of treatments are not significantly different ($P \leq 0.05\%$) using SNK (Student New Man Kurtz, 2004)

Number of Fruit per Plant

The effect of poultry manure and N.P.K on the growth yield of Okra on number of fruits per plant is presented in table 3. Application different rate of poultry dropping and NPK fertilizer had significant ($P \leq 0.05$) effect on number of fruit per plant at both locations. There was no significant effect among the different rate of poultry manure on number of fruits per plot at Dawakin kudu location. At Bagauda location, there were significant treatment effect among the different levels of poultry manure applied, in which 4 tons ha^{-1} of poultry manure produced high number of fruits per plant with mean value of (24.29) which is statistically similar to 2 ton ha^{-1} of poultry manure with mean value of (16.27) number of fruits per plant.

Table 3: Effect of different rate of Poultry Manure and NPK fertilizer on Number of Fruits per Plant of Okra at Dawakin kudu and Bagauda during the 2018/19 wet season

Treatment	Dawakin kudu			Bagauda
Poultry manure	No of fruits	Fruit yield	No of fruit/plant	Fruit yield
0	20.55	1.32d	16.27b	1.24d
2	24.06	3.37b	22.02a	3.39b
4	27.23	3.62a	24.29a	3.63a
NPK 15:15:15	26.91	3.18c	18.24b	3.13c
SE±	3.99	0.05	2.60	0.10
Significance level	NS	*	*	*

Means with the same letter (S) in the same column of any set of treatments are not significantly different ($P \leq 0.05\%$) using SNK (Student New Man Kurtz, 2004)

SUMMARY

The trials were conducted in 2018 wet season at two locations Dawakin kudu local Government (Latitude 11^0.762238N and Longitude 009^0.04805E) and Bagauda town (latitude 11^0 – 22N and longitude 180^0 22E and 500 m above the sea level) Kiru local Government both situated in Kano State Nigeria. The mean annual temperature is between 27^0C – 30.6^0C and the soil is clay loam for Dawakin Kudu. While, for Bagauda, the mean temperature is between 27^0C – 38.6^0C Sudan Savannan ecological zone of Nigeria for the study of Effect of Poultry manure and N.P.K on the growth yield of okra (*abelmoschus esculentus* L. moench) in Dawakin-kudu and Bagauda. The treatments consist of poultry manure at rate of (0, 2, and 4ton ha^{-1}) and NPK (15:15:15) fertilizer at rate (90kg/ha). The treatment were factorially combined and laid out in a split-plot design and replicated three times, the data collected was subjected to Analysis of Variance (ANOVA) procedure for Split-Plot Design using GenStat Software. F-test was used to test for the level of significance, mean separation was carried out using Student New Man kurl (SNK) at 5% level of significance.

CONCLUSION

Result of the study indicated that both mineral (NPK) and the organic manure (Poultry dropping) improved the growth and yield of Okra (*Albelmoschus esculentus*), but varying in degree, Organic fertilizers were better than the NPK mineral fertilizer. The treatment with Poultry dropping was found to be the best then NPK treatment. Used of Organic manure in the production of vegetables like Okra should be encouraged.

RECOMMENDATION

- Application of 4 tons ha-1 of Poultry manure in Okra production is recommended
- Application and combination of both NPK mineral fertilizer and Organic manure improved growth and yield of okra
- Farmers should be encouraged to adopt these methods to ease their way of production.

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