# EFFECTS OF POULTRY MANURE RATE ON THREE VARIETIES OF OKRA (Abelmoschus Esculentus L. Moench)

**Mariam Uyi Iguisi, Alkasin Idris Adam & Iyabode Joel Dada**
Department of Agricultural Technology, Federal College of Animal Health and Production Technology, Vom, Plateau State

## Abstract

The field trial was conducted at the Institute for Agricultural Research (IAR) Samaru, during the wet season to study the effect of poultry manure rate (0.2.4 and 6 t/ha) on three varieties of okra ( Abelmoschus Esculentus L. Moench), Jokoso, velvet and NAE47-4). The experiment was laid out in randomized complete block design (RCBD) and replicated three times. Three seeds were sown per hole at a spacing of 40cm apart on ridges according to treatment. The seedlings were thinned to one plant per stand at four weeks after sowing (4WAS). Manure application was done 3 days before planting by incorporating (0, 2.4.6t/hac) where 0t/hac serves as the control into the soil along rows of the ridges by making shallow grooves about 5cm as per treatment. The results obtained indicated that the application of poultry manure at different rates significantly influences the vegetative and fruit yields parameter of okra. Application of 6t/hac of poultry manure significantly increase plant height and the number of leaves per plant but did not have any significant effects on the number of days to flower. Application of 6t/hac increases the number of fruit per plot, fresh fruit weight, length of fresh fruit, and the diameter of fresh fruit. Dry fruit number and dry fruit weights were also increased by the application of 6t/hac of poultry manure. Application of 2t/hac of poultry manure also increases the number of plants per plot, number of leaves per plant, number of fruit per plot, fresh fruit weight, fruit length and fruit diameter. In conclusion, the result shows that the application of 2t/hac of poultry manure produced the significantly highest fresh fruit yield (130.00) with the Jokoso variety (197.42[a]). The optimum performance of okra was obtained at 2t /hac and could be recommended for enhancing the productivity of the crop in the study area.

**Keywords**: Okra, poultry manure, Effects

## Introduction

Okra (ebelmoschus esculentus l.moench) belongs to the family Malvaceae. It is a widely grown vegetable crop in the tropics, subtropics and temperate areas. It is mainly cultivated for its young fresh pod. (NRC, 2006). Okra is a herbaceous annual plant with erect hairy stems up to 2m tall.

Okra crop requires a long warm growing season and is susceptible to frost. It grows in all types of soil, thriving best in a moist friable well matured soil with a pH between 6.0- 6.8. Soil types do not appear to influence growth or development to any extent, a wide range of soil types have been found suitable but okra thrives best in soils with an adequate content of organic manure and reserves of the major element.

Some cultivars are sensitive to excessive soil moisture; others are slightly tolerant to acidic soil. Most cultivars are adapted to high temperatures throughout the growing period with little diurnal or seasonal fluctuation. Seeds will only germinate in relatively warm soils, no germination occurs below $16^0$c. A monthly range of 20 $^0$c - 30 c is considered appropriate for growth, flowering and development (Tridall *et al,* 1999). Okra can tolerate a wide range of rainfall conditions, but an average annual rainfall of about 750mm evenly distributed (Anon, 2000) and an optimum relative

humidity of 90-95% (Welby and McGregor, 1997) are adequate for growth. However. Okra does not grow well in water-logged soils. Okra is predominantly grown in Nigeria during the wet season. It is limited to irrigation sites during the dry season, especially in the Fadama. It is usually grown in compound gardens and smallholder plots in Nigeria and is commonly found in almost all Nigeria markets throughout the year. (Gemede et al, 2015). In the wet season, it is grown on ridges or beds at a spacing of 40-45 cm and a rate of 3 seeds per hole and later thinned to one plant per stand (Anon, 2000). On poor soil, a good supply of manure and fertilizer is recommended for maximal crop yield, the yield of up to 500kg/ha of pods may be produced over a harvesting period of 30-40 days (Tridall *et al,* 1999).

Poultry manure is an efficient organic fertilizer and also an important source of plant nutrients. In addition, it improves the physical properties of the soil (Reddy and Reddi, 1995). It has been reported that 30% of nitrogen from poultry litter is in urea or ammonium form and is hence readily available (Sunassce, 2001). Its average nutrient content is 3.03% N, 2.63% $P_2O_5$ and 1.4% $K_20$ (Reddy and Reddi, 1995).Nutrients absorbed by plants provide development at the early stages of growth and consequently improved the plant yield ( Aliyu, 2000). The supply of nutrients operates as a means of increasing yield with certainty and at the same time improving the quantity and quality of the crop. Also, most varieties are adapted to high temperatures throughout the growing period with little diurnal or seasonal fluctuation. The variety Jokoso with higher dry matter content and leaf area was relatively more vigorous. An examination of the growth pattern revealed early and faster accumulation of dry matter in "Jokoso". Variety "V 35" had a higher dry matter production. The peak of dry matter production was reached at 9 and 10 weeks after sowing in "Jokoso" and "V 35" respectively. White velvet is a popular variety in Northern Nigeria with a longish pod. NHAE47-4 is a variety of short roundish pods developed by the National Institute of Agricultural Research in Ibadan, Nigeria.

In recognition of high energy costs, rise in prices and scarcity of inorganic fertilizer in developing countries, there is a need for alternative sources of nutrients for improved okra production, especially in the guinea savanna of northern Nigeria. As long as poultry manures are relatively cheap, readily available and comparable to inorganic fertilizer in terms of crop yield improvement, their uses as a source of plant nutrients for growing vegetable crops assume increasing importance.
Accordingly, due to the high nutrient demand by okra, poultry manure was used to supply the requirement since it contains all the essential nutrients that the plant needs in high proportion. Even in cases where high-yielding cultivars have been grown, the inherently low fertility status of the soil coupled with minimal application of fertilizers remains the principal limiting factor to okra production, especially in the forest region of Nigeria and deficient soil moisture in savanna regions.
The objectives of this study were to determine the response of okra varieties (Jokoso, Velvet, and NHAE47-4) to 4 levels of poultry manure (0,2,4, and 6t/ha) and evaluate the effect of the poultry manure on the growth and yield of okra plant.

## Materials and Method

Experimental site: The study was conducted at the Institute for Agricultural Research Farm, Samaru (latitude $11^0$N and longitude $7^0$38'E and 686 meters above sea level) during the wet season. Samaru has a long-term annual rainfall average of 1100mm, received between May and September.

Treatment and Experimental Design: The treatment investigated involved three okra varieties Jokoso, Velvet, and NHAE47-4 and 4

levels of poultry manure, (0,2,4 and 6t/ha). The experiment was laid out in a Randomized Complete Block Design (RCBD) with treatments arranged in all their possible factorial combinations and replicated four times.

About the plot size**,e**Each gross plot measured 3m × 6m long (18$m^2$ and comprised of 4 ridges per plot 6m) while the net plot was (1.5×6m=9$m^2$). For cultural practices**,** the land was ploughed, harrowed, and the ridges were made 75cm apart. The seeds were treated with seed dressing chemical "Apron star 42WS (20% w/w thiamethoxam, 20%w/w metalaxyl-m, 2%w/w difenoconazole) at the rate of 10g per 5kg seed against soil-borne fungal diseases and insects. Three seeds were sown per hole at a spacing of 40cm apart on ridges according to treatment. The seedlings were thinned to one plant per stand at four weeks after sowing (4WAS).

Manure application was done 3 days before planting by incorporating it into the soil along rows of the ridges by making shallow grooves about 5cm as per treatment. The okra plants were sprayed against insect pests especially flea beetles, using perfection (dimethoate), which has a systemic and contact action, at the rate of 30mls per 15 litres of water at three-weekly intervals. Spraying started 3 weeks after seedling emergence. Weed Control was through hoe weeding has been carried out on all plots at 4, 8 and 12 weeks after sowing to keep the plots clean.

For data collection, three plants were randomly selected from each net plot and tagged for observations on growth which included plant height, number of leaves per plant and height to first fruit. This was taken 6 weeks after sowing. Yield and yield components were determined from fresh fruit harvested from the three tagged plants in the net plots. These include:- the number of fruits per plant and the fresh weight of fruits per plant. Other yield components determined were the number of seeds per fruit, average fruit length, and average fruit diameter. Where necessary, values were converted to per hectare basis.

For data analysis, the data collected were subjected to statistical analysis of variance to test the significance of the treatment effect using the F-test (Snedecor and Cochran, 1997). Where the F-test significant, the means were separated using Duncan's multiple-range test.

**Result**

Number of plants per plot - In table 1. Application of 2t/ha of poultry manure led to a significantly higher number of plants per plot than the other rate but was at par with the control. The result indicated that Jokoso had a significantly higher number of plants than Velvet and NHAE47-4 in that order.

Plant Height - Application of 6t/ha of poultry manure led to a significant plant height followed by 2 t/ha while 4t/ha and the control are at per. significantly tallest plants were observed in a plot that received 6t/ha of poultry manure. These were significantly taller than the control 0t/ha but statically at per with plot that received 2 and 4 t/ha. It was observed that jokoso produces taller plants than the other varieties.

*Yield component*

Number of fruits per plot -Statistically, the number of fruits per plot was not significantly different. (Table 1). Application of 2t/ha of poultry manure led to a significantly higher number of plants per plot than the other rates but was at par with control. The Jokoso variety had a higher number of fruits than the NHAE47-4 and Velvet variety.

*Fresh fruit weight t/ha* - Table 2 shows that application of 2t/ha of poultry manure produced the highest number of fruit weights per hectare. No significant difference between the application of 4 and 6t/ha of poultry manure

applied was observed. Jokoso variety had the significantly highest fresh fruit weight than velvet and NHAE47-4 in that order.

Table 1: Effects of poultry Manure rate on the number of plants and plant height and number of fruit per plot.

| Treatment | Number of plants per plot | Plant height per plot | Number of fruit per plot |
|---|---|---|---|
| Poultry Manure rate (t/ha ) | | | |
| 0 | 21.00[ab] | 18.00[b] | 90.00 |
| 2 | 24.56[a] | 22.44[ab] | 130.00 |
| 4 | 18.11[b] | 21.44[ab] | 113.78 |
| 6 | 18.22[b] | 23.44[a] | 108.33 |
| SE ± | 1.54 | 1.06 | 11.12 |
| Variety (v ) | | | |
| Velvet | 19.65[b] | 20.42[b] | 105.42[b] |
| Jokoso | 32.17[a] | 31.88[a] | 197.42[a] |
| NHAE47-4 | 9.58[c] | 11.92[c] | 28.75[c] |
| SE ± | 1.54 | 1.06 | 11.12 |
| Interaction (P&V ) | NS | NS | NS |

Means followed by the same letter(s) in a column of any set of treatments are not significantly different at a 5% level of significance using DMRT.

*Fruit length* -Fruit length was significantly affected by poultry manure rate (Table 2). Longer fruits were observed where 2t/ha was applied. Fruits supplied with 2t/ha were significantly longer than those supplied with no manure and 6t/ha of manure but statistically at par with 4t/ha poultry manure. The Jokoso variety had longer okra fruits than NHAE47-4; however fruit length of velvet is comparable to jokoso.

*Fruit diameter*-Table 2 shows the effect of poultry manure on fruit diameter. Application of 2t/ha of poultry manure led to significantly highest fruit diameter followed by 4 and 6t/ha which were comparable to the control that had the least diameter. Jokoso had a fruit diameter that was significantly higher than other varieties.

*Dry fruit number*-The result of the effect of poultry manure rate on dry fruit number indicates that significantly highest dry fruit number was obtained where 6t/ha was applied than other manure rates which were similar (Table 2). However, no significant differences were observed in the varieties concerning their dry fruit number.

*Dry fruit weight*-There were no differences observed in dry fruit weight among the varieties, (table 3). But the application of 6t/ha of poultry manure led to significantly highest dry fruit weight than the other rates. The interaction between the poultry manure rate and varieties was not significant.

Table 2: Effects of poultry Manure rate on fresh fruit weight, fresh fruit length and fresh fruit diameter (cm) of okra.

| Treatment | Fresh fruit weight (t/ha) | Fresh fruit length | Fresh fruit diameter (cm ) |
|---|---|---|---|
| Poultry Manure rate (t/ha ) | | | |
| 0 | 766.66$^{c}$ | 9.11$^{b}$ | 8.67$^{c}$ |
| 2 | 1300.00$^{a}$ | 9.78$^{a}$ | 9.56$^{a}$ |
| 4 | 1266.66$^{b}$ | 9.44$^{ab}$ | 9.22$^{b}$ |
| 6 | 1044.44$^{ab}$ | 8.89$^{b}$ | 9.11$^{b}$ |
| SE ± | 288.8 | 0.24 | 0.09 |
| Variety (v ) | | | |
| Velvet | 860$^{b}$ | 9.33$^{ab}$ | 9.33$^{b}$ |
| Jokoso | 1950$^{a}$ | 9.83$^{a}$ | 9.83$^{a}$ |
| NHAE47-4 | 140$^{c}$ | 8.75$^{b}$ | 8.25$^{c}$ |
| SE ± | 288.8 | 0.24 | 0.09 |
| Interaction (P&V ) | NS | NS | NS |

Means followed by the same letter(s) in a column of any set of treatments are not significantly different at a 5% level of significance using DMRT.

Table 3: Effects of poultry Manure rate on the number of dry fruits and number of dry fruit weight per plot of okra.

| Treatment | Number of dry fruit per plot | Number of dry fruit weight per plot |
|---|---|---|
| Poultry Manure rate (t/ha ) | | |
| 0 | 19.00$^{b}$ | 0.03$^{b}$ |
| 2 | 24.89$^{b}$ | 0.05$^{b}$ |
| 4 | 20.22$^{b}$ | 0.10$^{b}$ |
| 6 | 40.11$^{b}$ | 0.31$^{a}$ |
| SE ± | 2.42 | 0.04 |
| Variety (v ) | | |
| Velvet | 30.50 | 0.096 |
| Jokoso | 30.08 | 0.139 |
| NHAE47-4 | 17.08 | 0.135 |
| SE ± | 2.42 | 0.04 |
| Interaction (P&V ) | NS | NS |

Means followed by the same letter(s) in a column of any set of treatments are not significantly different at a 5% level of significance using DMRT.

## Discussion

Concerning the effects of the poultry manure growth of okra, most of the varieties did not respond significantly to the manure rate above 2t/ha. This is because there was enough N in the soil that could sustain the plant. This also supports the report of (Bhuma, 2001) which states that; the organic manure of plant nutrients in small quantities compared to fertilizers contains the presence of growth-promoting principles such as enzymes and hormones beside plant nutrients, making them essential for the improvement of soil fertility and productivity. The variety (Jokoso) responded well to both the manure rate and the weather conditions. This is because; some varieties are sensitive to excessive soil salt, while others are slightly tolerant to moisture. On the other hand, the Velvet variety exhibited a slow response to the manure rate. Also, it was observed that there was some seed burnt on the soil. This is because applying fresh manure before planting can decompose the soil causing damage to the root system. Rice *et al,* (1992) reported in his findings that a large amount of fresh manure may burn roots and seeds. It was observed that; the Jokoso variety with its deep root system to penetrate the soil to absorb more nutrients and water had a great advantage over the rest of the varieties in terms of plant height. Also, the observed difference in the fruit number as seen in the 3 varieties (Jokoso, Velvet and NHAE47-4) shows that NHAE47-4 lack the deep root needed to tap nutrient from the soil to aid its fruit formation this results in its low fruit number since okra has a taproot that anchors the plant deeply into the soil.

Considering the effects of rate of poultry manure on yield of okra, the rate of poultry manure had a slightly significant difference on the dry fruit number because it was allowed for a long time on the field and this makes it accumulate enough food to its fullest capacity which would have been transported to the top of the plant or the apex. Application of 6t/ha of poultry manure had a significant effect on dry fruit weight. This is similar to the report of (Ogunlela *et al,* 2006) in their experiment using farm yard manure observed that, okra plants which received 15 t/ha of manure treatment tended to produce green pods that were heavier, longer and thicker than those of plant in the control plot. The velvet variety had a small dry fruit number due to loss of moisture content as the weather becomes drier. It has also been observed that plants that suffer from water stress may drop their young fruit thereby leading to a reduction in total yield.

## Conclusion and Recommendations

Application of either 6 t/ha or 2t/ha of poultry manure rate to okra under any type of farming system i.e low scale or large-scale cropping system in the northern part of the country will be economical and sustainable since the manure contains a high amount of N, P, K and Urea which are readily available to the plant. Response to 6t/ha of manure gives credence to the widely held belief that soil fertility is a more potent limiting factor to crop production than soil moisture. Application of 2t/ha can give an encouraging yield to cover up for the labour intensity and capital input which is also a limiting factor, especially to the small-scale farmers in Nigeria.

In conclusion, the investigation of this study revealed that the application of 2t/ha of poultry manure resulted in a significant increase in fresh fruit weight/ha and other parameters. The Jokoso variety also produced significantly higher fresh fruit yield than other varieties at 2t/ha. Therefore to maximize the yield of okra under a small-scale system or low-input agric, an early application of well-rotted poultry manure at the rate of 2t/ha along the row and then covered by soil for one week before planting will be appropriate for optimum production of okra.

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