**Jewel Journal of Scientific Research (JJSR) 3(1): 122- 127, 2015**
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# Growth and yield of Okra (*Abelmoschus esculentus* L.) varieties as affected by poultry manure and inorganic fertilizer application

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**Abstract**
A trial to investigate the effect of poultry manure on the growth and yield of Okra (*Abelmoschus esculentus*) was conducted in the Teaching and Research Farm of Ibrahim Badamsi Babangida University during the 2012 and 2013 cropping seasons. The trial was a factorial experiment consisting of two varieties of Okra (NH Ae 47-4 and LD88-1) and five rates of poultry manure (0, 5, 10, 15 and 20 t $ha^{-1}$). Inorganic fertilizer (NPK 20:10:10) was applied at the rate of 200kg $ha^{-1}$. The experiment was fitted into randomized complete block design (RCBD). Poultry manure applied at 20 t $ha^{-1}$ and inorganic fertilizer significantly produced taller plants, more leaves and more fruits. Non application of fertilizer significantly delayed flowering. In 2012, poultry manure at 20 t $ha^{-1}$ and inorganic fertilizer statistically gave similar fruit weight which was significantly higher than other treatments. The highest fruit yield (13 t $ha^{-1}$) in 2013 was obtained with poultry manure at 20 t $ha^{-1}$. The varietal difference was not significant in most of the parameters measured.

**Key words**: Okra, poultry manure, inorganic fertilizer and variety

## Introduction

Okra is one of the most important vegetable grown and consumed widely in Nigeria. It is also widely cultivated and can be found in almost every market all over Africa (Schippers, 2000). Okra is mostly eaten in cooked or processed form and was reported to contained protein oil, calcium, iron, magnesium and phosphorus (Omotoso and Shitu, 2007). Decline in soil nutrient is one of the major constraints of crop production in Nigeria. In the past, inorganic fertilizer was advocated for crop production to ameliorate low inherent fertility of soils in the tropics (Adekiya and Agbede, 2009). However, high cost and scarcity of inorganic fertilizer as well as possibility of soil acidity and nutrient imbalance posed a constraint to use of inorganic fertilizer (Ogbalu, 1999; Agbede *et al*., 2008) and soil physical degradation hinder sustainable use of inorganic fertilizers in the tropics (Ewulo *et al*., 2008). In order to sustain soil fertility over a long period of time, the use of organic manure is been advocated. This is because the nutrients contained in organic manures are released more slowly and stored for a longer time in the soil, thereby ensuring a long residual effect (Sharma and Mittra, 1991). Abou El-Magd *et al*. (2005) also reported that manures provide a source of

all necessary macro- and micro-nutrients in available forms, thereby improving the physical and biological properties of the soil. Onwu *et al*., (2014) reported significant increased in growth and yield of okra due to application of poultry manure while Okwuagwu *et al*. (2003) reported that okra fruit yield was not significantly influenced by soil amendment, although higher yields were obtained from NPK + poultry manure treatment. The need for renewable source of energy and reduced cost of crop production using inorganic fertilizer has revived the use of organic manure. Therefore the objective of this study is to determine the effect of poultry manure on the growth and yield of two varieties of okra in southern guinea savanna.

**Materials and methods**

The experiment was conducted during the 2012 and 2013 cropping seasons at the Teaching and Research Farm of Ibrahim Badamasi Babangida University, Lapai, latitude $9^0$ 2''N and longitude $6^0$ 3''E, in the Southern Guinea savanna agroecological zone of Nigeria. The pH ($H_2O$) of the soil was 5.3 (pH meter), 2.4 g kg organic carbon(Walkley and Black), 0.40 g kg total N (Kjeldahl), 12 mg kg P(bray PT) and 0.35 cmol kg K (in NH OAC).

The treatments were two varieties of Okra (NHAe 47-4 and LD 88) and five rates of poultry manure (0, 5, 10, 15 and 20 t $ha^{-1}$). An inorganic fertilizer, NPK (20:10:10) was applied at the rate of 200 kg $ha^{-1}$ which served as a check. It is therefore a two factors factorial experiment fitted into randomized complete block design (RCBD) with three replications. Each plot measured 4 x 3 m ($12m^2$) with 1 and 0.5 m pathways between each replication and plot respectively. Poultry manure was applied in to the soil one week before planting while the inorganic fertilizer was split and applied at two and four weeks after sowing. Okra seeds were planted at a spacing of 30 cm by 50 cm at rate of three seeds which was thinned to one per hole.

The data collected includes plant height, stem girth, number of leaves per plant, number of fruit per plant, fresh fruit weight and fruit length. All the data collected were subjected to analysis of variance (ANOVA) and means separated at 5% probability using least significant difference (LSD).

**Results and discussion**

The effects of different rates of poultry manure on plant height and stem girth in 2012 and 2013 were significant as shown on Table 1. The tallest plants were obtained in both 2012 and 2013 cropping seasons when treated with poultry manure at rate of 20 t $ha^{-1}$ which did not differs significantly with inorganic fertilizer in 2012. In both 2012 and 2013 cropping seasons control plots significantly produced shorter plants. Also the effects of rates of poultry manure on stem girth were also significant ($P\leq 0.05$) with inorganic fertilizer, 15 t $ha^{-1}$ and 20 t $ha^{-1}$. Poultry manure statistically produced plants with similar girth which were significantly better than other treatments. These results can be attributed to organic manures which sustains cropping system through better nutrient recycling that give rise to improvement in crop growth, development and yield (Ayuso *et al*., 1996). This result is in agreement with the work of Dauda *et al.* (2008) on the efficacy of different levels of poultry manure on water melon. The result obtained shows that the application of poultry manure significantly enhanced all growth parameters of water melon. The result is also agreed with Aduloju *et al.* (2010) who reported that the nutrients from organic manure promote growth and yield of okra. The effects of poultry manure and variety on number of leaves per plant was not significant (Table 2). However control plots significantly took more days to 50 % flowering compared to others. This means that fertilizer enhanced the growth of Okra. This work is in agreement with the work of (Donnates *et al*., 2012) who reported that the earliness to flowering may be traced to relatively inherent nutrient availability which promotes crop performance.

**Table 1: Effects of rates of poultry manure and variety on plant height and stem girth of Okra 2011 and 2012 cropping seasons**

| Treatment | Plant height (cm) | | Stem girth (cm) | |
|---|---|---|---|---|
| | 2012 | 2013 | 2012 | 2013 |
| Poultry Manure (F) | | | | |
| 0 t $ha^{-1}$ | 45.02d | 43.89d | 1.58c | 1.56d |
| 5 t $ha^{-1}$ | 57.12bc | 55.45c | 2.78b | 2.55c |
| 10 t $ha^{-1}$ | 60.34bc | 67.89bc | 2.78b | 2.70b |
| 15 t $ha^{-1}$ | 76.34b | 78.45b | 3.89a | 3.98a |
| 20 t $ha^{-1}$ | 74.56a | 72.24a | 3.82a | 3.80a |
| Inorganic fertilizer | 77.56a | 76.09b | 3.92a | 3.93a |
| Variety (V) | | | | |
| NHe-47- 4 | 60.34a | 60.45a | 3.09a | 3.23a |
| LD 88- 1 | 58.45a | 58.12a | 3.13a | 3.16a |
| Interaction | | | | |
| V x F | NS | NS | NS | NS |

Means followed by the same letter(s) in the same column for each factor are not significantly different at P≤0.05

**Table 2: Effect of rates of poultry manure and variety on number of leaves and days to 50 % flowering of Okra 2011 and 2012 cropping seasons**

| Treatment | Number of leaves $plant^{-1}$ | | Days to 50% flowering | |
|---|---|---|---|---|
| | 2012 | 2013 | 2012 | 2013 |
| Poultry manure(t $ha^{-1}$) (F) | | | | |
| 0 t $ha^{-1}$ | 8ab | 8b | 38.23a | 37.28a |
| 5 t $ha^{-1}$ | 8b | 7ab | 34.37b | 35.12b |
| 10 t $ha^{-1}$ | 10ab | 11a | 32.94b | 32.92b |
| 15 t $ha^{-1}$ | 11a | 10a | 30.41c | 30.23c |
| 20 t $ha^{-1}$ | 12a | 12a | 29.11c | 30.24c |
| Inorganic fertilizer | 12a | 13a | 30.21c | 29.11c |
| Variety (V) | | | | |
| NHe-47- 4 | 11a | 10a | 33.67a | 34.45a |
| LD 88- 1 | 10a | 11a | 34.22a | 35.00a |
| Interaction | | | | |
| V x F | NS | NS | NS | NS |

Means followed by the same letter(s) in the same column for each factor are not significantly different at P≤0.05

The effects of poultry manure on number of Okra fruits were significant (P≤ 0.05) in 2012 and 2013 cropping seasons. The inorganic fertilizer and poultry manure at 15 and 20 t $ha^{-1}$ statistically produced similar number of fruits (Table 3) while control plots produced the lowest number of fruits.

**Table 3: Effect of rates of poultry manure and variety on number of fruits and fresh fruit weight of Okra, 2011 and 2012 cropping seasons**

| Treatment | Number of fruit $plant^{-1}$ | | Fruit weight $plant^{-1}$ (g) | |
|---|---|---|---|---|
| | 2012 | 2013 | 2012 | 2013 |
| Poultry manure (t $ha^{-1}$) | | | | |
| 0 t $ha^{-1}$ | 8.34c | 8.02c | 120.23c | 131.23d |
| 5 t $ha^{-1}$ | 8.45c | 10.45b | 135.94b | 142.90c |
| 10 t $ha^{-1}$ | 10.23b | 13.34b | 137.30b | 143.98c |
| 15 t $ha^{-1}$ | 14.45a | 13.89b | 144.09b | 143.88c |
| 20 t $ha^{-1}$ | 15.35a | 15.23a | 168.45a | 169.34a |
| Inorganic fertilizer | 15.12a | 15.78a | 166.12a | 157.23b |
| Variety | | | | |
| NHe-47- 4 | 17.33a | 13.08a | 165.21a | 165.30a |
| LD 88- 1 | 15.23a | 14.21a | 159.89a | 160.34a |
| Interaction | | | | |
| V x F | NS | NS | NS | NS |

Means followed by the same letter(s) in the same column for each factor are not significantly different at P≤0.05

The effect of fertilizer application on fruit weight was also significant (Table 3) in 2012, inorganic fertilizer and poultry manure at 20 t $ha^{-1}$ statistically produce similar fruit weight while in 2013 the fruit weight of poultry manure at 20 t $ha^{-1}$ was significantly higher than that of inorganic fertilizer. Generally the weights of fruits produced by the 0, 5, 10 and 15 t $ha^{-1}$ of poultry manure were statistically the same except in 2012. This implies that poultry manure at 20 t $ha^{-1}$ produced higher fruit weight which translated to yield (Table 4). The result is corroborated with Hamma *et al.* (2012) in their work on effect of poultry manure on the growth and yield of cucumber (*Cucumis sativum* L.) in Samaru, Zaria and reported enhancement in all growth and yield attributes measured in the field, which included vine length, number of leaves, leaf area, number of fruits, fruit length, fruit girth, fruit yield and fruit yield. All growth and yield attributes were significantly increased due to the application of poultry manure as a result of continuous supply of nutrients from the manure. However, Gudugi *et al.* (2012) obtained a contrary result in their work on the growth and yield of sweet corn (*Zea mays*). They observed that the application of inorganic fertilizer and poultry manure at 5, 10 and 15 tons $ha^{-1}$ were not significantly different on sweet corn.

**Table 4: Effect of rates of poultry manure and variety on fruit length, girth and fruit yield of Okra 2011 and 2012 cropping seasons**

| Treatment | Fruit length (cm) | | Fruit girth (cm) | | Fruit Yield (t ha$^{-1}$) | |
|---|---|---|---|---|---|---|
| | 2012 | 2013 | 2012 | 2013 | 2012 | 2013 |
| Poultry Manure (t ha$^{-1}$) (F) | | | | | | |
| 0 t ha$^{-1}$ | 4.55c | 4.98c | 2.12c | 2.12c | 10 | 11 |
| 5 t ha$^{-1}$ | 5.69b | 6.45b | 2.34b | 2.19c | 11 | 12 |
| 10 t ha$^{-1}$ | 9.92a | 9.34a | 2.35b | 2.44b | 12 | 12 |
| 15 t ha$^{-1}$ | 9.82a | 10.09a | 2.65a | 2.99a | 12 | 12 |
| 20 t ha$^{-1}$ | 11.02a | 10.08a | 2.45b | 2.96a | 13 | 13 |
| Inorganic fertilizer | 9.35a | 9.45a | 2.35b | 2.47b | 13 | 12 |
| Variety (V) | | | | | | |
| NHe-47- 4 | 9.01a | 9.01a | 2.87a | 2.50a | 13 | 14 |
| LD 88- 1 | 9.82a | 10.67a | 2.76a | 2.47a | 13 | 13 |
| Interaction | | | | | | |
| V x F | NS | NS | NS | NS | NS | NS |

Means followed by the same letter(s) in the same column for each factor are not significantly different at P≤0.05

The effects of rates of poultry manure and variety on fruit length and breadth was shown on Table 4. Control plots were significantly shorter in fruit length compared to treated plots. This could be attributed to soil nutrition availability due to application of poultry manure. This agrees with the work of Onwu *et al*. (2014) reported increase in pod length due to application of poultry manure.

**Conclusion**

Application of different rates of poultry manure to Okra led to significant increase in growth and yield over the control. Use of poultry manure at the rate of 15 to 20 t ha$^{-1}$ will significantly improve the performance of Okra comparable to use of inorganic fertilizer.

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