



Effect of Cattle Manure Rates on the Growth and Yield of Three Okra (*Abelmoschus esculentus* [L.] Moench) Varieties in Wukari, Taraba State, Nigeria

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ABSTRACT

Okra plays an important role in human diet, medicine and industrialization. However, productivity is low due mainly to the use of unimproved cultivar and low native soil fertility among others. This study was conducted in 2020 and 2021 raining seasons at the Teaching and Research Farm of Faculty of Agriculture and Life Sciences, Federal University Wukari, Taraba State, Nigeria to evaluate the effect of cattle manure rates on growth and yield of okra varieties. The treatments involved three varieties of okra (local, Clemson and Basanti 447) and four rates of cattle manure (0, 15, 20 and 25 t ha⁻¹) laid out in 3 x 4 factorial arrangement fitted into a randomized complete block design (RCBD) and replicated three times. Data were collected on growth characters (plant height, stem girth and number of leaves) and fruit yield (number of fresh okra and weight of fresh fruit). The results obtained showed that growth characters varied among varieties. Taller plants were observed in Clemson and Local than in Basanti 447. Plants emerging from Clemson had the thickest stem and highest number of leaves. Cattle manure application influenced growth characters positively as plants without its treatment had the lowest plant height, stem girth and number of leaves values. The tallest and highest numbers of leaves were observed on plants which received 25 t ha⁻¹ of cattle manure. Plants which received 25 t ha⁻¹ of cattle manure also produced the thickest stems but comparable with 20 t ha⁻¹ cattle manure fertilized plants. Basanti 447 plants had the highest fruit yield components but not significantly higher than those of Clemson plants. Plants supplied with 25 t ha⁻¹ of cattle manure had the highest number of fruit, heaviest fruit weight and yield but at par with plants which were fertilized with cattle manure at the rate of 20 t ha⁻¹. Clemson variety treated with 20 t ha⁻¹ of cattle manure are hereby suggested for farmers in Wukari area of Taraba State for profit maximization and sustainable production of okra.

INTRODUCTION

Okra (*Abelmoschus esculentus* [L.] Moench), a member in the family of Malvaceae is an important fruity vegetable, widely consumed and found in every market in Nigeria (Schippers, 2000). The crop plays an important role in human diet due to its supply of carbohydrates, proteins, fats, minerals and vitamins (Abd Elkader *et al.*, 2010). Its young leaves can be used as cattle feed (Siemonsma and Kouame, 2004). The pods have been used as plasma replacement and blood volume expander treatment (Haque *et al.*, 2015). Okra mucilage has been utilized in the production of glace paper production and confectioneries (Aliyu and Ajala, 2016). Despite the importance of okra, its productivity in Nigeria is often recorded low yield. The low yield has been attributed mainly to poor soil fertility, use of unimproved variety, obsolete cultural practices among other. Therefore appropriate emphasis had to be given to higher productivity of the crop through the selection of idea variety and nutrient supplementation to improve soil fertility. Most farmers often depend on planting material from neighboring farms rather than seek improved and certified seeds for their production. The problem of low fertility can be resolved through nutrient supplementation via organic and inorganic fertilizer application. The continuous use of inorganic fertilizer in crop production has created declined in soil fertility, nutrient imbalance, soil acidification, high energy cost and health hazards. Hence, animal wastes that results in organic manure will serve as a better alternative for high crop productivity in Nigeria. Animal manure when efficiently and effectively used ensures sustainable crop productivity by immobilizing nutrients that are susceptible to leaching. Nutrients contained in organic manures are released more slowly and are stored for a longer time in the soil, ensuring longer residual effects, improved roots development and higher crop yields (Abou ElMagd *et al.*, 2005). This study was undertaken to evaluate the effect of cattle manure rates on growth and yield of okra varieties in Wukari, Taraba State, Nigeria.

MATERIALS AND METHODS

Study Area

This experiment was conducted in 2020 and 2021 raining seasons at the Teaching and Research Farm of the Faculty of Agriculture and Life Sciences, Federal University Wukari, Taraba State, Nigeria. Wukari (latitude $7^{\circ} 51' N$ and $7.85^{\circ} N$, and longitude $9^{\circ} 47' E$ and $9.78^{\circ} E$ at elevation of 189 m above sea level.) is located within southern guinea savanna agro-ecological zone. The area is characterized by an average annual temperature of $28^{\circ} C$ and average precipitation is 1205 mm.

Experimental Design

The study involved three okra varieties (local, Clemson and Basanti 447) and four cattle manure application rates (0, 15, 20 and $25 t ha^{-1}$) which were laid out in 3 x 4 factorial arrangements, fitted into a randomized complete block design (RCBD) and replicated three times. Each plot measured 2 x 2 m (4 m²) with a spacing of 0.5 m apart between plots and 1m space between blocks. Prior to sowing, soil samples were collected from the experimental site at a depth of 0-15 cm using auger and bulked together to form a composite sample. The composite soil sample was air-dried and sieved through a 2 mm mesh and analyzed for its physical and chemical properties. The soil on laboratory analysis had pH, organic carbon, total nitrogen, exchangeable Ca, Mg, K, Na and exchangeable acidity of 7.75 , $24.00 g kg^{-1}$, $1.70 g kg^{-1}$, $3.05 mg kg^{-1}$, $2.03 cmol kg^{-1}$, $0.70 cmol kg^{-1}$, $0.24 cmol kg^{-1}$, $0.13 cmol kg^{-1}$ and $0.05 cmol kg^{-1}$ respectively. The proximate nutrient composition of the cattle manure were pH 6.5, organic carbon $28.50 g kg^{-1}$, N $33.00 g kg^{-1}$, P 1.31 %, 3.40 %, Ca, 0.56 %, Mg and 1.96 % K.

Cultural Practices, Data Collection and Analysis

The site was cleared of the existing vegetation followed by pegging and laid out into 3 blocks and 36 plots. Eight week old cured cattle dung manure under shade was crushed into granules and incorporated into designated plots using hoe and spade into prepared seedbed at the rate of 0, 15, 20 and $25 t ha^{-1}$ as per treatment. Sowing of seeds was done two weeks after applying manure. The seeds of the three varieties were soaked in water separately for 24 hours and spread on a platform to dry few hours before sowing. The non-viable seeds were discarded. Viable seeds were sown at a spacing of 50 x 50 cm and thinned to one seedling per stand two weeks after sowing (WAS). Five plant were randomly selected from each plot, tagged for data collection on growth (plant height, number of leaves and stem girth at 8 WAS) and harvest (number of fruits, fruit weight and yield). The obtained data were combined and subjected to analysis of variance using GENSTAT statistical package. Differences between treatment means were compared using least significant different at 0.05 level of probability.

RESULTS

Growth

The effect of cattle manure application on the growth of okra varieties are presented in Table 1. Variety and cattle application had significant ($P < 0.05$) effect on the growth of okra. Increased in cattle manure application rate brought about increased in growth and peak at $25 t ha^{-1}$. Plants without manure application had the shortest

plants. Local and Clemson had similar heights but taller than Basanti 447 plants. The tallest plants were observed on plants treated with 25 t ha⁻¹ of cattle manure. Clemson plants had the thickest stems while Basanti 447 had the thinnest stem but not thinner than the stem of the local plants. Only plants supplied with 20 and 25 t ha⁻¹ of cattle manure had thicker stems than control plants. Clemson variety produced plants with the highest number of leaves while Basanti 447 variety had plants with the least number of leaves but similar with the number of leaves produced by the local variety. Number of leaves produced by to plants treated with 25 t ha⁻¹ cattle manure had the highest number of leaves.

Fruit Yield Components

Fruit yield components of okra as influenced by variety and cattle manure application are shown in Table 2. Basanti 447 plants produced higher number of fruits than Clemson but at par with the local variety plants. Plants treated with 25 t ha⁻¹ of cattle manure had the most number of fruits but similar with the number of fruits products by plants treated with 20 t ha⁻¹ cattle manure. Variety had no significant ($P > 0.05$) effect on fruit weight per plant. All plants treated with cattle manure had similar weights but significantly higher than control plants except plants treated with 15 t ha⁻¹ of cattle manure. Clemson plants produced the highest fruit yield but comparable with the fruit yield produced by Basanti 447 plants. Plants treated with 25 t ha⁻¹ cattle manure had the highest fruit yield but similar with fruit yields of plants treated with 20 t ha⁻¹ of cattle manure.

DISCUSSION

The strategies employed to increased okra productivity in this study proved successful as growth and fruit yield components were increased. The study showed that the plant height, stem girth, number of leaves, number of fruits per plant and fruit yield varied among varieties. This implied that the productivity of each variety could be different in the same agro-ecological zone. Similar observation has been earlier reported by Ojo *et al.* (2012). Each variety exhibited differential plant height, stem girth and number of leaves due mainly to its genetic make-up. The Local variety exhibited higher height but thinner stem and lower number of leaves than Clemson variety which resulted in lower fruit yield. The higher number of fruits exhibited by Local variety than Clemson variety plant did not result in any fruit yield advantage in favour of the Local variety. Hence efficient utilization of photosynthetic organ (leaf) may

have been responsible for higher fruit yield in Clemson and Basanti 447. Clemson with moderate height and thick stem enhanced leaf production due to higher assimilate accumulation (Law-Ogbomo and Osaigbovo, 2017). Leaf is an organ of photosynthesis and higher number of leaves will enhanced photosynthetic production positively and its translocation to the storage organ (fruit) and hence higher yield. The soil of the experimental site was of low fertility status owing less than critical level of available phosphorus and exchangeable calcium. Calcium plays an important role in producing plant tissues and it enable plants to grow better. Phosphorus is important in cell division, development of new tissue and it is also associated with complex energy transformations in plant. Hence the deficiency of these nutrients in the plant will hamper its growth and yield. This low fertility status of the soil necessitated the application of cattle manure which contained high amount of organic carbon and appreciable amount of nutrients which mineralized to release its nutrients to supplement the soil fertility status. This trial showed the superiority of cattle manure treated plants over control plants in terms of higher height, thicker stems and more leaves. This is an indication that the treated plants benefited from manure application. The higher growth exhibited by the treated plants results in increased fruit yield. This observation is in agreement with the findings of Ojeniyi (2000) in which they reported that higher yield response of crops due to organic manure application could be attributed to improved physical and biological properties of the soil resulting in better supply of nutrients to plants. The poor expression of vegetative characters in plants without manure treatment (control) further confirmed the report of Akanbi and Togun (2002) who reported that nutrient availability determine plant vegetative growth.

CONCLUSION AND RECOMMENDATIONS

The growth and yield characters evaluated indicated that each respond differently in the same environment where they were grown. Clemson variety had the highest fruit yield but similar with Basanti 447. Cattle manure application enhanced the growth and yield of okra. Growth and yield peaked at the highest application rate (25 t ha⁻¹) but comparable with 20 t ha⁻¹. Based on these findings, Clemson variety is thereby suggested for farmers in Wukari as against Basanti 447 and Local due to its moderate height and higher fruit yielding as it will be resistant to lodging. The rate of cattle manure application should be 20 t ha⁻¹ for profit maximization and sustainable okra production.

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