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EFFECT OF POULTRY MANURE RATES AND DAYS AFTER ANTHESIS ON THE FRUIT QUALITY OF OKRA (*Abelmoschus esculentus* (L.) Moench)

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ABSTRACT

The cultivation of okra (A. esculentus) is crucial for sustaining food security and meeting nutritional demands, yet optimizing fruit quality remains a challenge. This research aimed to determine the effect of poultry manure rates and days after anthesis on quality of okra fruits. The experiment was carried out at the Crop section of the Teaching and Research farm of Ibrahim Badamasi Babangida University, Lapai, Niger State, Nigeria. The experiment was laid in a 3×3 factorial design consisting of two factors namely poultry manure rates (0, 7.5 and 12.5t/ha) and days after anthesis (7, 14, and 21 days) in a Randomized Complete Block Design (RCBD) and replicated three times. The plot area was 6m^2 with alley way of 1m between blocks and plots. The poultry manure was incorporated to the soil two weeks before planting and Okra seed were sown at a spacing of 50cm x 75cm in intra-row and inter-row spacing respectively. Data collected include: number of flowers/plots, number of fruits/plots, fruit length, fruit girth and the quality evaluation of okra fruits were evaluated. The result of the experiment revealed that the moisture content, dry matter, ash content, crude protein, carbohydrates and energy value of okra fruits were not significantly influenced by different rates of poultry manure and days after anthesis. However, significant differences were observed in the crude fat and crude fibre as application of 0t/ha of poultry manure produced significantly higher crude fat while 21 days after anthesis produced higher crude fibre.

Keywords: Days after anthesis, fruit quality, Okra, poultry manure

INTRODUCTION

Okra (*Abelmoschus esculentus* (L.) Moench), a versatile and valuable vegetable widely grown in tropical and subtropical regions, is known by many local names like "lady's finger" in England, "gumbo" in the U.S., and "bhindi" in India (Benchar, 2012). Its cultivation offers unique economic and nutritional benefits, adapting well to varying moisture levels and producing dependable yields, though it is sensitive to extremes such as frost, drought, and waterlogging (Santos et al., 2019). Belonging to the Malvaceae family, okra is cultivated for its edible pods, which serve as a critical dietary component in many parts of the world (Reddy et al., 2012).

Nutritionally, okra is rich in essential nutrients, including vitamins C and B9, calcium, iron, and fiber, along with medicinal properties that promote digestive health, cardiovascular function, and immune support (Uka et al., 2013). Additionally, okra seeds contain beneficial oils, comparable in nutritional value to poultry eggs or soybeans (Omotoso et al., 2007). This nutritional profile makes okra especially valuable in developing regions where diets may lack protein and diverse nutrients. Okra is also widely used in various culinary applications, either cooked, processed, or eaten raw when young and tender (Singh et al., 2018).

Marketability of okra depends heavily on fruit quality factors, including pod length, diameter, color, and mucilage content, which are important for consumer acceptance (USDA, 2018; Santos et al., 2019). Enhanced varieties of okra, achieved through genetic hybridization, offer further advantages by improving resistance to pests and diseases, increasing yield, and optimizing nutritional content. Hybridization, the process of crossing plants to produce new traits, allows selective breeding for desirable characteristics that better meet market demands and cultivation challenges (Whitney et al., 2010).

A promising approach to boosting okra productivity is using organic fertilizers, particularly poultry manure, which improves soil health and crop quality without the environmental risks associated with inorganic fertilizers (Williams and Harris, 2019). Poultry manure is rich in organic matter and nutrients, enhancing the soil’s fertility and structure while promoting sustainable farming practices. Unlike synthetic fertilizers, which can lead to groundwater pollution and other ecological concerns, organic manure provides a safer, eco-friendly alternative that aligns with the global push for sustainable agriculture (Kumar and Jangid, 2018).

However, research on how varying poultry manure rates and the timing of fruit development stages (measured as days after anthesis) affect okra’s fruit quality remains limited. These factors may influence nutrient density, fruit size, and other quality markers, which directly impact okra's nutritional value and market appeal (Rajurkar et al., 2011). Understanding the specific effects of these variables can help optimize okra production, enabling farmers to achieve higher-quality yields while maintaining sustainable agricultural practices. This study was aimed to determine the effect of poultry manure rates and days after anthesis on the quality of okra fruits. The specific objectives were to determine the effect poultry manure rates on the proximate analysis of okra fruits and to determine the effect of days after anthesis on the quality of okra fruit.

MATERIALS AND METHODS

This experiment was carried out at the Crop section of the Teaching and Research farm of Ibrahim Badamasi Babangida University, Lapai, Niger State, Nigeria. The experimental site is located on latitude 9°4'11''N and 6°34'21"E in the Southern Guinea Savanna zone of Nigeria with mean annual temperature ranging between 21°C and 36.5°C. The experiment was a factorial experiment laid in a 3×3 factorial design consisting of two factors namely poultry manure rates (0, 7.5 and 12.5t/ha) and days after anthesis (7, 14, and 21 days) in a Randomized Complete Block Design (RCBD) and replicated three times. The plot area was $6m^2$ with alley way of 1m between blocks and plots. The poultry manure was incorporated to the soil two weeks before planting. Okra seed were sown at a spacing of 50cm x 75cm in intra-row and inter-row respectively. Improved seeds of Okra seeds were obtained from the National Institute of Horticultural Research (NIHORT) in Ibadan, Oyo State, Nigeria. Poultry manure was obtained from Animal Section of Teaching and Research farm of IBBU, Lapai while working tools was obtained from the Crop Section of the Teaching and Research farm of IBBU, Lapai.

The land was cleared manually using cutlass and all debris were removed. The land was ploughed and ridged with aid of tractor mounted plough and ridge. Okra seeds were planted in the field at a spacing of 50cm within the row and 75cm between the rows and a depth of 4cm. 3 seeds were planted per hole and later thin to 2 per stand. Poultry manure was incorporated into the soil two weeks before planting. This is to allow mineralization to take place.

The following data were measured: Number of flowers per plot, Number of fruits per plot, Fruit length and Fruit weight. The determination of Dry matter (%), moisture content (%), ash content (%), crude fibre (%), crude protein (%), crude fibre (%), CHO (%) and Energy value (Kcal) were determined following the methods of the Association of Official Analytical Chemists (AOAC, 2002).

Data analysis

All data collected were subjected to analysis of variance (ANOVA) using Statistical Package for Social Sciences version 25 and significant means were separated using Least Significant Difference (LSD) at 5% probability level.

RESULTS AND DISCUSSION

Physiochemical analysis of in soil and poultry manure

Table 1 shows the physicochemical analysis of available N, P and K in the soil prior to the commencement of the experiment. The result revealed that both the soil and poultry manure had a considerable amount of N, P and K prior to the experiment. The experimental soil showed higher amount of available P and K while there poultry manure had higher N content. The textural class of the soil was Sandy loam.

Table 1. Physio-chemical analysis of the soil and manure before the experiment

Physical Properties	Soil	Poultry Manure
Sand (%)	71.3	
Silt (%)	18.1	
Clay (%)	10.6	
Textural Class	Sandy Loam	
Chemical properties		
pH in H_2O	6.48	6.30
pH in $CaCl_2$	5.40	
Organic carbon (g/kg)	0.35	25.29
Organic matter (g/kg)	20.64	74.71
Total N%	0.54	0.95
Available P(mg/kg)	0.08	0.25
Available K(Cmol/kg)	0.56	2.33
Exchangeable Base		
Na^+	0.46	2.12
K^+	0.29	2.33
Mg^{2+}	1.28	0.42
Ca^{2+}	2.38	1.36
CEC	3.84	

Effect of days after anthesis and poultry manure on number of flowers and fruits

The effect of days after anthesis and poultry manure rates on the number of flower and number of fruits of Okra is presented in Table 2. The result showed that variety has a significant ($p<0.05$) difference in the number of flowers of okra as improved variety had the highest number of flowers. Similarly, application of poultry manure at 12.5t/ha significantly produced higher number of flowers followed by application rate of 7.5t/ha while control (0t/ha) produced the least number of flowers at 5% probability level.

Table 2. Effect of Days after Anthesis and Poultry Manure on the Number of Flowers and Fruits of Okra

Treatment	Number of Flowers	Number of Fruits
Variety		
Local	9.20b	8.97b
Improved	12.17a	11.50a
Poultry Manure (t/ha)		
0	9.20c	8.60c
7.5	10.91b	10.34b
12.5	12.65a	12.32a

Values followed with same letter(s) across the column are not significantly different ($p<0.05$) using DMRT.

Table 3. Effects of days after anthesis and poultry manure on fruit length and fruit girth

Treatment	Fruit length	Fruit girth
Local	20.50a	25.31a
Improved	19.52a	19.87a
Poultry manure		
0	18.12a	23.18a
2.5	22.26a	23.40a
7.5	19.44a	22.96a
12.5	20.22a	20.83a

Values followed with same letter(s) across the column are not significantly different ($p<0.05$) using DMRT.

The result of the study also reveal that variety significantly influence the number of fruits of Okra as improved variety significantly produced higher number of fruits compared to local variety. Moreso, application of poultry manure rate of 12.5t/ha significantly ($p<0.05$) produced higher number of okra fruits while control (0t/ha) had the least number of fruits.

Fruit Weight

The consequence of days after anthesis on fresh fruit weight (kg) per plant and fruit yield was shown in table 4. (*Abelmuschus esculenus).* The result show that there was significant difference as improved variety performed higher than local variety, While at poultry manure 12.5ton per hectare had a highest performance with 0ton per hectare having poorest performance.

Table 4. Effects of days after anthesis and poultry manure (kg) on fruit weight

Treatment	Fruit weight
0.22b	356.46b
Improved	0.26a
Poultry manure	
0	0.18c
2.5	0.23b
7.5	0.27a
12.5	0.29a

Values followed with same letter(s) across the column are not significantly different ($p<0.05$) using DMRT.

Proximate Composition of Okra Fruit as influenced by Poultry Manure Rates and Days after Anthesis

The effect of poultry manure rates and days after anthesis on the proximate analysis is presented in Table 5. The result revealed that there were no significant ($p<0.05$) differences in the dry matter and moisture content of okra fruits as influenced by poultry manure rates as well as days after anthesis. However, application of poultry manure rate of 7.5t/ha had the highest moisture content of okra fruits but was not statistically significant from other application rates. Similarly, there were no significant differences in the ash content of okra fruits but application of poultry manure at 12.5t/ha and 21days after anthesis had higher ash content value but were not statistically different from other treatments respectively as observed.

With regards to the crude fibre of okra fruits, poultry manure showed a significant ($p<0.05$) difference. Application of poultry manure at 0t/ha (control) significantly had the highest crude fat compared to other application rates but there were no significant differences in the application rates of 7.5 and 12.5t/ha of poultry manure. Similarly, there were no significant differences in the crude fat of okra fruits as influenced by days after anthesis.

Application of poultry manure at 0t/ha had the highest crude protein although it was not statistically significant from other poultry manure application rates. Similarly, days after anthesis had no significant effect on the crude protein of okra fruits.

The result of the experiment also showed that there were significant differences in the crude fibre of okra fruits as inflicted by days after anthesis as 21days after anthesis significant ($p<0.05$) had highest value of crude fibre compared to other treatments. However, there were significant differences in CHO and energy value of okra fruits as influenced by poultry manure rates and days after anthesis in southern guinea savanna ecological zone of Nigeria.

Table 5. Proximate Composition of Okra Fruit as influenced by Poultry Manure Rates and days after Anthesis

	Dry matter (%)	Moisture content (%)	Ash (%)	Crude fat (%)	Crude protein (%)	Crude fibre (%)	CHO (%)	Energy value (Kcal)
Poultry Manure Rates (t/ha)								
0	96.61a	3.45a	8.70a	10.12a	18.58a	9.47a	49.68a	367.36a
7.5	95.45a	4.56a	8.66a	6.93b	15.98a	9.30a	54.58a	374.53a
12.5	96.43a	3.57a	9.53a	5.85b	16.55a	9.88a	49.74a	347.79a
SE±	0.420	0.413	0.593	0.847	1.089	0.518	3.564	10.892
Days after Anthesis								
7	96.42a	3.65a	8.59a	8.48a	17.56a	9.24ab	52.49a	369.53a
14	96.04a	3.96a	8.55a	6.19a	17.77a	8.83b	55.37a	359.13a
21	96.04a	3.97a	9.76a	8.23a	15.78a	10.58a	46.13a	360.92a
SE±	0.420	0.413	0.593	0.847	1.089	0.518	3.564	10.892

Values followed with same letter(s) across the column are not significantly different ($p<0.05$) using DMRT.

The result of the findings revealed that there is a significant difference in the number of flowers and number of fruits of okra as influenced by varieties and poultry manure rates. This effect on the number of flowers and number of fruits of okra variety can be attributed to the differences in the genetic make-up of the okra plant.

The application of different rates of poultry manure was observed to be significant in the number of flowers as well as number of fruits. Application of poultry manure at 12.5t/ha significantly ($p<0.05$) produced the highest number of flowers and number of fruits of okra, this could be attributed to the fact that poultry manure has been reported to be a good source of nutrient for crops likewise the attributes of easy availability and best conditions for quick absorption of nutrient by the plant. Earlier studies have found similar positive effects of PM (Onwu *et al*. 2014, Tiamiyu *et al*. 2012, Ali *et al.* 2014, Voor *et al*. 2018). According to Uka *et al*., (2013), using poultry droppings resulted in plants with the greatest fruit characteristics and yield.

The proximate composition of okra fruits as influenced poultry manure and days after anthesis no significant differences in the percentage of dry matter, moisture content, ash content, crude protein, CHO and energy value. The application of poultry manure is known to enhance soil fertility and nutrient availability, potentially impacting the nutritional composition of crops. However, the lack of significant differences in the measure parameters may indicate that the poultry manure rates did not induce substantial variations in nutrient uptake by okra plants. This result is in line with the findings of Ojeniyi *et al*., (2019) who reported that while organic amendments like poultry manure positively influenced soil nutrient level, the impact on crop nutrient content could vary depending on factors such as soil type and plant species. Days after anthesis can significantly affect the nutrient composition of fruits as they undergo various metabolic processes during development. In this study, the non-significant differences may imply that the nutrient composition of okra fruits was relatively stable across different stages of development. Similar results were reported by Oladipo *et al*. (2017) in a study on the influence of growth stages on the proximate composition of okra fruits.

The observed differences in the crude fat and crude fibre of okra fruits as influenced by poultry manure rates and days after anthesis suggest that these factors have a notable impact on the nutritional composition of the fruits Yadav *et al*., (2017) in his research reported that the impact of organic amendments is not always linear and an excessive application may not necessarily lead to increased nutrient accumulation. Furthermore, 21days after anthesis significantly produced higher crude fibre. The growth and development stages of fruits are known to influence fibre content. This finding is consistent with the research by Uwah *et al* (2020), which demonstrated that the proximate composition of okra fruits including fibre content can vary at different growth stages. The plant's metabolic processes during fruit development, particularly as it approaches maturity can contribute to variations in fibre composition.

CONCLUSION AND RECOMMENDATIONS

The result of the experiment revealed that the moisture content, dry matter, ash content, crude protein, carbohydrates and energy value of okra fruits were not significantly influenced by different rates of poultry manure and days after anthesis. However, significant differences were observed in the crude fat and crude fibre as application of 0t/ha of poultry manure produced significantly higher crude fat while 21 days after anthesis produced higher crude fibre.

It is therefore recommended that further research be conducted on considering different poultry manure application rates to determine the optimal application rates that can enhance the proximate composition of okra fruits.

REFERENCES

Ali, R., Konwar, J.S. and Saimbhi, M.S. (2014) Temporal Dynamics of Okra (*Abelmoschus esculentus*) Fruit Growth: Insights from Days after Anthesis Studies. *Journal of Horticultural Science*, 45(2), 123-136.

Benchar, S. (2012) Okra (*Abelmoschus esculentus* (L.) Moench) as a valuable vegetable of the world. *Ratarstvoi Povrtarshvo*, 49, 105 – 112.

Kumar, P., & Sharma, R. (2018) Impact of organic amendments on fruit quality of okra (*Abelmoschus esculentus* L.). *Journal of Environmental Science and Health*, Part B, 53(1), 35-42.

Kumar, S., & Jangid, A. K. (2018) Nutritional composition and health benefits of *Abelmoschus esculentus*: A review. *Pharmacognosy Reviews*, 12(23), 92–96

Ojeniyi, S. O., Fasoyiro, S. B., & Afolayan, R. A. (2019) Influence of organic amendments on soil fertility, okra (*Abelmoschus esculentus* L.) growth, yield, and nutrient composition. *Heliyon, 5* (12), e02895.

Oladipo, O. G., Babalola, O. O., & Lawal, A. T. (2017) Proximate composition and antioxidant properties of okra (*Abelmoschus esculentus*) at different growth stages. *Agricultural Science*, *15* (2), 84-91.

Omotoso, S.O. and Shittu, O.S. (2007) Effect of NPK fertilizer rates and method of application on growth and yield of Okra (*Abelmoschus esculentus* (L.)

Moench). Ado-Ekiti Southwestern, Nigeria. *International Journal of Agricultural Resources* 2(7); 614 – 619.

Onwu, I. U., Harris, H.A. and Bowel, F.K. (2014) Influence of poultry manure on fruit quality and yield of okra (*Abelmoschus esculentus* L.) in southeastern Nigeria. *Journal of Agricultural and Biological Science, 5*(2), 143-152.

Rajurkar, N. S., & Hande, S. M. (2011) Estimation of nutritive value and analysis of proximate composition, total flavonoids, total phenols and antioxidant activity of okra (*Abelmoschus esculentus* L. Moench). International Food Research Journal, 18(3), 1043–1048.

Reddy, M.T., Haribabu, K., Ganesh, M., Reddy, K.C and Bagum, H. (2012) Genetic divergence analysis of indigenous and exotic collections of Okra (*Abeslmoschus esculentus* (L.) Moench). *Journal of Agric-Technology*., 28 (2): 611 – 623.

Santos, H.C., Pereira, E.M., de Medeiros, R.L.S., Costa, P.M.D and Pereira, W.E. (2019) Production and quality of Okra produced with mineral and organic fertilization. *Revista Brasileira de Engenharia Agricolae Ambiental*, 23(2), 97 – 102.

Tiamiyu, O.E., Oyelade, O.J. Ade-Omowaye, B.I.O., Adeyemi, I.A., and Vande, O. (2012) Influence of pre-treatment on yield, chemical and antioxidant properties of Nigerian Okra see (*Abelmoschus esculentus*) flour. DIO:10.1016/j.fct.2s008.12.023

Uka, U.N., Chukwuka, K.S., and Iwuagwu, M. (2013) Relative effect of organic and inorganic fertilizers on the growth of Okra (*Abelmoschus esculentus* (L.) Moench). *Journal of Agricultural Sciences*, 58 (3): 159 – 166.

United States Department of Agriculture (USDA). Agricultural Research Service. (2018). Food Data Central. Retrieved from.

Uwah, D.F, Udoh A.I. and Iwo G.A. (2020) Effect of Organic and mineral fertilizer on growth and yield of Cocoyam (*Colocasia esculental* (.L.) Schott). *International Journal of Agricultural science* vol. 3, Pp 33 – 38.

Voor, S. A., Kameswara, R.N., Appa, M.H and Ellis, R.H, (2018) Influence of Days after Anthesis on Okra Fruit Size and Morphological Changes. *Agricultural Sciences Research*, 22(4), 567-580.

Whitney, K.D., Ahern, J.R., Campbell, L.G., Albert, L.P. and King, M.S. (2010) Patterns of hybridization in plants. Perspectives in plant ecology. *Plant Systematics and Evolution*, 12, 175 – 182.

Yadav, P. Singh, P. and Yadav R.L. (2017) Effects of organic manures and nitrogen levels on growth, yield and quality of okra. *Indian Journal of Horticulture*, 63 (2) : 215 – 217.