Growth and Yield of Okra (Abelmoschus esculentus L. Moench) as Influenced by different concentrations of Poultry Slurry in Lagos, Nigeria

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Abstract – Continuous cropping of same land as a result of pressure on land has seriously declined the fertility level of most farm lands over the years. Hence, there is need to sustain soil fertility through the use of organic fertilizers. However, some of these organic fertilizers can constitute environmental challenges, if not properly managed. Instead they can be diverted to maintain arable soils for fruit vegetable production. The cultivation of okra as a popular fruit vegetable crop in Nigerian diets requires fertile soil for maximum yield. The discharged (slurry) or liquid manure obtained from washing of poultry pen's floors cannot be stored for future use but be used as fertilizer added to water for irrigating (fertigation) okra field. Therefore an experiment was conducted to assess the different levels of poultry slurry concentration in the irrigation water on the growth and yield of okra (Abelmoschus esculentus L) between January and March, 2017 in Epe, Lagos.

The treatments comprises of the control (without poultry slurry application at 0 cl) and five PS (Poultry Slurry) at 25, 50, 75, 100 and 125 centiliters (cl) per square meter of land area, The six treatments were laid out in a randomized complete block design with three replications. The data were collected on plant height (PH) cm, number of leaves (NL), leaf area (LA) cm2, number of fruits (NF) and fresh pod weight of okra (FPW) g/m2.

Applications of PS increased PH and LA of okra in the following order: control (0cl)< 25cl<50cl<75cl<100cl<125cl respectively. The highest NL of okra (11±0.2) under the soil amended with PS (125cl) was higher than the control (5±0.1) and 100 cl PS (9±0.3) by 120.0 and 22.2% respectively. While the NF of okra recorded from PS at 125cl (14±0.4) was significantly higher ($P < 0.05$) than the control (11±0.1) and PS at 50cl (13±0.5) by 27.3 and 7.7% respectively. Relative to the control, application of 25, 50, 75, 100 and 125 cl PS significantly increased ($P < 0.05$) the fruit yield of okra by 51.6, 114.7, 278.9, 290.5 and 305.3% respectively. The result indicated that the higher the PS concentration, the higher the growth and yield of okra. However, the yield of okra recorded under Poultry-Slurry at 125 cl was significantly higher than other treatments and therefore recommended for okra production in Epe, Lagos.

Keywords: concentrations, okra yield, poultry slurry, organic fertilizer.

1.0 INTRODUCTION

Poultry industry is one of the fastest growing agro-based industries in the world today at a global rate of 5% per annum with its share in world meet production increasing from 15% three decades ago to 30% (FAO, 2006). As a result of this development, there is growing concern on how to dispose of poultry wastes from the environment in Nigeria.

Several efforts have been made to manage the wastes generated from poultry industry. For instance, in areas where facilities are available the poultry waste is sundried, bagged and stored for further use as fertilizer. While in most cases the waste is dumped indiscriminately. Improper management of these wastes could result to environmental and human health concern (Ogunlade *et al;* 2017). Moreover, in some poultry farms the waste is disposed of in slurry form which in turn becomes a menace and breeding site for other diseases causing organisms. However, the important of poultry waste in soil fertility management cannot be overemphasized, but common form of utilizing poultry waste is its dry

form for crop production and as raw material for biogas. As a result of this, there is need to put the liquid form of this waste into use especially in vegetable crop production.

Okra (*Abelmoschus esculentus* L. Moench) is an important and popular vegetable crop cultivated in Nigeria for its mucilaginous content. The importance of okra as a vegetable crop lies in its 'drawing quality' that aids easy consumption of bulky staple foods like Gari, Fufu and Pounded yam (AdeOluwa and Kehinde, 2011). They are boiled or fried and eaten as vegetable. They can also be cut into pieces, dried and/or powdered and stored for use in soups during the dry season when fresh okra fruits are scarce (Asare-Bediako *et al.,* 2014). Despite its nutritional value, its optimum yield ranged from 2-3 t per hectare. In the tropical countries the yield is low partly because of continuous decline in soil fertility (Chattopahyay *et al*., 2010).Several factors are responsible for low yield of crops in the tropics which include; low organic matter content, low soil pH and deficiency of Ca among others (Hue, 1992).

Therefore there is need to apply organic or inorganic fertilizers to ameliorate depleted condition of the tropical soils for crop production. However, poultry waste is a reservoir for various essential elements, cation exchange capacity, soil buffering, and a large geochemical reservoir of carbon (Amanullah *et al;* 2010). Similarly, Olugbemi and Falade (2014) observed 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. It is locally available source of nutrients that has enhanced the efficiency of soil in crop yields and reduced soil degradation. The use of inorganic fertilizers has drastically declined due to the energy crisis, which has immensely affected most of the developing countries. In contrast to chemical fertilizers, nutrients contained in organic manures are released more slowly and are stored for a longer time in the soil ensuring longer residual effects, thereby improved root development for higher crop yields. They are usually applied at larger quantities relative to chemical fertilizers. When applied at such quantities, they give residual effects on the growth and yield of succeeding crops (Seasto, 2013). Improvements of environmental conditions as well as the need to reduce cost of fertilizing crops are reasons for advocating use of organic materials (Singh, 2008).

Many workers have tried to assess the importance of organic manures in crop production. Senjobi *et al.* (2010) reported that the use of poultry, plant and sheep/goat manures improved all the growth parameters of the leafy vegetable they worked with. Other workers have reported beneficial effects of organic manure on soil properties such as bulk density (Adegbola *et al*., 2010), soil moisture content (Amanulla *et al*., 2010), water-holding capacity and other soil physical properties (Adewumi *et al.,* 2010). Many materials which are waste products of agricultural enterprises and the saw-mill industry can be used beneficially to produce crops and amend the soil for sustainable crop production.

Therefore application of organic fertilizers not only produced the highest and sustainable crop yield, but also improved the soil fertility and productivity (AdeOluwa and Kehinde, 2011). Hence, this trial assessed the effect of different levels of dissolved poultry manure (slurry) on the performance of okra under field condition in Epe, Lagos.

2.0 MATERIALS AND METHODS

2.1 Description of experimental site:

The field experiment was conducted at the Teaching and Research Farm (TRF) Michael Otedola College of Primary Education, Noforija Epe, Lagos State. Lagos is located in the Southwest of Nigeria between latitude 6.6^{0}N and longitude 4.0^{0}E. Koppen-Geiger climate classification reported that Lagos average rainfall and temperature was 1693mm and 27℃ respectively (Kottek *et al.* 2006).

2.2 Soil samples collection and laboratory analysis:

Prior to land preparation**,** five soil samples (0-15 cm) were randomly collected using soil auger at the Teaching and Research Farm, Michael Otedola College of Education Epe, Lagos and analyzed in the Department of Agronomy, University of Ibadan in 2016. The bulk samples were air driled, crushed and passed through 2 mm

wire mesh for the determination of pH, P, K, Ca, Mg and Na. The soil pH was determined on pH meter using 1:1 soil: water ratio. Phosphorus was determined by Bray P1 method and colour was developed in soil extracts using the ascorbic and acid blue method (Murphy and Riley, 1962). Exchangeable K, Ca, Mg and Na were determined by neutral ammonium acetate extraction method. Potassium and Na concentration in the extract were determined using the flame photometer; while Ca and Mg were determined by atomic absorption spectrophotometer (Okalebo *et al.,* 1993). Organic carbon and total N was determined from the soil sieved with 0.5 mm wire mesh. Soil organic carbon was determined using the Walkley- Black oxidation method (Nelson and Sommers, 1982). Total N was also determined using the Macro kjeldahl procedure (Bremner and Mulvancy, 1982). Particle size analysis was determined using Bouyoucous hydrometer method (Bouyoucous, 1962).

2.3 Experimental materials:

The materials used for the experiments include; okra seed (*Jokoso;* a dwarf variety) sourced from Agricultural seed store, Iragunshin Epe Lagos State while the poultry waste was sourced from the Teaching and Research farm Michael Otedola College of Education Epe, Lagos.

2.4 Experimental procedures:

The experimental site was manually prepared by clearing the land with cutlass and hoe, and beds were constructed at 1m x 1m. The okra seeds were sowed at 2 seeds per hole at 60 cm by 60 cm on 1.0 m^2 bed. Hand weeding was carried on each bed regularly to avoid competition. Regular manual irrigation was carried out except on rainy days. All pests were handpicked on daily basis to avoid much, damage to the okra plants.

2.5 Experimental treatments:

The slurry concentrations used as treatments were: control (0 cl), 25 cl, 50 cl, 75 cl, 100 cl and 125 cl.

2.6 Experimental design:

The experiment was laid out in a Randomized Complete Block Design (RCBD) with six (6) levels of the treatments (control (0 cl), 25 cl, 50 cl, 75 cl, 100 cl and 125 cl) and were replicated three times given a total unit of (18) eighteen micro plots.

2.7 Experimental treatments application:

The slurry was diluted at a ratio of 50: 100 cl of water. To every 50 centiliters of poultry waste slurry, 100 cl (1 litre) of water was used to dilute it before application. This was applied inform of irrigation a week after 2 weeks of sowing (WAS) the okra in the field.

2.8 Data collection:

Data were collected on Plant Height, Number of Leaves and Leaf Area of okra using two plants per plot at 2 weeks after sowing (WAS) in the field. Number of Fruits and fresh yield of okra were also recorded at five days interval. Plant height was taken from the ground level to the tip of the plant, using a measuring tape. Average fruits weights were determined using weighing balance.

2.9 Statistical analysis:

Data collected were analyzed using analysis of variance (ANOVA $P \leq 0.05$). Mean treatments were subjected to standard error and the significant difference among the treatment means were separated using Duncan's Multiple Range Test (DMRT) at 0.05 level of probability.

3.0 RESULTS AND DISCUSSION

Table 1: The physical and chemical properties of the soils used for the experiments

Parameters	Values
pH (H_2O) (1:1)	7.1
Organic C (g kg^{-1})	1.4
Total N (g kg^{-1})	0.3
Available P (mg kg^{-1})	55.1
Potassium K (cmol kg^{-1})	0.7
Calcium Ca (cmol kg^{-1})	26.5
Sodium Na (cmol kg^{-1})	0.4
Magnesium Mg (cmol kg^{-1})	2.8
Particle size distribution (g/kg^{-1})	
Sand	726.0
Clay	140.0
Silt	134.0
Textural class	Sandy loam

*S*ource: 2016. Department of Agronomy Soil Laboratory, University of Ibadan, Oyo state

Table 1: Shows the result of analysis of experimental field before cropping. The sandy loam soil gave pH 1:1 (H_2O) of 7.1 which was neutral and within range of 6.5-7.5 for optimum okra production (Banashree and Nirmali, 2015). The SOC (1.4 g/kg) and total N (0.3 g/kg) were below the critical limit of 8.7 g/kg and 1.5 g/kg respectively reported for soils in Southwestern, Nigeria (Sobulo and Adepetu, 1987; Enwezor *et al.,* 1989). The available P (55.1 mg/kg) was above the critical limit of 10-16 mg/kg reported by Adeoye and Agboola, 1985. Exchangeable cation such as K (0.7 cmol/kg), Ca (26.5 cmol/kg) and Mg (2.8 cmol/kg) were above critical limit of 0.2, 2.0 and 0.4 cmol/kg respectively (Adeoye, 1986; Akinrinde and Obigbesan, 2000). Theerefore the soil was not adequate in N and soil organic C. Nitrogen is very essential for okra growth and fruit development.

Table 2. Show that the poultry slurry (PS) was high in C (14%), Ca (3.6%) and N (1.5%) contents of the sample. However, it was very low in P (0.3%), K (0.6%) and Mg (0.3%) concentration. This indicated that application of poultry slurry will improve the N and soil C content which were not adequate for okra production (Table 1).

Table 2. Nutrients composition of poultry slurry used for the trial

Parameters	Values (%)
C	14
N	1.5
P	0.3
K	0.5
Ca	3.6
Mg	0.2

*S*ource: 2016. Department of Agronomy Soil Laboratory, University of Ibadan, Oyo state

Table 3. The result revealed that the plant height of okra was ranged from 8.3 to 19.3cm and 35.8 to 43.9 cm at 3 and 4 WAS respectively. The highest value was observed under the highest slurry concentration application. The leaf area of okra increased in the following order of poultry slurry applications: 0 cl < 25cl <50cl< 75 < 100cl < 125cl while at 4 weeks after sowing (WAS), the plant height and number of leaves showed no significant difference between the slurry concentrations across the treatments. However, the least value of plant height (35.8 cm) was observed under control and this was noticed across other okra plant growth parameters (Table 3). Therefore the present study attested to the ability of the poultry slurry manure (organic fertilizer) to increase plant height, number of leaves and leaf area of okra. Similar report was recorded by Ayeni *et al.* (2008) which found that cocoa pod ash and poultry manure increased plant height and number of leaf of maize. This was also corroborated by Ojeniyi *et al.* (2007) which noted that crop wastes such as spent grain and cocoa husk combined with poultry, cow and goat manure at equal rates to 25 t ha^{-1} significantly increased plant height, leaf area, stem girth and number of leaves of tomato.

Table 3. Effects of different poultry slurry concentrations on the growth parameters of okra

Poultry slurry concentration Levels (cl)	Weeks after sowing (WAS)					
	Plant height(cm)		Number of leaves		Leaf Area (cm^2)	
	3 WAS	4 WAS	3 WAS	4 WAS	3 WAS	4 WAS
Control (0)	8.3	35.8	4.0	5.0	70.63	79.4
25	13.5	38.6	7.0	8.0	162.4	247.3
50	15.3	38.7	7.0	8.0	163.5	250.2
75	17.3	39.4	7.0	8.0	211.3	316.1
100	17.2	43.8	7.0	9.0	234.7	350.9
125	19.3	43.9	9.0	11.0	276.1	410.4
SE (df = 17)	0.2	0.3	0.1	0.2	24.4	22.6

LEGEND: WAS = Weeks after sowing; SE = Standard Error; CL=Centilitres

Table 4. Shows that at the harvest, the number of okra fruits per treatment was not significantly different but fresh fruit size and weights were positively increased as the slurry concentrations increased by 25 cl. The least (11) number of fruits was observed under no application of poultry slurry and the highest value (14) of number of okra fruits were recorded under 125cl slurry application (Table 4). The fresh fruits weight ranged from 95.0 to 385.0 g/m^2. However the least fruits weight were observed under the control (95.0 g/m^2) while the highest (385.0 g/m^2) was recorded under the application of poultry slurry at 125 cl. When 50 cl poultry slurry was applied, the okra fruits weight increased by 29.4% compared with when 25 cl application but the percentage of increase was reduced to 3.6 between 100 and 125 cl applications. Relative to the control, application of 25, 50, 75, 100 and 125 cl PS significantly increased ($P < 0.05$) the fruit yield of okra by 51.6, 114.7, 278.9, 290.5 and 305.3% respectively (Table 4). This inferred the potential of the poultry slurry manure to improve the yield of vegetable even at higher concentration. The report of several researchers (Ojeniyi *et al;* 2007; Ayeni *et al;* 2008) on the ability of organic fertilizers to improve the yield of crops corroborated the performance of poultry slurry application on okra fruit yield.

Table 4: Yield parameters of okra as influenced by different poultry slurry concentration

Poultry slurry concentration (cl)	Number of fruits	Fresh fruit weight (g/m^2)
control	11_d	95.0_f
25	13_b	144.0_e
50	13_b	204.0_d
75	12_c	360.0_c
100	12_c	371.0_b
125	14_a	385.0_a

S.E (df = 17)	±0.4	±5.4

Means in a column followed by the same letter are not significantly different by Duncan Multiple Range Test at P < 0.05.
LEGEND: WAS = Weeks after sowing; SE = Standard Error; CL=Centilitres

4.0 Summary, Conclusion and Recommendations

Continuous cropping of same land as a result of pressure on land has seriously declined the fertility level of most farm lands over the years. Hence, there is need to sustain soil fertility through the use of organic fertilizers. However, some of these organic fertilizers can constitute environmental challenges, if not properly managed. Instead they can be diverted to maintain arable soils for fruit vegetable production. Therefore field experiment was conducted at the Teaching and Research Farm, Michael Otedola College of Education between January to March, 2017 to assess the effects of different levels of poultry slurry concentration on the growth and yield of okra in Epe, Lagos.

The result obtained shown that the effects of poultry slurry fertigation at various concentration increased the growth parameters and fruits yield of okra. Therefore Nutrients contained in poultry slurry could be used for effective soil management for sustainable okra production in Epe, Lagos.

In conclusion, okra growth and yield performances under the applications of poultry slurry under field conditions responded to the rate of increase of poultry slurry. Besides, as the poultry slurry contains nutrients as require for okra production amidst other merits of organic fertilizer application, it is hence, recommended for okra fertigation to reduce the menace of poultry waste. However, the best performance was recorded under Poultry Slurry at 125 cl.

5.0 REFERENCES

1. Abdel-Baset, N.S. and Abbas, S.F. 2010. Study on the use of dried poultry litter in the camel's ration. Vet. Res. For., 2: 65-71.

2. Adegbola, A.A., Smith, O.B. and Okeudo, N.J. 2010. Response of West African dwarf sheep fed cassava peel and poultry manure based diets.

3. FAO Corporate Document Repository Produced by ILRI, 1-8. Retrieved from http://www.fao.org/wairdocs/ILRI/x5536E/x5536e0p.htm on 5th of May, 2017.

4. AdeOluwa .O O. and Kehinde, O .B. 2011. Genetic variability studies in West African okra (Abelmoschus caillei). Agric. Biol. J. N. Am. 2:1326-1335.

5. Adeoye, G.O. and Agboola, A.A. 1985. Critical level for soil pH, available P. K. Zn. and maize ear leaf content of P. Cu. and Mn in sedimentary soils of Southwestern, Nigeria. Fertilizer Research 6: 65-71.

6. Adeoye, G.O. 1986. Comparative studies of ammonium bifluoride chelate extractant and some conventional extractants for sedimentary soils of southwestern Nigeria. Ph.D. Thesis. Dept. of Agronomy. University of Ibadan.xiv + 245pp.

7. Adewumi, A.A., Adewumi, I.K. and Olaleye, V.F. 2010. Livestock waste-menace: Fish wealth-solution. Afr. J. Environ. Sci. Technol., 5: 149-154.

8. Amanullah, M.M., Sekar S. and Muthukrishnan, P. 2010. Prospects and potential of poultry manure. Asian J. Plant Sci., 9: 172-182.

9. Akinrinde, E.A., and Obigbesan, G.O. 2000. Evaluation of the fertility status of selected soils for crop production on five ecological zones of Nigeria. Proceedings of the 26th Annual Conference of Soils Science Society of Nigeria. 30 October-3 November, 2000. Ibadan. 279-288.

10. Asare-Bediako E; Addo-Quaye A. A; Bi-Kusi, A. 2014. Comparative efficacy of
11. phytopesticidesin the management of Podagrica spp and mosaic disease on okra (Abelmoschus esculentus L.). Am. J. Expt. Agric. 4:879-889.

12. Action, A. D. 2013. Fertility status of an Alfisol after five years of continuous cassava. Retrieved from www.google scholar. AJFAND scholarly, Peer-reviewed online 11(5) September 2011. ISSN16845374

13. Ayeni, L.S. Adetunji, M.T. Ojeniyi, S.O. Ewulo, B.S. and Adeyemo, A.J. 2008. Comparative and cumulative effect of cocoa pod husk ash and poultry manure on soil and maize nutrient contents and yield. American-Eurosian Journal of Sustainable Agriculture 2: 92-97.

14. Banashree, S. and Nirmali, G. 2015. Germination and seedling growth of okra as influenced by organic amendments. Journal of cogent food agriculture 1:1Bouyoucos, G.J. 1962. Hydrometer method improved for making size analysis of soils. Agronomy Journal. 54:464-465.

15. Bremner, J . M and Mulvaney, C. S. 1982. Total Nitrogen In: Page, A.L, Miller, R. H and Keeney, D. R (Eds.). Method of soil analysis. American society of Agronomy and Soil Science Society of America. Madison, Wisconsin, USA. 595-624.

16. Chattopadhyay A, Dutta S, Chatterjee S 2010. Seed yield and quality of okra as influenced by sowing dates. African Journal of Biotechnology 10: 5461 – 5467

17. Esthiet J.A; Brisibe A.E. 2015. Morphological Characterization and Yield Traits Analysis in
18. Some Selected Varieties of Okra (Abelmoschus Esculentus L. Moench). Adv. Crop. Sci. Technol. 3:1-5.

19. Enwezor, W.O., Udo, E.J., Usoroh, N. J., Ayotade, K.A, Adepetu, J.A., Chude, U.O. and Udegbe, C.I. 1989. Fertilizer use and management practices for crops in Nigeria. 2: 163.

20. Hue, N. V. 1992. Increasing soil productivity for the Humid tropics through organic matter management. Tropical and Subtropical Agricultural Research progress achievements. The Pacific Basin Administrative Group. University of Hawali and University of Guani.

21. FAO.2006. Livestock impacts on the environment. Agriculture and Consumer Protection Department of Food and Agriculture Organization of the United Nations. Retrieved January 10th , 2016 from www.fao.org/ag/magazine/0612spl.htm

22. Kottek, M; Grieser, C; Beck, B. R. and Rubel, F. 2006.World map of the Koppen-Geiger climate classification updated, meteorologische zeitschrift, 15:259-263.

23. Murphy, J. and Riley, J.P. 1962. A modified single solution method for the determination of phosphate in neutral water. Analytical Chemical acta. 27: 31-36.

24. Nelson, D. W. and Sommers, I. E. 1982. Total organic carbon and organic matter In: methods of soil analysis part 2. Agronomy Monograph 9 American Society of Agronomy. Madison WI. 539-594

25. Ogunlade, I;Oduwaiye, M. O; Omotesho, K. F. and Komolafe, S. E.2017. Constraints faced by commercial poultry farmers in waste management practices in Kogi and Kwara States, Nigeria. Agricultura Tropica Et Subtropica, 50/4. 16:7-174

26. Ojeniyi, S.O., Awodun, M.A. and Odedina, S.A. 2007. Effect of animal manure amended spent grain and cocoa Husk on nutrient status, growth and yield of tomato, Middle-east Journal of Scientific research 2.1: 33-36.

27. Okalebo, J.R., Gathual, K.W. and Woomer, P.L. 1993. Laboratory methods of soil and plant analysis: a working manual. Tropical Soil Biology and Fertility Programme (TSBF), Nairobi, Kenya. 88.

28. Olugbemi P W and Falade A. A. 2014. Fundamental principles of soil Fertility ISBN9788-0472-88. pp154.

29. Senjobi, B.A. 2007. Comparative assessment of the effect of land use and land type on soil degradation and productivity in Ogun State, Nigeria. Ph.D. Thesis, University of Ibadan
30. Sesato, I. G. 2013. Effects of fertiliser types on growth and yield attributes of maize. Crop Protection. 11: 1 – 6.

31. Singh, P. I. 2008. Influence of plant residues management techniques on soil fertility and maize performance. Soil Fertility and Plant Nutrition. 12: 6 – 12.

32. Sobulo, R.A. and Adepetu, J.A. 1987. Soil testing and fertilizer formulation for crop production in Nigeria.Proceedings of the National Fertilizer Seminar. 28-30th October 1987. Port Harcourt, Nigeria. 93-105.