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THE PERFORMANCE OF OKRA AND SOME SOIL NUTRIENTS ON COW-DUNG AND PIG MANURES APPLICATION

[1]Bello, W.B., [1]Olla, N.O, [2]Salami, T.B. , [2]Amusat, M.A. , [3]AbdulAzeez, S.A. , and [1]Omilabu,
[1]Department of Soil Science Technology, Oyo State College of Agriculture and Technology, Igboora, Oyo State, Nigeria
[2]Department of Agricultural Science Education, Emmanuel Alayande University of Education, Oyo, Oyo, State, Nigeria
[2]Department of Biology and Integrated Science, Emmanuel Alayande University of Education, Oyo, Oyo, State, Nigeria
[1]Department of Crop production Technology, School of Agricultural Technology, Yaba College of Technology, Epe, Lagos
[3] Department of Crop Production Technology, Oyo State College of Agriculture and Technology, Igboora, Oyo State, Nigeria.
Corresponding author ; waswarith@gmail.com

ABSTRACT

Experiment was carried out at the Research Farm, Oyo State College of Agriculture and Technology, Igboora, Oyo State. It aimed at evaluating the effects of organic fertilizer on growth, yield of Okra and soil chemical properties. It was laid out in a Randomized Complete Block Design (RCBD) replicated five times. Treatments includes; Control (Co), 5t/ha (CD and Pgm) and 10t/ha (CD and Pgm). Data were collected on growth (plant height, number of leaves, stem girth and number of days to 50% flowering) and yield (number of harvested pods, fresh and dry weight of pods of Okra) components. All data collected were subjected to Analysis of Variance (ANOVA) and the means were separated using Duncan multiple range test. Application of Cow-dung and pigmanure positively influenced ($P< 0.05$) growth and yield of okra. Number of harvested pods, fresh and dry pods weight were significantly ($P< 0.05$) different compared with control. The result showed that application of 5t/ha CD resulted in increased Okra yield, although, higher level of CD and Pgm at 10 t/ha did not resulted in corresponding increase in yield of Okra. The result also showed that the addition of CD and Pgm increased some of the soil chemical properties (Soil pH, total N, available P, Organic matter and some cation exchange capacity) considered. Thus, application of either 5 t/ha of CD and Pgm could be used as a better option for soil management and restoration of the nutrients for sustainable Okra production in the study area.

Key words: Pig and Cow dung manures, Okra performance, soil chemical properties, Soil management

INTRODUCTION

Okra (*Abelmoschus esculentus)* is a common fruit vegetable that is widely grown in the tropics throughout the year. (Gajete, 2008). The total world annual production of okra is estimated at 6 million metric tonnes (FAOSTAT, 2010). In Africa, the total annual production was put at 1,951, 064 metric tons, with Nigeria being the largest producer (1,039, 000 tons per annum). In Nigeria, okra ranks third in terms ofconsumption and production area following tomato and pepper. The young leaves, pods, leaf buds and flowers are all edible. Okra seeds and stems are also ofnumerous uses (Uche, 1991). The edible pods are rich sources of vitamins, calcium, potassium and other minerals.

Decline in soil nutrient is one of the major constraints of its production in Nigeria. To sustain crop yields, the removal of nutrients from the soil has to be balanced by adding organic fertilizer.

Fertilizers are added to the soil to supply nutrients for crop growth and development. However, the inability to recycling of crop residues makes crop yield to decline. Organic manures are derived from animal or plant sources and are excellent sources of organic matter. However, for effective utilization of organic manures there is therefore, the need to applied at a very high rates to make up for their low nutrients content and improve the soil condition (Mathew and karikari, 1995).Animal manure is an important source of N,P and K and its additions to the soil increase the available P and exchangeable K, Ca and Mg content (Magdoff, 1998).

Aliyu *et al.*, (2015) reported that soil acidity, nutrient imbalance, high cost of inorganic fertilizers and inability to access credit facilities

are also a constraint for okra production in Nigeria. However, in order to sustain soil fertility status over a long period of time, the use of organic manure is therefore, mandatory. This is because the nutrients contained in organic fertilizers are released more slowly and stored for a long time in the soil, thereby ensuring a long residual benefit (Sharma and Mittra, 1991). In view of the above mentioned fact, it is imperative to investigate the performance of Okra and some soil nutrients on cow-dung and pig manure application.

MATERIALS AND METHODS

This study was conducted at the Teaching and Research Farm, Oyo State College of Agriculture and Technology, Igboora (latitude 3° 30' E East and longitude 7° 40' N) in the derived savanna zone, Oyo State, Nigeria. The region has two rainy periods and has between 1000 to 1600mm of annual rainfall and temperature between 22°C and 38°C. Okroseeds (var. Lady's finger) were obtained from National Horticulture Research Institute (NIHORT), Ibadan, Oyo state, Nigeria.

Experimental site was ploughed and harrowed. The experimental site was demarcated into treatment plots of 1.5 x 1 m dimension. The soils of the experimental site were randomly sampled at depth 0-30 cm before and after planting using auger. The soil samples were bulked, air-dried and sieved through 2 mm mesh before the analysis of physical and chemical properties. The parameters measured include; the pH taken in a 1:25 solution of 10g air-dried soil + 25ml distilled water or 1MKCL solution. Texture was determined by the pipette method. Samples were fractionated using Vanluwe et al., (1998) method. The Olsen-P method was used to determine the available Phosphorus concentrations in the soils. Percentage total nitrogen was measured by the Kjeldahl digestion method while the Amato method was used to measure the percentage total soil carbon (Amato, 1983).

Treatments used were: control (Co), Piggery manure (Pgm) applied at (5t/ha and 10t/ha) and Cow-dung manure (CD) applied at 5t/ha and 10t/ha respectively. The treatments were laid out in a complete Block Design (RCBD) replicated three times. Each plot was 3 m x 3 m in size.

The manures proximate analysis were evaluated to revealed the nutrient components of each of the organic manure.

The manures were applied a week before planting to hastening decomposition and enhance nutrient use efficiency by the crop.The treatments were worked into the soil with hoes while the Okra seeds were planted a week after. Okra seeds were planted at 0.25 m within rows and 0. 5 m between rows and the seedlings were thinned to one plant per hill two weeks after planting (WAP). Weeding was carried out at regularly and hand pulling of weeds was done up till 6 WAP.

RESULTS AND DISCUSSION

The pre- soil analysis of the experiment is presented in Table 1. From the result, the soil was sandy loam in texture with high proportion of sand (75.4%). This indicated that the basic cations Ca, K, Na and Mg would be easily leached with the type of the textural nature of the soil (Sanni and Adenubi, 2015.). The soil was slightly acidic in pH (6.6) and low in organic carbon, total Nitrogen and available P content of the soil. The low organic carbon and organic matter in the soil could be as a result of high proportion of the sandy nature of the soil. Similarly, the low N levels noticed in the soil could be as a result of continuous cropping on the soil. With regards to the FAO, (1984) ratings, nutrient contents of the soil fell within the low rating scale (Mafongaya et al. , 2003). Thus, the low soil OC, N, P, K, Mg status and acidic nature of the soil justify the need for cow-dung and pig manure addition (Table 1). Also, Table 1, revealed the chemical properties of the manures (pig and cow-dung), the result showed that cow-dung manure is richer than pig manure and this may definitely influence the result of the experiment.

The effect of cow-dung and pig manure on okra plant height, number of leaves and stem girth are shown in Tables 2 -3. Plant growth was greatly influenced by the application of cow-dung and pig manures at different rates. The application of these manures improved the growth performance ofthe crop compared to the control. The bestperformance was recorded by $10tha^{-1}$ for both manures at 4, 6 and 8 weeks after planting followed by 5tha-1 while control gave the least. Similarly, the use of CDM performed

better than Pgm at both levels considered. Although, the use of 10tha^{-1} gave the highest result in both manures considered but does not resulted in corresponding increase in growth. The okra growth rate increased progressively with the age of the plant. The increase in height, girth and number of leaves with application of cow-dung and pig manure ascertain the role of the manures in promoting the vegetative growth in crops.

The performance of the manures corroborated with the findings of Oscarson, (2000) who obtained higher N harvest from high N application. The number of days to 50% flowering was significantly improved by the application of cow-dung and pig manure (Table 3) compared to the control. The result from Table 3, also followed the same pattern as expressed by the growth characters examined (plant height, Number of leaves and stem girth. From the result there was no significant difference by the 50% flowering days after planting between 5 5tha^{-1} and 10tha^{-1}for both Pgm and CDM manures considered.

The okra fruit yield and yield components (number of harvested pods, fresh podweight and dry pod weight) produced were significantly ($p<0.05$) affected by the applied treatments (Table 4). The highest pods yield was recorded from the plots CD 10tha^{-1} followed by Pgm 10tha^{-1}, followed by CD 5tha^{-1} and Pgm 5tha^{-1}; while the least okra pods yield and yield components were recorded for okra plant with no manure application. The observed result shown by yield and yield component of okra ascertained the work of Patience et al. , (2003) who concluded that poultry manure and rabbit urine increased the production of okra significantly and identified the manures as better sources of organic manure for okra production.

The results of the study showed that the treatments are capable of improving crop yield. The significant effect shown by the addition of cow-dung and pigmanure application could be attributed to easy solubilization effect of released plant nutrient leading to improved nutrient status of the soil. The results obtained were in agreement with the findings of Ojeniyi and Olumilua, (2006) who obtained highest number of pods with application of 10tha^{-1} of pig manure and similar also with Aliyu, (2000) and Onwuet al. , (2008) who opined that increase in growth with increased organic manure rates.

Addition of cow-dung and pig manures resulted in improvement in soil chemical properties; soil pH, total N, available P, organic matter, exchangeable cations and cation exchange capacity were improved (Table 5). Thus, the application of cow-dung and pig manures could be used for soil restoration for improved nutrient status and sustainable production of crops with minimum risk. In line with the above findings, Ano and Agwu, (2006) had reported that animal manure increased soil pH and macronutrient of soil. The reduction in exchange acidity in plots added with organic manures suggested that manures had ability to supply calcium to the soil (Cooper and Warman, 1999).The potential of cow-dung and pig manures confirmed the results of Adeleye and Ayeni, 2010; Bello and Adejuyigbe, 2012 who investigated the effect of cow-dung , poultry manure, and swine manures on soil chemical properties, tomato and maize yield. Also, this work is line with the findings of Bello et al. , (2019) who confirmed from their study that farmyard manure and their compost are valuable amendments for improving soil fertility for sustaining maize production in the sandy loam soil of Oyo State in the derived savanna zone of south west Nigeria.

CONCLUSION AND RECOMMENDATION

The application of cow-dung and pig manures significantly affect plant height, number of leaves and stem girth, yield and yield component of Okra and soil properties. The results obtained revealed that okra responded positively to the application of the manures compared to control in the study. The use of Cow-dung gave a better performance than Pig manure application at both rates of application.

However, the higher the quantity of manure applied the better the result. Thus, the application of 5tha-^{1} CD resulted in improved Okra performance, although, higher level of CD and Pgm at 10tha-^{1} did not resulted in corresponding increase in the growth and yield of Okra. Hence, the application 5t ha-^{1}of cow-dung and pig manure is recommended for sustainable production of okra in the area of investigation.

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Table 1: Pre-Soil properties of the experimental site and chemical properties of the manures

Parameters	Value	Pig-manure	Cow-dung manure
Physical characteristics			
Sand %	75.4	----------	---------
Silt %	13.6	----------	----------
Clay %	11	----------	----------
Textural class	Sandy loam	----------	----------
pH (H_20)	6.6	**8.06**	**8.74**
Org C	1.54	-------	------
Total N%	0.12	**1.53**	**1.65**
C/N	12.83		
P (mg/kg)	18.6	**320**	**389.85**
Ca(cmol/kg)	0.42	**8.2**	**9.1**
Mg ,,	1.4	**37.21**	**36.52**
K ,,	0.57	**5.6**	**7.6**
Na ,,	0.53	**2.68**	**7.08**
Acidity ,,	0.4	--------	-------
Mn ,,	0.1	----------	--------
ECEC	3.68	----------	--------
Temperature (0C)	-----	**27.2**	**27.4**

Table 2: Effect of Cow-dung and Pig manure on plant height(cm) and number of leaves in week after planting (WAP) of Okra

Plant height(cm)				Number of leaves		
Treatment	4WAP	6WAP	8WAP	4WAP	6WAP	8WAP
Control	9.30d	11.60e	28.96e	2.60d	3.20d	9.48e
Pgm5t/ha	11.30c	14.68d	36.14d	3.20c	3.46cd	10.50cd
Pgm10t/ha	13.60ab	16.28c	42.18c	3.42ab	4.40bc	11.16cd
CDM5t/ha	14.30b	17.52b	48.74ab	3.43ab	5.40ab	12.98b
CDM 10t/ha	15.30a	18.68a	52.66a	3.48a	5.80a	15.94a

Means followed by the same letter in the columns are not significantly different at 5% level of probability by DMRT. Pgm – Pig manure, CD – Cow-dung manure

Table 3: Effect of Cow-dung and Pig manure on OkraStem girth (cm)in weeks after Planting (WAP) and number of days to 50% flowering

	Stem girth (cm)			
Treatment	4WAP	6WAP	8WAP	50% flowering days after planting
Control	0.58d	1.86e	2.18e	32.20c
Pgm 5t/ha	0.76bc	1.94d	2.58d	34.60b
Pgm 10t/ha	0.86b	2.28c	2.84c	34.80b
CDM 5t/ha	0.92ab	2.72b	3.71b	37.40a
CDM 10t/ha	1.02a	2.96a	4.28a	38.40a

Means followed by the same letter in the columns are not significantly different at 5% level of probability by DMRT. Pgm – Pig manure, CD – Cow-dung manure

Table 4: Effect of Cow-dung and Pig manure on number of harvested pods, fresh and dry weight of pods of Okra

Treatments	Number of Pods	Fresh weight of Pods (kg/ha)	Dry weight of Pods (kg/ha)
Control	32.66e	0.56e	0.18d
Pgm5t/ha	75.56dc	0.86cd	0.22c
Pgm 10t/ha	110.60b	1.25b	0.27b
CD 5t/ha	86.20c	0.97c	0.24c
CD 10t/ha	126.16a	1.36a	0.29a

Means followed by the same letter in the columns are not significantly different at 5% level of probability by DMRT. Pgm – Pig manure, CD – Cow-dung manure

Table 5: Soil properties of the experimental site after harvesting

Parameter	Control	PGM 5t/ha	PGM 10t/ha	CD 5t/ha	CD 10t/ha
Physical characteristics					
Sand %	75.4	74.70	70.40	75.00	71.00
Silt%	13.6	10.0	11	10.00	10.00
Clay %	11	15.30	18.60	15.00	19.00
Textural class	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam
pH(H_20)	6.6	6.60	7.25	6.55	7.30
Org. C%	1.54	2.14	2.62	1.96	2.96
Total N%	0.12	0.21	0.43	0.36	0.49
C/N ratio	12.83	10.19	6.09	5.44	6.04
P (mgkg-1)	18.6	27.48	22.53	27.10	19.39
Ca (cmolkg-1)	0.42	5.26	7.66	2.06	4.46
Mg ,,	1.4	4.93	6.13	1.33	3.73
K ,,	0.57	1.05	0.71	0.71	1.01
Na ,,	0.53	0.54	0.88	0.49	0.93