Performance of *Abelmoschus esculentus* (L Moench) as Influenced By Different Organic Manure Amendments in Yewa Enclave of Ogun State, Nigeria

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Abstract

An open field pot experiment was conducted in Yewa North Local Government Area, Ogun State to evaluate the effect of soil amended with three types of organic manures: sheep and goat manure (SGM), poultry manure (PM), plant manure (PLM) and NPK on the performance of Abelmoschus esculentus. Three levels of organic manure and inorganic fertilizer viz: 0; 200 g and 400 g / 10 kg of soil were applied respectively. The experiment was conducted for a period of 8 weeks. The experimental design used is 4 x 3 factorial experiments in a randomized complete block design (RCBD) replicated five times. Pre-treated seeds were planted and routine cultural were maintained. Agronomic data collected on days after planting were plant height, number of leaves, stem girth, leaf length, leaf width, number of fruits, fruit length, fruit width, fresh and dry weight of fruits. Data collected were subjected to the analysis of variance (ANOVA) and means were separated using Duncan Multiple Range Test (DMRT) at p<0.05. Results obtained indicate that there was significant difference between the soil amendments and leaf length amidst other morphological components. Also, there was a significant difference between the treatments and the yield components. PM gave the best significant value for the number of fruits, fruit length and leaf length, SGM gave the highest value for the fruit width while for other yield components PLM gave the highest value. PM gave the best performance on the fruit production while PLM gave the best for most of the other significant parameters. It is recommended that poultry manure at the rate of 200 mg/ha should be used as a source of fertilizer if Okra fruit is envisaged. For the production of okra with respect to the mineral content and morphology component, plant manure (Cnidoscolus aconitifolius) at the rate of 400 mg/ha is recommended.

Keywords: *Okra, organic amendment, NPK fertilizer, yield, soil fertility.*

Introduction

Okra (*Abelmoschus esculentus*) L Moench belongs to the family Malvaceae (Tindall, 1983) It is cultivated in the tropical and sub tropical regions mainly for its pod yield. Okra is a tropical lowland cropwhich serves as one of the major sources of vitamins A, B and C andessential mineralssuch as calcium and iodine (Fayemi, 1999). The oil in the seed could be as high as in poultry eggs and soybean (Akinfasoye *et. al.*, 2005). Okra is adapted to a pH of 6.0-6.5 and a wide range of soil types give economic yield. However, a well drained fertilized soil with adequate organic materials is preferred (Akanbi *et. al.*, 2010).

Tropical soils are beset with the problems of acidity, low nutrient contents, nutrients imbalance and soil erosion. Use of fertilizer such as organic and inorganic had been found to solve these problems (Babatola and Olaniyi, 1997). Moreover, the high cost of synthetic fertilizer coupled with unavailability of its use as at when due by the local farmers constitute a major challenge.

Inorganic fertilizers when added to the soil increase the supply of one or more essential nutrients such as nitrogen, phosphorus and potassium while organic manure on the other hand, improve the physical and chemical properties of the soil; humus content and also maintain the optimum conditions for the activities of the micro and macro organisms. As a result of the high energy costs, inorganic fertilizers have become very expensive and scarce, especially in developing countries. Consequently, unavailability of the resource to the poor farmers is already becoming a source of concern in developing countries. Recently, organically produced foods are gaining more attention and patronage over inorganically packaged food in the developed world. Currently, in some countries any food having less than 70% organic production is banned from entering into the market.This is because inorganic fertilizer has toxic or residual effect on soil which upon uptake by plant contaminates the produce and as such threatening the safety level if the residual level is above the maximum permissible level by WHO. As a result of this, the use of organic wastes in supplying plant nutrients and replacing the toxic effect of the synthetic chemical particularly on the non- target organism are becoming increasingly important as an alternative measures (Adenowoola *et. al.*, 2005.).

Organic manures such as compost, animal manure, crop residues and municipal wastes when used as primary source of plant nutrients constitute part of management practices often referred to as organic farming. Thus, the food produced through this approach is commonly termed organic food and is relatively free from toxic residues (Adenowoolaet. *al.*,2005). Therefore, organic manure functions as an important nutrients reservoir for crop production. It is a source of almost all essential plant nutrients. This enhances the soil quality by improving many chemical, physical and biological processes operating within the soil.

Soil organic matter properties (C: N ratio and macro organic matter) had been proposed as diagnostic criteria for soil health and performance (Adenowoola *et. al.*, 2005) This coupled with the known beneficial effect on the soil physical and chemical properties through the release of macro and trace elements not contained in the inorganic fertilizers, improves the productivity of planted crops especially in tropical country like Nigeria. However, these beneficial roles have not been properly explored by most peasant farmers in the rural areas which constitute the mainstay of Nigeria economy. Again, soil management is sometimes neglected or even forgotten by African farmers. Also, the use of poultry manure as a good source of macro and micro-elements (Yayock and Awoniyi,1974) are currently discarded due to the recent outbreak of "bird flu" diseases associated with its use, where adopted (Senjobi *et al*,2011). Moreover, since understanding of nutrient supply to the soil is crucial for soil optimum production and maintenance. Therefore, there is need to adequately study the effects of different organic amendments on the performance of okra. Specifically, the project aims at evaluating the effects of different organic amendments on the performance of *Abelmoschus esculentus* and to come up with the best organic amendment that will enhance optimum production.

Materials and Methods

Description of Experimental Site

The experiment was an open field pot experiment. It was carried out at the Teaching and Research Farm of College of Agricultural Sciences, Olabisi Onabanjo University, Ayetoro, Yewa North, Ogun State, Nigeria which is located on Latitude 70° 12^1N and Longitude 3° 0^1E. It is located in a subtropical region with an average rainfall of 250mm and mean temperature of 26^0C.

The soil consists of deeply weathered layers of sedimentary. It lies within the ferralitic zone. Soils within this zone are characterized with deep highly weathered red soils (oxisols) of humid tropics, strongly leached and, highly deficit in weatherable mineral resources. The clay contents are of the kaolinitic type with low water and nutrient holding capacity.

It lies within the derived guinea savannah zone of southwestern Nigeria. The area is colonized with grasses and savannah tree and shrubs but there are evidence that the area was formally a humid tropic forest with tall trees and green leaves.

Methodology

Composite soil samples, which were randomly taken at 0-30 cm depth in the same soil type, were potted for the experiment. Soil and organic manure were analyzed in the laboratory to ascertain their nutrients composition before the experiment. The experimental design used is 4 x 3 factorial experiments in a randomized complete block design (RCBD) replicated five times. 10kg of soil was bagged each into a polythene bag; this was replicated five times, totaling 60 bags. The treatments used were poultry manure, sheep and goat manure, plant base organic manure (*Cnidoscolus aconitifolius*) and NPK fertilizer. Three levels of each treatment were employed at the rate of 0, 100tons/ha and 200tons/ha for the organic manure, which was calculated to be 0g,100g and 200g per 10kg of soil following Senjobi, *et.al.*,(2010). The inorganic fertilizer was applied at the rate of 0, 150kg/ha and 300kg/ha, (NPK 15-15-15) which was calculated to be 0, 2.5, 5.0g per 10kg of soil.The soils and manures were left to mineralize for 2 weeks before planting as described by Haper *et.al.*,(1980). The variety of okra planted was NHAE 47-4. The seeds were broadcasted on the peripheral 3cm depth of the bag and were watered every other day depending on the field capacity. The bags were perforated at the bottom to allow for easy drainage and facilitate aeration. Three plants were randomly selected from each pot, tagged and used for weekly observation.

Four weeks after planting (4WAP), organic manures treatments were repeated due to the yellowish colouration of leaves. For the whole experiment the total amount of manures incorporated were 0, 200, 400g of poultry manure, sheep and goat, and *C. aconitifolius* respectively. The 0g of each treatment depicts the control (no treatment; NT) as shown in the results.

Data collection

Morphological data were collected as follows: Plant height, Leaf length, Leaf width, Stem girth, Number of leaves and Yield components were collected as follows: Number of fruits, Fruit length, Fruit girth, Fresh and Dry weight of fruit.

The data were collected on weekly basis two weeks after planting till the period of experiment which was 56 days.

Plant height, leaf length and leaf width were taken using a measuring tape and ruler. The circumference of okra plants and fruits were taken and divided into two to get the stem girth and fruit girth respectively.

The fruit were weighed immediately after harvesting to get the fresh weight of fruits and sun dried to constant weight to get dry weight of fruits.

Mineral nutrient analysis of the soil was carried out after the final harvesting according to AOAC (1990) as well as the proximate analysis to determine the nutrient uptake.

Data Analysis

Data collected were then subjected to the analysis of variance (ANOVA) using Gomez and Gomez (1984) procedure. The means were separated using Duncan Multiple Range Test (DMRT) at $p \leq 0.05$ level of significance.

Results

Table 1 showed physico-chemical properties of the soil before planting. The percentage (%) sand, silt and clay of soil before application of manure were 77.0, 16.2 and 6.8 respectively showing that the soil is sandy loam soil texture. It is slightly acidic with pH 5.85. The organic carbon and organic matter were low.

The result in table 2 shows that the poultry manure was very rich in all the chemical properties tested for and was closely followed by the sheep and goat manure.

Table 3 showed that the pH level of the amended soil rose up from 5.85(acidity) to above 7 making the soil alkali. The soil amended with 400g of sheep and goat manure gave the highest pH level of 9.85. This implies that all the amendments improve the soil pH.

Table 4 showed that virtually all the physical parameters were significantly different among various treatments employed; however, there was no significant difference between SGM at 200g and PM at 200g rates for all the physical parameters.

The chemical properties were also significantly different from one another under the various treatments as shown in table 5 but there was no significant difference between SGM at 200g and PM at 200g rates for all the chemical properties. Table 4 showed that there were significant difference $P < 0.05$ between the treatments and the physical properties of the soil.

Table 1: Pre-Physico-chemical Properties of the Soil

Soil properties	Values
Sand ↓	770
Silt g/kg	162
Clay ↑	68
pH	5.85
Ca	0.85
Mg	0.78
Na ↓	0.34
K Cmol/kg	0.16
H+ ↑	0.12
Fe	1.97
Zn	3.63
C.E.C	2.31
Av.P (mg/kg)	1.69
O.C ↓	143
O.M g/kg	247
N ↑	1.6

Table 2: Chemical Composition of the Organic manure

Soil Properties	**Organic Manure**		
	Poultry	**Sheep and Goat**	**Plant Manure**
Ca (Cmol\kg)	30.2	21.8	8.0
Mg (Cmol\kg)	6.6	5.8	10.7
Na (Cmol\kg)	6.0	2.3	7.1
K (Cmol\kg)	12.7	6.4	13.3
O.C. (g\kg)	398.2	387.1	84.9
O.M. (g\kg)	685.0	683.6	146.6
N (g\kg)	31.2	21.8	8.5
P (mg\kg)	19.1	12.2	9.9
Fe (cmol\kg)	50.02	106.12	1.40
Zn (cmol\kg)	482.5	984.95	1.08

Table 3: Post- Physiochemical Analysis of Soil

Soil Properties	Values								
	NT	SGM2	SGM3	PM2	PM3	PLM2	PLM3	NPK2	NPK3
Sand(g/kg)	820	750	770	810	790	740	730	780	770
Silt (g/kg)	160	204	188	166	182	206	203	171	180
Clay (g/kg)	20	46	42	24	28	54	67	59	50
pH (H20)	8.25	7.95	9.85	7.85	7.95	7.55	7.60	7.45	7.15
pH (KCl)	7.40	7.00	7.10	7.15	7.20	6.90	6.95	6.65	6.50
Ca	2.30	1.90	1.50	1.90	1.60	3.10	1.70	1.00	1.10
Mg	1.88	1.52	1.05	1.45	1.20	2.68	1.25	0.85	0.90
Na	0.60	0.582	0.643	0.591	0.582	0.608	0.669	0.652	0.634
K Cmol\kg	0.767	0.860	1.125	1.275	1.074	0.664	0.971	0.511	1.125
H+	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
C.E.C	5.557	6.872	4.328	5.228	4.467	7.062	4.600	3.033	3.779
Base Sat	99.8	99.9	99.8	99.8	99.8	99.9	99.8	99.3	99.5
Av.P(mg\kg)	4.70	8.45	6.60	6.60	8.45	8.45	5.65	13.60	7.05
O.C	38.8	26.2	26.5	38.8	26.2	32.8	12.8	20.7	21.9
O.Mg/kg	66.7	45.0	45.6	66.7	45.1	56.4	22.0	35.6	37.7
N	6.73	2.57	4.59	6.71	4.55	5.68	2.31	3.58	3.81

Table 4: Effect of Manure on the Soil Physical Properties

Treatment	Sand	Silt	Clay
	---------g\kg---------		
NT	820c	160a	20a
SGM 200g	750ab	204e	46bc
SGM 400g	770abc	188cd	42b
PM 200g	740ab	206e	54abc
PM 200g	730a	203e	67c
PLM 400g	810c	166a	24c
PLM 200g	790ab	194de	41b
NPK 2.5g	780ab	171ab	59bc
NPK 5.0g	770abc	180bc	50bc

NT- No treatment (control), SGM – Sheep and Goat Manure, PM – Poultry Manure and PLM – Plant Manure

Table 5: Effect of Manure on the Soil Chemical Properties

Treat	%N	Av.P	K	Na	Mg	Ca	H20	KCl	% O.C	% O.M	Base Sat	C.E.C
				Mg\kg		pH						
NT	0.67e	4.70a	0.77bc	0.60bc	1.88bcd	2.30cd	8.25e	7.4e	3.88e	0.67a	99.8c	5.56cd
SGM2	0.27a	8.45d	0.86bc	0.58a	1.52abc	1.90bc	7.95d	17.00bcd	2.62e	4.50d	99.9d	6.87de
SGM3	0.46c	6.60c	1.13de	0.64de	1.05ab	1.50abc	9.85f	7.10cd	2.65c	4.56d	99.8c	4.33abc
PM2	0.57d	8.45d	0.66ab	0.61c	2.68d	3.10d	7.55ab	6.9b	3.28d	5.64e	99.9d	7.06e
PM3	0.23a	5.65b	0.97cd	0.67f	1.25abc	1.70abc	7.60bc	6.95bc	1.28a	2.20b	99.8c	4.60bc
PLM2	0.67e	6.60c	1.28e	0.59ab	1.45abc	1.90bc	7.85d	7.15d	3.88e	6.67f	99.8c	5.23bc
PLM3	0.52cd	8.45d	0.87bc	0.60abc	1.94cd	2.35cd	7.75cd	7.05bc	2.95cd	5.08de	99.85cd	5.77cd
NPK2	0.36b	13.60e	0.52a	0.65e	0.85a	1.00a	7.45b	6.65a	2.07b	3.56c	99.3a	3.03a
NPK3	0.38b	7.05c	1.13de	0.63d	0.90a	1.10ab	7.15a	6.50a	2.19b	3.77c	99.5b	3.78ab

NT- No treatment (control), SGM – Sheep and Goat Manure, PM – Poultry Manure and PLM – Plant Manure

Morphological Components of *Abelmoschus*

Table 6 showed that the morphological components of *A.esculentus* were not significantly different from one another for most of treatments except for the leaf length which showed significant differencewith various treatments.

The plant amended with NPK fertilizer gavethe highest value for all the morphological components of *A.esculentus* while the PLM and NT gave the least value.

Plant height **(**NPK3 > PM2 > NPK2 > PLM3 > PM3 > SGM3 > SGM2 > PLM2 > NT), Leaf area **(** NPK3 > NPK2 > PLM3 > PM3 > PM2 > SGM3 > SGM2 > NT > PLM2), Leaf width (NPK2 > NPK3 > PLM3 > PM2 > SGM3 > SGM2 > NT > PLM2), stem girth (NPK2 > NPK3 > PLM3 > PM2 > PM3 > SGM2 > PLM2 > SGM3 > NT) and number of leaves **(**NPK3 > NPK2 > PM2 > PM3 > PLM2 > SGM2 > SGM3 > NT PLM3).

Table 6: Mean values of the morphological characteristics of Okra as influenced by organic manure types

Treatment	PH (cm)	LL (cm)	LW (cm)	SG (cm)	NL (cm)	NF (cm)	FL (cm)	FW (cm)	WWF (cm)	DWF (cm)
NT	30.58	11.60	15.88	0.75	9.00	53.00	6.83	2.91	17.20	2.28
SGM200g	34.78	12.94	17.76	0.88	10.00	59.00	7.06	3.28	17.10	2.76
SGM400g	35.69	13.40	18.06	0.78	9.00	79.00	7.20	3.39	22.30	3.02
PM 200g	37.45	14.40	19.53	0.91	10.00	94.00	7.17	3.25	19.37	2.60
PM400g	36.36	14.73	19.31	0.89	11.00	63.00	7.94	3.26	24.08	2.92
PLM200g	33.23	11.51	15.68	0.79	11.00	62.00	6.42	2.80	17.81	2.19
PLM400g	36.88	15.75	22.23	0.91	9.00	84.00	7.50	3.32	25.60	3.29
NPK2.5g	37.28	17.15	24.06	0.99	12.00	73.00	8.16	3.36	25.03	3.39
NPK5.0g	39.56	18.16	23.66	0.97	10.00	82.00	8.04	3.38	28.63	4.15

NT- No treatment (control), SGM – Sheep and Goat Manure, PM – Poultry Manure and PLM – Plant Manure

PH- Plant height; LL- Leaf length; LW- Leaf width; SG- Stem girth; NL- Number of leaves
FL- Fruit length; FW- Fruit width; WWF – Wet weight of fruits; DWF- Dry weight of fruits
NF – Number of Fruits

Yield Components of *Abelmoschus*

All the yield components of *A.esculentus* in table 6 were significantly difference from one another.

The plot that received no amendment (control) gave the least value of the NF and FL while plot amended with 400g of NPK fertilizer gave the highest value for WWF and DWF of *A.esculentus* fruit.

Table 7: Effects of different rates of fertilizers on morphological components of okra

Treatment	PH	LL	LW	SG	NL
	------------------------cm-------------------------------				
NT	30.58a	11.68ab	15.88a	0.75a	9a
SGM 200g	34.79a	12.94a	17.76a	0.88a	10a
SGM 400g	35.69a	13.40a	18.06a	0.78a	9a
PM 200g	37.45a	14.40ab	19.53a	0.91a	11a
PM 400g	36.36a	14.74ab	19.31a	0.89a	11a
PLM 200g	33.24a	11.51a	15.68a	0.79a	11a
PLM 400g	36.89a	15.75ab	22.23a	0.91a	9a
NPK 2.5g	37.29a	17.15ab	24.06a	0.99a	12a
NPK 5.0	39.56a	18.16b	23.66a	0.97a	13a

NT- No treatment (control), SGM – Sheep and Goat Manure, PM – Poultry Manure and PLM – Plant Manure
PH: Plant height; LL: Leaf length; LW: Leaf width; SG: Stem girth; NL: Number of leaves.

NT (No treatment), SGM 200g (200g Sheep and goat manure per 10g of soil), SGM 400g (400g Sheep and goat manure per 10g of soil), PM 200g (200g of poultry manure per 10g of soil), PM 400g (400g of poultry manure per 10g of soil), PLM 200g (200g of plant manure (*C. aconitifolius*) per 10g of soil), PLM 400g (400g of plant manure (*C. aconitifolius*) per 10g of soil), NPK 2.5g (2.5g of NPK 15-15-15 per 10g of soil at the rate of 150kg N/ha) and NPK 5.0g (5.0g of NPK 15-15-15 per 10g of soil at the rate of 300kgN/ha)

Table 8: Mean values of yield component of *Okra* with respect to different manures rate

Treatment	NF	FL (cm)	FW (cm)	FWF (g)	DWF (g)
NT	53	6.83b	2.91b	17.20b	2.28b
SGM 200g	59	7.06c	3.28e	17.10a	2.76d
SGM 400g	79	7.20e	3.39i	22.30e	3.02f
PM 200g	94	7.17d	3.25c	19.37d	2.60c
PM 400g	63	7.94g	3.26d	24.08f	2.92e
PLM 200g	62	6.42a	2.80a	17.81c	2.19a
PLM 400g	84	7.50f	3.32f	25.60h	3.29g
NPK 2.5g	73	8.16i	3.36g	25.03g	3.39h
NPK 5.0g	82	8.04h	3.38h	28.63i	4.15i

NT- No treatment (control), SGM – Sheep and Goat Manure, PM – Poultry Manure and PLM – Plant Manure
NF: Number of fruits; FL: Fruit length; FW: Fruit width; FWF: Fresh weight of fruit; DWF: Dry weight of fruits

NT (No treatment), SGM 200g (200g Sheep and goat manure per 10g of soil), SGM 400g (400g Sheep and goat manure per 10g of soil), PM 200g (200g of poultry manure per 10g of soil), PM 400g (400g of poultry manure per 10g of soil), PLM 200g (200g of plant manure (*C. aconitifolius*) per 10g of soil), PLM 400g (400g of plant manure (*C. aconitifolius*) per 10g of soil), NPK 2.5g (2.5g of NPK 15-15-15 per 10g of soil at the rate of 150kg N/ha) and NPK 5.0g (5.0g of NPK 15-15-15 per 10g of soil at the rate of 300kgN/ha)

Proximate Analysis

The trend at which the % crude protein and %ester ether moved for all plants under various organic amendments were the same. *A.esculentus* amended with plant manure at 400g has the highest value for both % crude protein and % ester ether while *A.esculentus* amended with 0g (no treatment) has the least value of % crude protein and % ester ether.

Table 9: Mean value of the proximate analysis of *Okra Fruits*

Treat	%MC	%DM	%ASH	%CF	%CP	%EE
NT	11.04i	88.36a	6.85i	7.84b	2.99a	1.19a
SGM 200g	8.60b	91.40h	4.85f	9.41g	4.90d	1.41d
SGM 400g	7.98a	92.20i	4.59c	9.36f	4.99e	1.43e
PM 200g	10.85g	89.16b	5.95h	7.91c	5.74f	1.67f
PM 400g	10.65h	89.36c	5.81g	7.65a	5.84g	1.69g
PLM 200g	9.81f	90.20d	3.59a	8.86e	6.61h	1.86h
PLM 400g	9.47d	90.16e	3.64b	8.81d	6.84i	1.89i
NPK 2.5g	9.50e	90.49f	4.75d	10.90h	3.67b	1.35b
NPK 5.0g	9.16c	90.85g	4.81e	10.65h	3.71c	1.37c

NT- No treatment (control), SGM – Sheep and Goat Manure, PM – Poultry Manure and PLM – Plant Manure

MC: Moisture content; DM: Dry matter; ASH: Ash content; CF:Crude fibre; CP:Crude protein; EE: Ether ester

NT (No treatment), SGM 200g (200g Sheep and goat manure per 10g of soil), SGM 400g (400g Sheep and goat manure per 10g of soil), PM 200g (200g of poultry manure per 10g of soil), PM 400g (400g of poultry manure per 10g of soil), PLM 200g (200g of plant manure (*C. aconitifolius*) per 10g of soil), PLM 400g (400g of plant manure (*C. aconitifolius*) per 10g of soil), NPK 2.5g (2.5g of NPK 15-15-15 per 10g of soil at the rate of 150kg N/ha) and NPK 5.0g (5.0g of NPK 15-15-15 per 10g of soil at the rate of 300kgN/ha)

Discussion

The results of the soil analysis showed that the textural class is sandy loam with the pH of 5.85. The nitrogen content of the soil was 1.5% which is exactly the recommended critical level for Southwestern Nigerian Soils for most crops. The available phosphorus content of the soil and exchangeable potassium of the soils were very low compared with their critical levels of 10-12mg\kg and 0.16-0.20 cmol\kg respectively (Omotoso *et al.*,2008.)

There was an appreciable increase in the soil fertility at the end of the experiment as confirmed by the post soil analysis. The soil acidity was reduced towards neutral for most of the amendments. Also, the soil nitrogen increase appreciably. This is due to application of nitrogen rich fertilizer.

The analysis of the organic manures showed that poultry manure has the highest percentage (%) of nitrogen, phosphorus while the plant manure (*C. aconitifolius*) gave the highest percentage (%) of potassium.

The morphological characteristics of okra were higher in the soils treated with mineral fertilizer and this could be due to the fast rate of mineralization for the first few weeks unlike the organic fertilizer. Organic manure on the other hand undergo gradual decomposition leading to the gradual release of nutrients for the plant which could be responsible for the high marketable yield of the plants grown under organically amended soil because of the high Nitrogen content.

There was no significant difference between the treatments and the morphological components viz: (plant height, leaf length, leaf width, stems girth and number of leaves). This could be as a result of low decomposition of organic manure which responsible for the difference during the morphological growth of okra plant. Among the organic manures, the application of poultry manures at 200mg/ha gave the highest values of plant height and stem girth. Plant manure at 400mg\ha also gave the highest value for the leaf width and leaf length. This is followed closely by poultry manure at the rate of 200mg\ha. This could be due to the high application of plant manure.

There was a significant difference ($p<0.05$) between the treatment and the yield components. Plant manure at the rate of 200 mg\ha gave the highest significant value for the wet weight and dry weight of the fruit. Poultry manure at the rate of 100mg\ha gave the highest value for the number of fruits followed by the plant manure at the 200mg\kg. This is indicative of the induced C:N ratio (Omotoso *et. al.*, 2008). As a result of this, the nutrients cannot be easily leached away due to their slow released rate. Sheep and goat manure at the rate 400mg\ha gave the highest value for width of the fruits and which it was at par with the plant manure of the same rate.

The dry matter of okra was significantly ($p<0.05$) enhanced by the addition of N fertilizer. Meanwhile the absence of fertilizer produced the lowest dry matter. This is in accordance with the finding of Akanbi *et. al.* (2010) which revealed that variation in dry matter yield in response to N source may arise from differences in the amount of intercepted photosynthetic active radiation (PAR) by the canopy, and the light use efficiency (LUE) (Robert and Walker, 1989).

There was also a significant difference between the plot treated with organic and inorganic fertilizers and moisture content, crude protein, crude fibre, ash, ether ester and as reflected in the proximate analysis. This can be associated with the addition of N/P fertilizer with the exception of the ash content in which the okra plant treated with no treatment gave the highest value. This may be due to the immobilization of the K nutrient in the soil.

Conclusion

From the result of the experiment, it was shown that 400g plant manure gave the overall best performance of okra. Although, the result of the laboratory analysis of the organic manures showed that poultry manure has the highest percent of nitrogen and phosphorus. This could be due to the slow rate of decomposition of poultry manure compared with bio- fertilizer. From the results, the use of plant residue or sheep and goat manure as fertilizers could serve as an alternative not only to the use of mineral fertilizers, but also to poultry manure. This is because for most of the morphological characteristics, plant manure gave the highest significant value and it is closely followed by the poultry manure among other treatments applied.

More so, the recent reluctant attitude developed by farmers towards the use of poultry as a result of the endemic avian flu associated with poultry will no longer be a constraint to vegetable production since alternative means are available.

Also, the high cost of using animal manure as fertilizer considering the cost of purchase from farmer, transportation in respect with bulkiness will be eradicated if the use of plant manure is employed.

Plant manure (*Cnidoscolus aconitifolius*) gave the overall best performance of*A. esculentus*, yet poultry manure gave the best production of fruit which is the target of the commercial farmers generally. Therefore, it is recommended that poultry manure should be used as a source of fertilizer if Okra fruit is envisage while for the production of okra with respect to the mineral content and morphology component plant manure *A. esculentus* is recommended. Again, research efforts should be geared towards the eradication of "avian flu" associated with poultry manure which may prevent present farmers from using the organic manure of poultry source.

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