Effects of Organic Soil Amendment on the Growth and Yield of Okra (*Abelmoschus esculentus*) in Ifite Ogwari, Southeastern Nigeria

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KEYWORDS

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ABSTRACT

The experiment was conducted at Ifite Ogwari, Anambra State to evaluate the effects of some soil amendments on thegrowth and yield performance of Okra (Abelmoschus esculentus). The experiment was laid out in a completely randomized design (CRD) with three (3) replications and an Okra variety made up my treatment. This experiment was carried out in a pottedbag with a total of (24) treatments including the control experimental bag. Data on growth and yield parameters were collected and analyzed using analysis of variance (ANOVA) for completely randomized design. The treatment means were separated using least significant difference at 5% probability level. The results obtained showed that treatment T8 (poultry manure + rice husk + compost + cow dung) performed significantly well in plant height and number of leaves, while on the other hand treatment T5 (poultry manure + rice husk + top soil),T2 (poultry manure + top soil) and T3(cow dung + top soil) performed notably better with respects to leaf area , number of fruits, stern girth and fruit weight.

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INTRODUCTION

Okra (*Abelmoschus esculentus* L.) is an annual crop grown mainly as fruits and leafy vegetables in both green and dried state in the tropics (Gibbon and Pain, 1984). The crop is used as soup thickener which may also be served with rice and other food types. The fresh fruit is a good source of vitamins, minerals and plant protein (Eke *et al*., 2008). The mature stem contains crude fibre which is used in paper industries and for making ropes. Okra's flower can be very attractive and sometimes used in decorating the room (Schippers, 2000).

Okra is cultivated under rainfed and in irrigated areas on a wide range of soils. The production is seriously affected by non-utilization of organic materials in soil fertility management. The use of inorganic manure has not been helpful under intensive agriculture because it is often associated with reduced crop yield, soil acidity and nutrients imbalance (Ojeniyi, 2000). This has encouraged scientists towards making use of organic materials (both organic manures as well as organic wastes) for improving the physical properties of soils th*at al*low profitable crop production (Somani and Totawat, 1996). There is dearth published works on the organic manure and waste use in Okra production. In view of the above, this study aimed to evaluate the effects of sources of some organic manure on the growthand yield performances of Okra.

MATERIALS AND METHODS

The potted experiment was conducted at Ifite Ogwari,Anambra State, Nigeria. Ifite Ogwari is a town located at latitudes 6°36'14.8"N and longitudes 6°57'02.5"E.

Planting media preparation

The planting media for each treatment was produced by mixing each treatment thoroughly ie top soil, poultry manure, cow dung, rice husk depending on treatment in use in a ratio of 6:1:1:1. Using a perforated cement bag as pot, painter of custard bucket of equal volume of treatment was filled into each pot, each medium was replicated three times making a total of 24 pots of media.

Sowing of Okra Seeds

Five (5) seeds was sown per bag and watered daily.Thinning of seedlings was done once they are grown.Eight (8) treatments were used in total and was replicated (3) three times. Treatments used include:

T1- Top soil (control),T2 - Top soil + poultry manure , T3 - Top soil + Cow dung , T4 - Top soil + rice husk , T5 - Top soil + poultry manure + rice husk , T6 - Top soil+ rice husk +cow dung, T7 - Topsoil + poultry +cow dung, T8 - Topsoil + poultry manure +rice husk +cow dung). In a situation where the treatments occur in pairs e.g rice husk and cow dung, rice husk and poultry manure, rice husk and poultry manure, cow dung and poultry manureis 6:1.5:1:5 and 6:1:1:1 Top soil 6, poultry manure 1, cow dung 1 and ricehusk 1 respectively. The experiment was laid in a completely randomized design (CRD) with three replications. Treatment T1 (top soil) was the control. The layout was in 5m by 4m, a potted experiment with 0.5m between treatments and 1m breadth between replicates.

Data Collection:

Data was collected on the following parameters:

Growth parameters (plant height, number of leaves, leaf area and stem girth)

Yield parameters (Number of fruits and weight of fruits).

Data Analysis:

The data generated from the pot study were subjected to Analysis of variance (ANOVA) using GenStat 4th edition statistical package (2013). Separation of means was done using the probability level significant difference at 5%.

RESULTS

Effects ofsome Organic Soil Amendments on Okra height 2-8 weeks (cm) after sowing

The results indicated th*at al*l treatments had a significant ($p<0.05$) effect on the plant height , compared to T1(Top soil only) the control at 2 weeks after sowing T8(Top soil +poultry manure + rice husk + cow dung), T2 (Top soil + poultry manure), T7 (Top soil + poultry manure +cow dung) and T5 (Top soil + rice husk + poultry manure) had the highest plant height with values ranging from 10.50cm to 9.83cm . At 8 weeks after sowing T7 (Top soil + poultry manure + cow dung), T8(Top soil + poultry manure + rice husk + cow dung) ,T2 (Top soil + poultry manure) and T5 (Top soil + rice husk + poultry manure) had the tallest plant height with mean values ranging 60.33cm to 67.57cm.

Table 1. Effects ofsome organic soil amendments on Okra height at 2-8 weeks (cm) after sowing

Treatment	Weeks						
	2 WAP	3 WAP	4 WAP	5 WAP	6 WAP	7 WAP	8 WAP
T1=Top Soil	3.18	8.45	12.79	16.78	20.95	25.57	29.33
T2 =Top Soil + Poultry Manure	10.50	22.00	34.57	45.33	53.07	57.17	65.33
T3 = Cow dung + topsoil	8.07	17.07	26.33	31.57	43.00	44.43	51.77
T4 = Rice husk + topsoil	9.50	16.20	22.67	26.50	31.67	33.33	35.50
T5 =Top soil + rice husk + poultry Manure	9.83	20.57	33.20	41.50	54.50	56.67	60.33
T6 = Rice husk + top soil + cow dung	8.33	18.83	30.50	39.00	47.33	54.67	56.33
T7=Top soil + poultry manure + cow dung	10.50	19.90	33.80	40.33	48.07	59.83	67.57
T8=Top soil+ poultry manure + rice husk + cow dung	10.83	21.40	34.23	43.00	53.33	61.17	67.33
LSD (*0.05*)	1.971	1.335	2.997	3.158	6.786	4.903	3.742

WAP – Weeks after planting

Effects of some organic soil amendments on Okra leaf area at 5-8 weeks after sowing.

Table 2 showed the effects of some organic soil amendments on the Okra leaf area from 5-8weeks. The result showed that T5 (Topsoil + rice husk + poultry manure) had the largest leaf area with a mean value of 250.30cm at 5 weeks after sowing and increased to 325.00cm at 8 weeks after sowing.However, T4 (Top soil + rice husk) had the least leaf area with a mean value of 61.0cm at 5weeks after planting which later increased to 95.0cm at 8weeks after planting.Top Soil showed the least followed by Rice husk + topsoil. Top soil + rice husk + poultry manurerecorded the highest mean value for leaf area.

Table2. Effects some oforganic soil amendments on Okra leaf area (cm) at 5-8 weeks after sowing.

Treatment	Weeks			
	5	6	7	8
T1=Top Soil	64.60	84.00	90.00	99.40
T2=Top Soil + Poultry Manure	240.30	280.00	318.80	330.30
T3=Cow dung + topsoil	200.30	273.00	270.00	300.30
T4=Rice husk + topsoil	61.00	75.00	86.00	95.00
T5=Top soil + rice husk + poultry Manure	250.30	290.00	320.00	325.00
T6=Rice husk + top soil + cow dung	139.90	160.40	180.30	200.10
T7=Top soil + poultry manure + cow dung	229.90	270.00	296.70	335.00
T8=Top soil+ poultry manure + rice husk + cow dung	197.70	202.3	220.00	335.00
LSD (*0.05*)	5.389	36.50	5.298	3.827

Effects of someorganic soil amendments on okra number of leaves at 2-8 weeks after sowing.

The results showed that at 2 weeks T8 (Top soil + poultry manure + rice husk + cow dung) had the highest number of leaves (4.66), while T1 (Top soil only) had the lowest number of leaves at 2 weeks after sowing

(2.85). At week 8, T2 (Top soil + poultry manure) had the highest number of leaves (31.00) while T1 (top soil only) had the lowest number of leaves at week 8 (13.46). The significant difference ($p<0.05$) observed indicates that different soil amendments had a significant effect for number of leaves at different times.

Table 3. Effects some of organic soil amendment on number of leaves from 2-8 weeks after sowing

Treatment	Weeks						
	2	**3**	**4**	**5**	**6**	**7**	**8**
T1=Top Soil	2.86	5.74	7.67	9.62	11.52	13.02	13.36
T2=Top Soil + Poultry Manure	3.33	9.00	11.33	19.00	22.67	27.67	31.00
T3=Cow dung + topsoil	3.00	8.00	11.67	16.67	19.67	21.00	23.00
T4=Rice husk + topsoil	3.67	8.00	10.67	13.67	14.33	15.67	17.00
T5=Top soil + rice husk + poultry Manure	3.33	6.00	7.00	11.57	13.67	15.33	16.00
T6=Rice husk + top soil + cow dung	3.00	7.33	11.33	15.67	18.67	20.67	22.00
T7=Top soil + poultry manure + cow dung	4.00	8.67	12.00	19..67	24.67	27.00	28.00
T8=Top soil+ poultry manure + rice husk + cow dung	4.67	8.67	12.67	19.00	26.00	28.33	30.00
LSD (0.05)	1.751	1.204	1.809	2.723	1.971	1.814	2.109

Effects of some organic soil amendments on the stem girth of okra plant from 4-8 weeks after sowing

It's observed from Table 4,that treatment T2 (Top soil + poultry manure) had the highest stem girth throughout the weeks with the highest stem girth of mean value of 5.53 cm at 8 weeks. Treatment T1 (top soil) only had the lowest stem girth from week 5 - 8 and had the highest value of 3.35cm at week 8 . Treatment 2 (Top soil + poultry manure) had the biggest stern girth mean valueat 4-8 weeks after sowing while treatment T1 (Top soil) performed the least of all treatment.

Table 4. Effects ofsome organic soil amendments on the stem girth (cm) of Okra plant from 4-8 weeks after sowing

Treatment	Weeks				
	4	**5**	**6**	**7**	**8**
T1=Top Soil	2.27	2.44	2.75	3.24	3.55
T2=Top Soil + Poultry Manure	3.93	4.90	5.30	5.50	5.53
T3=Cow dung + topsoil	3.80	4.15	4.30	4.70	5.00
T4=Rice husk + topsoil	2.25	2.63	3.00	3.40	3.70
T5=Top soil + rice husk + poultry Manure	3.68	3.95	4.17	4.58	5.00
T6=Rice husk + top soil + cow dung	3.00	3.60	4.00	4.70	5.40
T7=Top soil + poultry manure + cow dung	3.10	3.67	4.20	4.48	4.75
T8=Top soil+ poultry manure + rice husk + cow dung	2.90	3.40	3.70	3.90	4.38
LSD (*0.05*)	0.3396	0.3483	0.2223	0.2029	0.2431

Effects of someorganic soil amendments on the number of Okra fruits at 4-8 weeks after sowing.

The data shows the number of fruits produced by each treatment at different weeks at week 4 - 8.Treatment T3 (Top soil + cow dung) had the highest number of fruits in most of the weeks ranging from 5.0 to 5.0. On the other hand, treatment T1 (Top soil) had the lowest number of fruits produced at most week intervals ranging from 1.9 to 1.2 fruits.

Table 5. Effects of someorganic soil amendments on the number of okra fruits at 4-8 weeks after sowing.

Treatment	Weeks				
	4	**5**	**6**	**7**	**8**
T1=Top Soil	1.93	3.93	3.00	4.79	1.29
T2=Top Soil + Poultry Manure	2.00	5.00	4.00	6.00	5.00
T3=Cow dung + topsoil	5.00	5.00	6.00	4.00	5.00
T4= Rice husk + topsoil	2.00	5.00	4.00	3.00	3.00
T5=Top soil + rice husk + poultry Manure	5.00	5.00	6.00	5.00	4.00
T6 =Rice husk + top soil + cow dung	3.00	4.00	5.00	5.00	3.00
T7= Top soil + poultry manure + cow dung	2.00	3.00	3.00	3.00	2.00
T8=Top soil+ poultry manure + rice husk + cow dung	2.00	2.00	5.00	4.00	4.00
LSD (*0.05*)	1.675	2.060	1.362	1.730	1.230

Effects of some organic soil amendments on the fruit weight of Okra plant at 4-8 weeks after sowing.

The result of the analysis showed that, Treatment T6 (top soil + rice husk + cow dung) had the highest fruit weight at week 4 and 5 after sowing with values of 12.60g and 17.60g respectively. At week 6, Treatment T2 (top soil + poultry manure) had the highest fruit weight with a mean value of value of 18.67g. However, treatment T1 (top soil only) had the lowest fruit weight value at 5 , 7 and 8 and Treatment T8 (top soil + poultry manure + rice husk + cow dung) had the lowest fruit weight value at week 4 and Treatment T4 (rice husk + top soil) had the lowest fruit weight value at 6 weeks after sowing.

Table 6. Effects of some organic soil amendments on the fruit weight of okra plant from 4-8 weeks after sowing.

Treatment	Weeks				
	4	**5**	**6**	**7**	**8**
T1=Top Soil	8.51	13.07	12.53	11.11	10.48
T2=Top Soil + Poultry Manure	12.50	15.57	18.67	13.37	16.27
T3=Cow dung + topsoil	10.50	16.50	15.23	17.20	12.80
T4=Rice husk + topsoil	8.40	13.33	11.37	19.30	15.00
T5=Top soil + rice husk + poultry Manure	8.43	16.50	15.20	17.10	12.73
T6=Rice husk + top soil + cow dung	12.60	17.60	14.40	15.70	16.27
T7=Top soil + poultry manure + cow dung	8.27	16.73	14.97	17.50	12.50
T8 = Top soil+ poultry manure + rice husk + cow dung	5.20	16.33	14.63	16.30	13.80
LSD (*0.05*)	0.3113	0.4711	0.4056	0.3799	0.4849

DISCUSSION

Growth Parameters

Plant Height

Plant height of Okra is genetically determined (IAR, 1995). The height of okra studied is perhaps more of genetic than environmental trait. The positive effect of organic manure on plant height could be due to its genetic makeup as well as the contributions made by manure to fertility status of the soil. Thus, the results suggests that the use of soil amendments had a positive effect on development and growth of okra plants and

the combination of Top Soil, poultry manure, rice husk and cow dung, proved to be the most effective treatment in terms of plant height. The results obtained collaborated with the findings of Ajari *et al*. (2003) in okra production in which they reported that organic manure especially poultry manure could increase plant height of crops when compared to other sources of manure.

Leaf Area

The importance of leaf area in relation to basic plant metabolic processes such as photosynthesis and respiration is generally recognized. The result suggests that the use of Top soil, rice husk and poultry manure can significantly increase leaf area and increase photosynthesis and respiration efficacy in plants (Bueno, 1979).

Number of leaves

It appears that different soil amendments had varying effects on number of leaves of okra over time. From the results, T3, T7 and T8, had the highest mean values for number of leaves at different weeks, implying that these soil amendments maybe more effective in promoting leaf growth and development. T1 had comparatively low number of leaves at most times suggesting that this amendment may be less effective.

Okra Stem girth

The results obtained shows the effect of different soil amendments on stem girth at 4-8 weeks after sowing at Ifite Ogwari. The stern girth is principal parameter in determining plant growth and development.The results suggest that the addition of poultry manure to top soil has a positive effect on stern girth, while the addition of cow dung to the mixture further enhances growth.

Number of fruits and Fruit Weight

The results suggest that adding cow dung to top soil can positively affect the number of fruits produced. Treatment T3 (Top soil + cow dung) been the most effective for number of fruits, Treatment T6 (top soil + rice husk + cow dung) had the highest fruit weight at week 4 and 5 after sowing with values of 12.60g and 17.60g respectively. At week 6 Treatment T2 (top soil + poultry manure) had the highest fruit weight value of 18.67g. The results was in consonance with the findings ofSanwel*et al*. (2007) who observed that organic manure produce higher pods and improved productivity. The results also aligned with the findings of Abou El magd*et al.* (2006) who observed that animal manure nutrientsreleased more slowly and stored for a longer time in the soil, improves root development and high crop yield.

CONCLUSION

The use of different soil has a consequential effect on the growth and yield of Okra plant. Generally, the treatments that included a combination of organic soil amendments like poultry manure, rice husk, cow dung and top soil resulted in higher plant growth, plant height and number of leaves.

These treatmentsT8(poultry manure + rice husk + cow dung + top soil) and T7 (poultry manure + cow dung + top soil) consistently showed highest mean values for plants height and number of leaves across different weeks after sowing. Treatment T2 (poultry manure + top soil), T3 (cow dung + top soil) and T5 (poultry manure + rice husk and top soil) also showed congruous performances in terms of leaf area,number of fruits, stem girth and fruit weight. While Treatment T4 (rice husk + top soil) and treatment T1(top soil only) showed inconsistent mean values. Treatment T6 (rice husk + cow dung + top soil) showed mixed results with no clear course in terms of growth and yield. In conclusion the results suggest that the use of organic soil amendments can improve growth and yield of Okra.

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