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RESPONSE OF OKRA (*Abelmoscus esculentus Moench L.*) AND PUMPKIN (*Telfairia Occidentalis Hook*) INTERCROP TO SOIL AMENDMENTS

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Abstract: *The experiment was carried out at the Teaching and Research Farm Delta State University, Abraka. To evaluate the effects of organic and inorganic fertilizer on okra-pumpkin intercrop. The fertilizer treatments were 150kg/ha NPK: 15:15:15, 10t/ha 50%CM+50%CP, 15t/ha 60%CM+40%CP, 20t/ha 70%CM+30%CP, 30t/ha 80%CM+20%CP manure and control. A spacing of 60 cm x 40 cm for okra and 1m x1m for pumpkin plant/ha. The experiment was a 6x3 factorial in a randomized complete block design (RCBD) with three replications. Each plot measured 3.5 m x 3.5 m and 0.5m pathway between plots and 1m between blocks. An improve okra cultivar (Cv-N35) and pumpkin seeds were planted in April 2023 for early planting season and July 2023 for late planting season. Data were randomly collected for growth parameters such as plant height, number of leaves, leaf area, leaf area index, stem girth, vine girth, vine length, pod yield, yield leaf and weights respectively. Data collected were subjected to analysis of variance using SAS (1996), means were separated using Ducan Multiple Range Test (DMRT) at 5% level of probability. Results from study indicated that 30t/ha 80%CM+20%CP were significantly better in growth parameters compared to other treatment except in number of leaves. Based on the findings of this study, it is recommended that subsistence/commercial farmers apply 30t/ha 80%CM+20%CP for increased growth and yield of okra/pumpkin at reduced cost of production.*

Keywords*: okra, Pumpkin, Intercropping, Fertilizer, Manure and Spacing*

INTRODUCTION

The crop is widely cultivated in tropical, subtropical and warm temperature regions (Adeniyi, 2001). It is found to be a member of the hibiscus floral characteristics of that family originating from Africa. Okra is fast growing annual vegetable widely grown than other vegetable crops such as amaranths, lettuce, cabbage etc. The approximately nutrient content of the edible okra pod is as follows; water 88%, fibre 1.7 and ash 0.2% (Alake, 2020) while the nutritional constituents of okra calcium, protein, carbohydrate, iron, magnesium, including phosphorus as (Yasmeen, 2008). Okra plays a significant role in off security and alleviate malnutrition especially in Children (Gemede, 2015). Okra (*Abelmoschus esculentus* Moench (L) is a vegetable crop found in most market in Africa (Sankar, 2008). Its fruit can also be eaten raw, oil content in okra seed was reported to be as high as that of poultry eggs including soybean (Folurunso, 2003). It plays a vital role in human diet and can be consumed in various form (Philip *et al*., 2020). Okra is an essential vegetable with high nutritive value and contains antioxidant, phenolic compounds and flavonoids such as catechin which are helpful in reducing cancer and diabetics with several research findings show that okra pods are beneficial to the immune system because of its richness in several vitamin, minerals and protein called lectin (Ayami 2011). Fluted pumpkin (*Telfairia Occidentalis*) originated from Tropical West Africa but it is mostly cultivated in various parts of Southern Nigeria (Oladale, 2007). Pumpkin is a high climbing perennial crop with partial drought tolerance and penetrating root system. It is a leafy vegetable of great economic importance and belongs to the family, cucurbitaceous. Fluted pumpkin is mostly cultivated during rainy season but can also be grown in the dry season with irrigation. (Alawode, 2020). It is widely cultivated for its palatable and nutritious value. The seeds are also nutritious and rich in an oil which may be used for cooking and soap manufacture (Smith, 2007). Pumpkin is cultivated in Nigeria, at a subsistence level with virtually no commercial importance (Delahaut, 2006). The leaves, fruits, flowers and seeds are health promoting food and different parts of the plant have been used as medicine in some developed world. The leaves are hematinic, analgesic, and also used externally for treating burns (Eyzaguirre, 2007). The pulp is used in relieve intestinal inflammation or enteritis, dyspepsia and stomach disorders (Sentu and Debjani 2007). Pumpkin fruit is an excellent source of vitamin A which the body needs for proper growth, healthy eyes and protection from diseases. It is also rich in Vitamin C, Vitamin E, lycopene and dietary fiber (Pratt and Mathews 2003, Ward, 2007). It is grown mainly for the leaves which constituted an important component of the diet in many West African countries Farmer harvest the leaves either for consumption or for sale. Fluted pumpkin is an excellent vegetable rich in vitamins. (Eseyini *et al*, 2014). These vegetable has 37.3% protein content on a dry weight basis, fluted pumpkin is one of the most widely cultivated leaf vegetable in Nigeria. The leaves are rich in protein, oil, vitamins and minerals. Intercropping is a multiple cropping system in which two or more crop species are grown simultaneously in a field during a growing season. It is an essential component of small holder cropping system, while in large scale production, where nutrient cycles are externally regulated, intercropping is under utility (Olaniyi, 2010). Intercropping leads to higher productivity per unit land

area in addition to higher aggregate yield and stability of production. It utilizes plant growth resources more and their productivity is therefore enhanced. It also reduces seasonal peak as a result of the different planting and harvesting time, as described, farmer can achieve the full production of the main crop and also an additional yield from the component crops hence it increase income in short supply and act as insurance against crop failure labour distribution throughout the years fixing of atmospheric nitrogen to associated crop and diversity of farm produce (Oroka and Emuh, 2014). The use of organic fertilizer or manure to meet the nutrient requirement of crops to soil fertility would be inevitable practice in the years to come for sustainable agriculture. Since organic manure generally improve soil physical, chemical and biological properties (Aruna, 2020). Manure are usually applied at higher rates, they give residual effects on the growth and yield of succeeding crops (Makinde and Ayola, 2008). Improvements of environmental conditions as well as the need to reduce cost of fertilizing crops are reasons for advocating the use of organic materials (Bayu *et al*, 2006). Application of manures sustains cropping system through better nutrient recycling and provide a source of all increasing macro and micro-nutrients in available forms. Thereby improving the physical chemical and biological properties of the soil (Abou El- Malgd *et al*, 2006). Plant residue wastes as incorporated in the field, improved chemical nutrient elements which in turn increased okra yield (Onyibe, *et al.*, 2021) Mixing organic and inorganic fertilizers will enhance soil fertility management strategy to improve crop yields. Organic manure is the use of fertilizers of organic origin, such as compost manure, green manure, poultry manure cattle manure, farm yard manure in the improvement of soil fertility, plant nutrient and an increase in the cation exchanged capacity (Adekiya 2020). Onyibe *et al* (2021) reported that application of yam peels as an organic residues significantly increased okra germination count, height, leaf area, stem girth and number of leaves. High cost of inorganic fertilizer makes it uneconomical and out of reach to poor farmers and it is also undesirable due to its hazardous environmental effects therefore, it is essential to investigate the use of locally sourced organic materials which are environmentally friendly, cheap and probably have an effective way of improving and sustaining the productivity of crops and vegetables, like okra, pumpkin and arable crop production (Iyagba *et al*, 2012, Chutichudet *et al*, 2007). Hence the broad aim of this study was to evaluate the impact of organic manure and inorganic fertilizer to determine the performance responses on the growth and yield of okra and pumpkin intercrop.

MATERIALS AND METHODS

Experimental site

This study was conducted at the Delta State University Teaching and Research Farm, site 3, Abraka. It is situated between latitude $6^0$12`N and Longitude $6^0$12'N Temperature ranges from 250^0-310^0C with annual rainfall of 2000mm-3000mm (Delta State Investors Guide, 2014).

Land preparation

A land area measured 30mx15m was prepared with cutlass and hoe and demarcated into three blocks (replications).
Each block contains 18 plots, each plot was measured 3.5mx3.5m with 0.5m pathway between plots and 1m between blocks. A total of 54 plots was used in the experiment.

Soil analysis and analytical procedure

Composite soil sample were obtained at random from the experimental site at a depth of 0- 15 cm and the bulked soil sample was air dried, crushed, sieved through a 2mm mesh and was analyzed to ascertain soil physio-chemical properties.

Experimental materials

Materials for this experiment were, Okra seeds, Pumpkin seeds, Cattle manure, and Cassava peels.

Agro-waste procurement and composting

Materials that were used are: cow dung and cassava peels.

Cow dung: cow dung was obtained from Obiaruko cattle ranch, Obiaruko Delta State. The dung was sun-dried, after which the lumps was broken into smaller and smoother particles size.

Cassava peel: fresh cassava peel was obtained from local garri processing center located at Ugono Orogun Delta State. The cassava peel was washed, sun-dried after which, a local grater was used to grind to powdery form.

Agro-waste mixtures: these materials were thoroughly mixed manually, placed in a composting chamber; water was sprinked at every two days of turning to increase the moisture content for microbial activities and decomposition. At four weeks, the content was removed from the chamber and air dried.

Experiment design

The response of okra/pumpkin on the growth and yield performance on intercrops to soil amendment was evaluated by 6x3factorial a randomized complete block design (RCBD) with three replications and six treatments consisting of two organic wastes combinations, NPK and control.

Treatment 1: Control
Treatment 2: NPK 15-15-15
Treatment 3: F_4 50%CM + 50%CP
Treatment 4:F_3 60%CM + 40%CP

Treatment 5: F_2 70%CM + 30%CP
Treatment 6: F_1 80%CM +20%CP
Mixture Ratio of cattle manure (CM) and cassava peel (CP).
Rep/factor 1: Nutrient sources
T_1: control
T_2: NPK 15-15-15
T_3: 50%CM + 50%CP
T_4: 60%CM + 40%CP
T_5: 70%CM + 30%CP
T_6: 80%CM + 20% CP
Factor 2: intercropping pattern (IP)
IP_1: 100% okra
$1P_2$: 100% pumpkin
$1P_3$: 50% okra, 50% pumpkin
A factorial experiment in a randomized complete block design (RCBD) evaluated by 6 x 3 factorial with six (6) treatments and three replicates.

The farm size was 30mx15m while each plot measured 3.5mx3.5m and 0.5m pathway between plots and 1m between blocks. A total of 54 plots was used in the experiment.
The nutrient sources for the soil amendment are (Agro-waste mixture and 150kg/ha of NPK fertilizer).

Table 1: Rate of Application of NPK 15:15:15 and organic manure.

Symbol	Nutrients	Types of fertilizer
T_1	Control	No Treatment
T_2	150kg NPK15:15:15	Inorganic
T_3	10t/ha of CM50%+CP50%	organic
T_4	15t/ha of CM60%+CP40%	Organic
T_5	20t/ha of CM70%+CP30%	Organic
T_6	30t/ha of CM80%+CP20%	Organic

Table 2: Intercropping pattern (IP)

Symbols	Planting pattern
IP_1	100% Okra
IP_2	100% Pumpkin
IP_3	50% Okra, 50% Pumpkin

Table 3: Combinations of the different rate of Manure and fertilizer application

Symbols	Treatments
T_1P_1	Control (No Nutrient)
T_1P_2	Control (No Nutrient)
T_1P_3	Control (No Nutrient)
T_2P_1	150 $kgha^{-1}$ NPK 15:15:15
T_2P_2	150$kgha^{-1}$ NPK 15:15:15
T_2P_3	150$kgha^{-1}$ NPK 15:15:15
T_3P_1	10t/ha of CM50%+CP50%
T_3P_2	10t/ha of CM50%+CP50%
T_3P_3	10t/ha of CM50%+CP50%

T_4P_1	15t/ha of CM60%+CP40%
T_4P_2	15t/ha of CM60%+CP40%
T_4P_3	15t/ha of CM60%+CP40%
T_5P_1	20t/ha of CM70%+CP30%
T_5P_2	20t/ha of CM70%+CP30%
T_5P_3	20t/ha of CM70%+CP30%
T_6P_1	30t/ha of CM80%+CP20%
T_6P_2	30t/ha of CM80%+CP20%
T_6P_3	30t/ha of CM80%+CP20%

Planting season

An improved Okra variety C.V N54 and pumpkin seeds was used as planting materials. The planting operation commenced at the beginning of April 2023 early plating season and July 2023 for second planting season (Late planting season season). Three (3) seeds of okra and one (1) seed of pumpkin was planted per hole according to each prepared plots for their treatment combinations. Thinning was done immediately after seed emergence of okra seedlings where one vigorous stand was maintained and weeding was carried out throughout the period of the experiment to keep the experimental plots weed free.

Data collection for initial physio-chemical properties of the experimental site

Initial composite soil sample was prepared and analyzed according to laboratory analytical procedure for chemical and physical properties of soil to determine the particle size distribution and the initial nutrient level.

Data collection for both okra and pumpkin on growth parameter

Data were collected at 3, 6, 9, and 12 weeks for both okra and pumpkin, after planting, three plants at the middle was randomly selected and sampling was tagged for measurement.

Data taken on growth parameters of okra were:

Plant Height (cm): Plant height was measured from the soil surface to the top of the plant at 3, 6, 9 and 12 weeks after planting (WAP). The three plants that were used for the measurement were selected randomly and measured.

Stem girth (cm): The stem girth was measured using vennier calipers.

Leaf Area (LA): The leaf area was calculated using the formula developed by Omolaiye *et al* (2015);

LA = 0.34 (LW)

Where L = Length and W is width

Vine Length (CM): The vine was determined by measuring the length of vine using a measuring tape.

Vine girth (VG): The vine girth was determined by using vennier calipers. In the absence of veneer calipers, a tread was used to measured the thickness of the girth circumference and placed on a meter ruler reading for the values recorded.

Statistical analysis

The research data were processed by analysis of variance (ANOVA) and significant treatment means were separated using Ducan Multiple Range Test (DMRT) at 5% level of probability.

Results and Discussions

Table 4.1 Shows the Physio-chemical constituents of the soil in the experimental site. Soil is sandy loam with the pH in Naler 6.00 which is slightly acidic and total nitrogen is 0.24kg/kg, organic carbon 2.18g/kg, available phosphorus 8.61mg/kg, magnesium calcium, Potassium and sodium were 0.33, 2.09, 0.45 and 0.43 expressed in (cmol/kg). Exchangeable acidity was 0.24 cmol/kg, Manganese , Iron , Copper and Zinc were rated as follows 226, 140, 2.40 and 0.48 (mg kg^{-1}) accordingly.

Table 4: Initial physio-chemical properties of the experimental site

Parameter	Values
pH (Water 1.1)	6.00
Organic Carbon (g kg^{-1})	2.18
Total Nitrogen (g kg^{-1})	0.24
Phosphorus (mg kg^{-1})	8.61
Calcium (cmol kg^{-1})	0.61
Potassium (cmol kg^{-1})	0.33

Magnesium (cmol kg^{-1})	2.09
Sodium(cmol kg^{-1})	0.43
Exchangeable Acidity	0.24
Manganese (mg kg^{-1})	226
Iron (mg kg^{-1})	140
Copper (mg kg^{-1})	2.40
Zinc (mg kg^{-1})	0.48
Particle size distribution	66.02
Sand	
Silt	23.6
Clay	10.4
Textural Name (USDA)	sandy loam

The effects of intercropping of fertilizer in the plant height of okra in table 5 showed no significant difference. Results recorded at 20t/ha 70% CMx30%CP of organic fertilizer at 3WAP had a better value of 16.00cm than other treatments. However, at 9WAP and 12WAP recorded better values compared to other treatments where the control had the least values at 3WAP, 6WAP, 9WAP and 12WAP and 10t/ha 50% CMx50%CP of organic manure had the highest values at 9WAP and 12WAP. There was no interaction in the intercropping pattern, because no parameter is significantly different. Organic fertilizer showed a progressive increased plant weight values from 6WAP – 12WAP respectively. In some cases, CM+CP manure recorded the least value at 3WAP while at 6WAP – 12WAP recorded the highest values on plant height respectively. From the results above in table 7 on length of vine were not significantly different. 6WAP-12WAP showed a significant difference across control. However, it was observed that at 15t/ha 60%CMx40%CP manure with 12.28cm value was superior among the treatment and increases to 85.56cm and still retained the highest value of 12WAP. Results from table 8 on the interaction of fertilizer and intercropping on length of vine made no significant difference across all parameters. Values recorded in this study were in agreement with the reports of (Shazadi, 2011) that intercropped okra with pumpkin were both highest at 12 WAP intercrop. Oroka, (2016) observed that vermi-compost, green manure performed better in plant height number of leaf and stem girth than NPK.

Table 5: Fertilizer effects on plant height (cm) of okra

	Weeks After Planting			
Nutrient	3	6	9	12
Control	15.46a	21.88b	39.99b	45.13c
150kg/ha NPK 15:15:15	15.67a	24.13ab	48.37a	53.96b
10t/ha 50CM x 50CP	14.63a	23.96ab	50.63a	56.20b
15t/ha 60CM x 40CP	15.29a	25.54ab	49.92a	51.6ab
20t/ha 70CM x 30CP	16.00a	28.62a	48.83a	54.29ab
30t/ha 80CM x 20CP	15.33a	28.29a	49.92a	51.79a

Means followed by same letter(s) within treatment group are not significantly different at 5% level of significance using Ducan multiple Range Test (DMRT).

Table 6: Fertilizer effects of intercropping on plant height (cm) of okra

	Weeks After Planting			
Cropping patteren	3	6	9	12
Sole okra	15.46a	25.43a	48.75a	53.14b
Okra-intercrop	15.33a	25.38a	47.14a	51.50a

Means followed by same letter(s) within treatment group are not significantly different at 5% level of significance using Ducan Multiple Range Test (DMRT).

Table 7: Fertilizer effects on length of vine of pumpkin

Nutrient	**Weeks After Planting**			
	3	6	9	12
Control	8.45a	50.28b	55.94b	64.94b
150kg/ha NPK 15:15:15	11.94a	57.38a	72.33a	81.72a
10t/ha 50%CM x 50%CP	11.33a	57.56a	78.28a	83.83a
15t/ha 60%CMx40%CP	12.28a	57.22a	68.33a	85.56a
20t/ha 70%CMx30%CP	11.99a	58.72a	68.94a	86.17a
30t/ha 80%CMx20%CP	11.61a	56.67a	70.28a	85.67a

Means followed by same letter (s) within treatment group are not significantly different at 5% level of significance using Ducan Multiple Range Test (DMRT)

Table 8: Fertilizer effects of intercropping on vine length of pumpkin

Cropping pattern	**Weeks After Planting**			
	3	6	9	12
Sole Pumpkin	11.43a	56.48a	71.46a	81.50a
Pumpkin- intercrop	11.11a	56.13a	66.58a	83.13a

Means followed by same letter (s) within treatment group are not significantly different at 5% level of significance using Ducan Multiple Range Test (DMRT)

From the result above in table 9 and table 10 on leaf area were significantly different across the weeks. 30t/ha 80%CMx20%CPshowed better values of leaf area at 3WAP – 12WAP while they had the least values for leaf area. However, it was observed that at 9WAP on 30t/ha 80%CMx20%CP manure with 34.98cm was superior among the treatments but couldn't retained the highest value at 12WAP but on 15t/ha 60%CMx40%CP manure obtained the highest value of 41.51cm at 12WAP. The leaf area shows no significant difference across all treatments. The values recorded during the cropping seasons of this study showed significant similarity with NPK. The report of (Audi *et al*, 2013, Enujeke, 2013) which indicated that the combination of manure resulted in significant increased leave area stem and vine girt and total marketable yield. From the result above in table 11 on leaf area were not significantly, different across the weeks. 30t/ha 80%CMx20%CP manure showed better leaf area. However, observation was recorded that 9WAP on 30t/ha 80%CMx20%CP with 18.20cm value was superior among the treatment but still retained the highest value of 36.80cm at 12WAP. Results from table 12 on the interaction of fertilizers and intercropping on leaf area showed to fertilizer application indicated no statistical difference across all treatment.

Table 9: Fertilizer effects of leaf area (cm) of okra

Nutrient	**Weeks After Planting**			
	3	6	9	12

Control	9.87b	8.42b	14.89c	16.59d
150kg/ha/NPK 15:15:15	12.73b	10.13ab	25.63b	26.88c
10t/ha 50%CM x 50%CP	16.70a	10.25ab	27.93b	35.43b
15t/ha 60%CMx40%CP	17.97a	9.83a	26.66ab	41.51ab
20t/ha 70%CMx30%CP	17.85a	9.92a	28.44ab	39.91ab
30t/ha 80%CMx20%CP	17.64a	10.63a	34.98a	39.89a

Means followed by same letter(s) within treatment group are not significantly different at 5% level of significance using Ducan Multiple Range Test (DMRT).

Table 10: Fertilizer Effects of intercropping on leaf area (cm) of okra

Cropping pattern	**Weeks After Planting**			
	3	6	9	12
Sole Okra	16.17a	9.90a	26.15a	32.63b
Okra-Intercrop	14.54b	9.82a	26.70a	34.11a

Means followed by same letter(s) within treatment group are not significantly different at 5% level of significance using Ducan Multiple Range Test (DMRT).

Table 11: Fertilizer effect on leaf area (cm) of pumpkin

Nutrient	**Weeks After Planting**			
	3	**6**	**9**	**12**
Control	14.26a	16.94a	22.53a	24.51a
150kg/ha NPK 15:15:15	15.11a	20.48a	27.42a	27.71a
10t/ha 50%CM x 50%CP	14.96a	16.72a	27.91a	31.57a
15t/ha 60%CMx40%CP	16.46a	22.50a	21.33a	36.85a
20t/ha 70%CMx30%CP	17.16a	14.87a	27.42a	27.26a
30t/ha 80%CMx20%CP	18.20c	17.92a	28.27a	36.80a

Means followed by same letter (s) within treatment group are not significantly different at 5% level of significance using Ducan Multiple Range Test (DMRT)

Table 12: Fertilizer effect of intercropping on leaf area (cm) of pumpkin

Cropping pattern	**Weeks After Planting**			
	3	**6**	**9**	**12**
Sole Pumpkin	16.08a	17.78a	24.35a	28.58a
Pumpkin- intercrop	15.97a	18.70a	27.28b	30.99b

Means followed by same letter (s) within treatment group are not significantly different at 5% level of significance using Ducan Multiple Range Test (DMRT)

The effect of fertilizer and intercropping on stem girth recorded significant differences respectively in table 13. Results in all the weeks with fertilizer and manure application 150kg/ha NPK 15:15:15 + 30t/ha 80%CMx20CP manure had better stem girth value recorded at 9WAP and 12WAP showed the highest stem girth value 1.50cm and 3.10cm. The table also recorded that 9WAP and 12WAP, higher stem girth were recorded. From the results above in table 15 on vine girth were not significantly different. However,

at 3WAP-12wap showed a significant different in control across the results. In this study, 30t/ha 80%CMx20%CP manure showed better vine girth at 3WAP-12WAP with 1.64cm but still retained the highest value of 3.68cm at 12wap. Results from table 16 on the interaction of fertilizer and intercropping showed no significant difference across all parameters. The combination of agro-waste manure produced better results as compared to inorganic fertilizer, this indicated that an approximate dosage with right combination of agro-waste corresponded to a long term effect when compared to inorganic fertilizer (NPK) as reported by Akande *et al*, (2013). The nutrient use efficiency of crops is better with a mix of agro-base manure as compared to inorganic fertilizer. A similar trend of responses had been earlier observed with other crops (Makinde and Ayola, 2008) the application of organic based fertilizer mixture ; cow manure(CM) and cassava peel (CP) as utilized by pumpkin and okra enhanced the growth and yield of both crops as compared to inorganic fertilizers and untreated controls. This study showed that organic manures can be used to provide nutrition to crop especially vegetables such as pumpkin and okra and attain yields that generally are compared to that of inorganic fertilizer

Table 13: Fertilizer effects on stem girth (cm) of okra

Nutrient	Weeks After Planting			
	3	6	9	12
Control	0.56b	0,72b	0.80b	0.85b
150kg/ha NPK 15:15:15	0.69b	1.12a	1.18ab	2.97a
10t/ha 50%CM x 50%CP	0.76b	1.24a	1.50ab	3.08a
15t/ha 60%CMx40%CP	0.80b	1.09a	1.17ab	3.05a
20t/ha 70%CMx30%CP	0.75b	1.13a	1.39ab	3.10a
30t/ha 80%CMx20%CP	1.05a	1.25a	1.40ab	3.10a

Means followed by same letter(s) within treatment group are not significantly different at 5% level of significance using Ducan Multiple Range Test (DMRT).

Table 14: Fertilizer effects of intercropping on stem girth (cm) of okra

Cropping pattern	Weeks After Planting			
	3	6	9	12
Sole Okra	0.77a	1.08b	1.23b	2.86b
Okra Intercrop	0.76a	1.12a	1.25a	2.72b

Means followed by same letter (s) within treatment group are not significantly different at 5% level of significance using Ducan multiple range test (DMRT)

Table 15: Fertilizer effect on vine girth (cm) of pumpkin

Nutrient	Weeks After Planting			
	3	6	9	12
Control	0.74b	1.30b	3.07b	3.07b
150kg/ha NPK 15:15:15	1.40a	1.69a	3.67a	3.67a
10t/ha 50%CM x 50%CP	1.47a	1.71a	3.61a	3.61a
15t/ha 60%CMx40%CP	1.63a	2.00a	3.39a	3.39a
20t/ha 70%CMx30%CP	1.28a	1.89a	3.62a	3.62a
30t/ha 80%CMx20%CP	1.64a	1.94a	3.67a	3.68a

Means followed by same letter (s) within treatment group are not significantly different at 5% level of significance using Ducan Multiple Range Test (DMRT)

Table 16: Fertilizer effect of intercropping on vine girth of pumpkin

Cropping pattern	Weeks After Planting			
	3	6	9	12
Sole Pumpkin	1.35a	1.76a	3.51b	3.52a
Pumpkin- intercrop	1.37a	1.76a	3.49b	3.49a

Means followed by same letter (5) within treatment group are not significantly different at 5% level of significance using Ducan multiple range test (DMRT)

CONCLUSION

Organic fertilizer application, cow dung manure volume percentage plus cassava peel manure with 30t/ha 80%CMx20%CP recorded significantly better values in all parameters compared to NPK. The results of organic fertilizer significantly affected majority of the growth parameters, pod yield/ha and leaf yield/ha in the planting seasons with 30t/ha 80%CMx20%CP higher compared to other treatments. It is therefore recommended that low income farmers / peasant farmers should apply 30t/ha 80%CMx20%CP of agro-based manure as equivalent to 150kg/ha NPK 15:15:15 fertilizer with the following spacing order of both crops (60 cm x 40 cm for okra and 1 m x 1 m for pumpkin) which enhanced the growth and yields of both crops at reduced cost of okra and pumpkin production.

REFERENCES

Adekiya A.O, Ejue W.S, Olanyanju A, Dunsin O, Aboyeyi C.M (2020): Different organic manure sources and NPK fertilizer on soil chemical properties, growth, yield and quality of okra. Journal of Scientific reports, (10), 158-163.

Adeniyi, O. R and Omotunde, C. T. (2001) Effect of planting pattern on growth and yield of tomato-cowpea intercrops. journal of vegetable crop production, 7(2) 75-81

Alake C.O (2020): Genetic variability and diversity in okra landraces using agromorphological traits and seed determination. International Journal of Vegetable Science 26 (2), 127-149.

Amafade, U.G, Ofuoku, A.U, Ovharhe, O.J, & Eromedoghene, E.O. (2022). Evaluation of the Livelihood Improvement: Family Enterprise Project for the Niger Delta (LIFE-ND) Programme on the Living Standard of Youths in Delta State, Nigeria. Innovation 6(71), 970-984

Audi N, Aguyoh M.I and Ojeniyi S.O (2013) yield and quality of watermelon as affected by organic and inorganic nitrogen sources. Asain journal of agriculture and food science, 1:180-185.

Iyagba AG, Onuegba B.A, Ibe A.E (2012): Growth and yield response of Okra (*Abelmoscus estulentus L. Moench*). Varieties to weed interference in South-Eastern Nigeria. Global Journal of Science frontier Res, 12:8 (1) 23-31.

Falola A, Ayinde O.E, and Ojehomon V.E (2019). Economic and analysis production in Kwara State Nigeria Albanian Journal of Agricultural Science vol. 12, Pp 503-510.

Enujeke E.C (2013). Response of grain weight of maize to veriety, organic manure and inorganic fertilizer in Asaba area of Delta State. Asian journal of agriculture and rural development vol. 3 (05) 1-15.

Folorunso O.N and Ojeniyi O.A (2003) comparative effectiveness of different levels of poultry manure with NPK fertilizer on residual soil fertility, nutrient uptake and yield of Okra. Moor Journal of agriculture research (2): 191-197.

Franus M., Barnat D. (2017): Regulation for separate collection of bio-waste and treatment of biodegradable waste. *Journal of Tropical Agriculture and Food environment*, 10(2), 154-160.

Gemede H.F (2015) Nutritional quality and health benefits of Okra (*Abelmoscus esculentus*). A review: international journal of food science 4(2) 208-215.

Goodluck, AU, Joseph OO. Oil Palm Production Value Addition in Nigeria: The Way Forward. *World Journal of Advance Research and Reviews.* 2024;21(3):2009-2017.

Khandaker M.M, Jusoh N, Ralmi N.H (2017): The effect of different types of organic fertilizers on growth and yield of okra (*Abelmoscus esculentus L*. (moench) Bulgarian Journal of Agricultural Science, 23(1), 119-125.

Mala M, Mollah M.M and Baishnah M. (2020) Importance of intercropping for Biodiversity construction Journal of Science and Technology, 10(2) 709-716.

Makinde E.A and Ayoola O.T (2008) influence of cassava population density on the growth and yield performance of cassava-maize intercrop with a relayed cowpea. Journal of tropical and subtropical agro-systems pg. 235-241.

Njoku S, Muoneke C.O, Okpara D.A, Agbo, M. (2007). Effect of intercropping varieties of sweet potato and okra in ultiso of Southern-East Nigeria African Journal of Biotechnology vol. 6(4), 1650-1654.

Nyawade S.O (2019). International legumes in finger Millet. International Journal of Potato Resource vol. 98, Pp 457-471.

Ogunbor .G. (2020): Okra: Origin, classification uses, Pest and disease. International Journal of development Research 13 (3): 14-30.

Ogunwande G.A, Ogunjimi A.O and Fafiyebi J.O (2012). Effect of farming frequency on composting of chicken litter in turned window piles. International Journal of Agrophysics 22:159.

Olaniyi J.O, Akanbi W.B, Oladiran O.A, (2010): The effect of organo-mineral and inorganic fertilizers in the growth, fruit yield, quality and chemical compositions of okra Journal of Animal and Plant Science, 9 (1) 1135-1140.

Onyibe, C.E., Obiazi, C.C. and Erutor, G.J (2021) Effects of Yam Peels on Soil Chemical Properties, and Yield of Okra (Abelmoschus esculentus L. Moench.) in Asaba, Nigeria. Journal of Agriculture and Food Environment Volume 8(3): 49-57

Onyibe, C. E., Alama, I. S. A and. Emefe, O. M (2021). Effects of selected wastes on some chemical properties in An alfisol, Delta State. International Journal of Agriculture and Rural Development. Volume 24(2): 5819-5824 2021

Oroka F.O and Omoregie A.U (2007) Competition in a rice cowpea intercrop as affected by nitrogen fertilizer and plant population. Science Agricola 64 (6), 621-629.

Oroka F.O and Emuh F.N (2014) competition in rice-cowpea intercrop as affected by nitrogen fertilizer and plant population. Journal of agriculture vol. 64 pg. 621-629.

Oroka, F.O (2016) Comparative effects of Municipal Solids waste Compost and NPK on the growth and Enarketable yield of colosia Argentia L.-Newyork Journal of Science, 5(10), 34-38.

Ouma G, *2009): Intercropping and its application to banana production in east Africa: *A review* Journal of plant Breeds Crop Science 7(1)-13-15.

Parnada C, Chigiya Y, Ngezimana W. (2020): Growth and Performance of baby Spinach (*Spinacia oleracea L.*) growth under different organic fertilizer. International Journal of Agronomy Pp 1-16.

Ukeh D, and Uko, A (2007): Effects of application of inorganic fertilizer and organic manure on insect pests and yield of soybeans (*Glycine max L.*) in the rain forest of *Nigeria-Journal of Agricultural Science and Technology* 10 (1): 37-40.