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EFFECT OF ORGANIC AND INORGANIC FERTILIZER ON GROWTH AND YIELD OF FLUTED PUMPKIN (*TELFARIA OCCIDENTIALIS*, HOOK F.) IN UYO, AKWA IBOM STATE, NIGERIA

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ABSTRACT
Field trails were conducted during 2009 and 2010 farming seasons at University of Uyo Teaching and Research Farm, to asses the effect of organic and inorganic fertilizers on growth and yield of fluted pumpkin (Telfaria occidentalis). A randomized complete block design was used with three replicates. The treatments were inorganic fertilizer (N.P.K. 15:15:15) rates (0,200, 400 and 600kg/ha), poultry manure (2t/ha) and combination of 2t/ha of poultry manure with 200, 400 and 600kg/ha of inorganic fertilizer. In both years planting was done in March at 1m x 1m spacing. The following growth and yield parameters were obtained; average number of leaves per plant, leaf area, vine length, number of branches per vine, number of pod per plant and pod yield. The result showed significant difference ($p \leq 0.05$). Increase in fertilizer led to increase in growth and yield parameters. The application of 600kg/ha + 2t/ha of poultry manure performed best but in terms of economic and environmental consideration, application of 200kg/ha + 2t/ha of poultry manure was recommended, since the yield from 600kg/ha + 2t/ha was not significantly higher than yield from 200kg/ha + 2t/ha of poultry manure.

Key words: Fluted pumpkin, organic, inorganic

Introduction

Fluted pumpkin (*Telfairia occidentalis* Hook F.) is an indigenous vegetable consumed in Nigeria. It belongs to the family of *Cucurbitaceae*. Fluted pumpkin has about 90 genera and more than 70 species distributed all over the warm parts of the world (Axtell, 1992). *Telfairia occidentalis* is a dioecious, creeping perennial vegetable shrub that spreads low across the ground and climbs by means of befit and often coiled tendrils (Okoli and Mgbeogwu, 1983; Horsfall and Spiff, 2005; Udoh *et al;* 2005). According to Ossom *et al* (1997), *T. Occidentalis* thrives well within the temperature range of 30 - 50^0C while Udoh *et al.* (2005) reported that the tropical vine crop thrives under a warm environment with plenty of sunshine and prolonged rainy season. Rainfall appears to be the major factor in its productivity with a requirement of 1000 - 2500mm per annum (Akoroda, *et al;* 1990).

In Nigeria, the edible vegetable is commonly known as "*Ugu"* (Igbo), "*Ubong, Nkong" Ubong (*Efik/Ibibio), and "*Ireke*" (Yoruba). Its succulent young shoots and tender leaves are used in preparing soups (Schippers, 2000) and sauce for *garri* and *foofoo* meals and it is usually cooked lightly with okro and fish or meat (Udoh *et al;* 2005). It is an important vegetable crop that has high nutritional and commercial value (Schippers, 2000). Fluted pumpkin leaves have high iron and protein contents about 86% moisture, 11% crude protein, 25% carbohydrate, 3% oil, 11% ash as much of 700ppm of iron (Oyolu, 1978). According to FAO, (1998) and Udoh *et al,* (2005), fluted pumpkin leaves have nutritional values of about 86ml water, .9g protein, 1.8g fat, 7.0g carbohydrate and 1.7g fibre. Its seed contains 13% oil which is used for cooking, manufacturing and cookies formulation (Okoli

and Nyanayo, 1998; Horsfall and Spliff, 2005). The oil in the seeds is non-drying and useful in soap making (Fasuyi, 2006).

Several workers have reported the nutritional composition, chemical characterization and functional properties of fluted pumpkin seed (Badifu *et al;* 1995; Fagbemi *et al;* 2005; Ganiyu, 2005; Fasuyi, 2006). The seeds are used as propagating materials, eaten roasted, boiled or ground to paste as soup thickener. The Igbo and Ibibio tribes in Nigeria, boil the seed remove the seed coat and ferment the endosperm for about 4 - 6 days, then use in preparation of local seasoning known as '*Ogiri'* (Igbo) and *'Ofiop'*(Ibibio) in the absence or in combination with castor or "*egusi*" melon seeds. The fruit case and pulp of *Telfairia* constitute 64% of whole fresh fruit weight and can be used as feed stuff for livestock (Essien *et al;* 1992; Egbekan *et al;* 1998). Apart from the nutritional and agricultural importance, the plant is also medicinal, it possesses anti-inflammatory (Oluwole *et al;* 2003), anti-bacterial (Odoemena and Essien, 1995), erthropioeti, anti-cholesterolemic and anti-diabetic properties (Eseyin *et al;* 2000; 2005).

Considering the importance of this vegetable in the life of people, it has become necessary to carry out research on ways of increasing its production in order to meet up with the increased demand for its products. One of the major problems limiting crop production is soil fertility (Ogbonna, 2008). This has so far been checked by the application of plant nutrients to the soil, either in the organic or inorganic form. Organic fertilizers apart from releasing nutrient to the soil also improve its physical properties, which enhance plant growth and development. However, release of nutrient is slow in organic fertilizers, but more lasting compared to the faster release of nutrients by inorganic fertilizers, which are often lost rapidly by leaching in porous soil and heavy rainfall areas. Frequent and high rate of inorganic fertilizers used have been associated with some environmental pollution. Also these important production input has become expensive and scarce in many parts of in Nigeria. It therefore becomes necessary to carry out studies on ways of reducing the dependence on mineral fertilizer. Research work in other crops revealed that best yields were obtained by appropriate combination of organic and inorganic fertilizers (Ogbonna, 2008, Ndaeyo *et al,* 2005, Makinde, *et al;* 2007, Dauda *et al;* 2008). The objective of this study is to determine the best combination of poultry manure and NPK 15:15:15 fertilizer that will give optimum yield of *Telfairia occidentalis*

MATERIALS AND METHODS

The study was conducted during the 2009 and 2010 first farming seasons at the University of Uyo Teaching and Research Farm located at Uyo (Latitude 5.17^0N and 5.27^0N and Longitude 7.27^0E and 7.58^0E, with mean altitude of 38.1m above sea leave). Uyo has bimodal rainfall pattern (Long-March to July and Short-September to November) with about 2500mm rainfall annually. The mean relative humidity is 79%, a minimum temperature is 22.50^0C and maximum temperature is 30.70^0C while the mean sunshine hour is 12 (Peters *et al;* 1989). The soil is acidic and classified as ultisol with well-drained coastal plain sands of Benin formation (Peters *et al;* 1989). Table 1 shows physico-chemical characteristics of the study site. These were similar to those reported by Peters *et al* (1989).

A randomized complete block design was used with three replicates. The treatments were inorganic fertilizer rates (NPK, 200kg; 400kg and 600kg/ha) poultry manure (2t/ha) whose chemical composition presented in Table 2, combined application of inorganic and organic manure (200kg/ha + 2t/ha, 400kg/ha + 2t/ha and 600kg/ha + 2t/ha) and control. Each plot size was 3m x 3m. The total numbers of plots in each replicate were 8, giving a total of 24 plots. The inter block and plot spacing were 1m and 1m, respectively.

Table 1: Soil physico-chemical properties of experimental site

Parameters	**Soil Depth**			
	0 - 15cm		15 - 30cm	
	2009	**2010**	**2009**	**2010**
pH	5.94	5.94	5.77	5.00
Ec ds/m	0.03	0.03	0.02	0.03
Organic matter(%)	2.81	2.71	2.20	2.21
Total N (%)	0.07	0.08	0.05	0.05
Available P (mg/kg)	18.60	18.70	12.96	10.82
Exchangeable Base (mol/kg)				
Exchangeable Ca (mol/kg)	3.84	3.72	3.84	3.73
Exchangeable Mg (mol/kg)	1.20	1.21	1.20	1.21
Exchangeable Na (mol/kg)	0.06	0.06	0.06	0.06
Exchangeable K (mol/kg)	0.09	0.09	0.09	0.09
Exchangeable Acidity (mol/kg)	2.12	2.13	2.12	2.13
ECEC (mol/kg)	7.31	7.31	7.31	7.31
Base Saturation (%)	70.99	76.90	70.99	70.92
Particle size analysis (%)				
Sand	90.96	85.96	88.90	84.96
Silt	2.70	3.76	3.82	1.76
Clay	6.34	10.28	7.28	13.28

In both years, planting were done in March at a spacing of 1m x 1m. Three seeds were planted per hole at about 6cm depth but later thinned to two plants per stand. Poultry manure was incorporated into the soil according to treatment two weeks before planting. Weeding was carried out monthly. Pest attack observed did not reach the threshold level.

Table 2: Chemical composition of poultry manure used during 2009 and 2010

% chemical composition	**2009**	**2010**
N	2.78	2.80
P	0.31	0.32
K	6.25	5.93
Ca	5.20	5.30
Mg	0.42	0.48
Na	0.35	0.34
Organic carbon	46.80	47.90

A compound fertilizer (NPK-15:15:15) was applied once at 3 weeks after planting according to treatment; ring method of application was used. Five plants were randomly tagged per plot for determination of average vine length (cm), number of leaves per plant, number of vines per plant and inter nodes length (cm). The average yield and yield components data were recorded; number of pods per plot, weight of pod per plot, length (cm) of pod per plant. Data collected were subjected to analysis of variance procedure and treatment means that indicated significant difference were separated using the least significance difference (LSD) at 5 percent level of probability (Gomez and Gomez, 1984).

RESULTS

The result presented in Table 3 showed significant difference at 2, 4, 6 and 8 weeks after planting (WAP) in both years. In all the treatments, vine length gradually increased from 2 to 10 WAP in both years. However, the combined application of 600kg/ha of NPK and 2t/ha of poultry manure produced the longest vines; 314.0, 476.6, 655.7, 850.4 and 1024.2cm in 2009 and 315.3, 478.4, 656.2, 847.8 and 1002.4cm in 2010 at 2, 4, 6, 8 and 10 WAP respectively. It also produced highest average number of leaves in both years; 35.7, 60.2, 77.3, 89.8 and 103.5 in 2009, 35.6, 60.3, 78.1, 89.9 and 104.1 in 2010 at 2, 4, 6, 8 and 10 WAP respectively in both years (Table 4). Treatment effect on mean internode length differed significantly only at 4 WAP in both years (Table 5). The combined application of poultry manure (2t/ha) and 600kg/ka produced highest mean internode length 5.21, 9.08, 8.89, 9.47, and 10.4 in 2009, 5.22, .01, 8.87, 9.45 and 10.52 in 2010 at 2, 4, 6, 8 and 10 WAP respectively in both years. The treatment effect on mean number of vines per plant of fluted pumpkin varied significantly only at 2 WAP in 2009 and 2010.

The combined application of 400kg/ha of NPK and 2t/ha of poultry manure produced highest number of vine in 2009, 1.53, 1.77, 2.15, 2.82, 2.97 and in 2010, 1.38, 1.54, 1.73, 2.12, 2.8 and 2.93 at 2, 4, 6, 8 and 10 WAP respectively (Table 6). In all the growth parameters considered, control treatment performed lowest, followed by application 2t/ha of poultry manure only. There was slight different in growth attributes of fluted pumpkin in 2009 and 2010. The treatments mean effect on yield and yield components of fluted pumpkin in 2009 and 2010 differed significantly on average number of pods only (Table 7). Application of 600kg/ha of NPK and 2t/ha of poultry manure produced highest number of pods per plot, (10.00) and (11.1) in 2009 and 2010 respectively, followed by combined application of 400kg/ha + 2t/ha of poultry manure (9.30) and (9.30) respectively. The least number of pods per plot was obtained in the control treatment, (4.0) and (4.5) in 2009 and 2010 respectively. Average weight of pod was higher in combined application of 600kg/hs of NPK and 2t/ha of poultry manure (12.36) and (12.40) in 2009 and 2010 respectively (Table 7). The least average weight of pod per plot (kg) was obtained in control (8.23kg) and (8.20kg) in 2009 and 2010 respectively. The treatment effect on mean length of pod (cm) showed no significant differences in 2009 and 2010, however, the combined application of 600kg/ha of NKP and 2t/ha of poultry manure produced longest pods (81.70cm) and (80.70cm) in 2009 and 2010 respectively, followed by combined application of 400kg/ha of NPK and 2t/ha of poultry manure, (74.0cm) and (74.10cm) in 2009 and 2010 respectively (Table 7). The shortest pods were obtained in control treatment, (53.0cm) and (52.0cm) in 2009 and 2010 respectively.

DISCUSSION

The soil analysis showed that the soil is a sandy clay loam. It is also noted that the soil has low pH (5.00 – 5.94) which means that it is acidic. From the recommendations of Ibedu *et al;* (1988), Udoh *et al;* (2005), Ibia and Udo (2009), the soil is low in total nitrogen, organic matter content, available K, and P. this implies low soil fertility status.

The significant effect of both poultry manure application and NPK 15:15:15 fertilizer application may be attributed to low soil fertility of the experimental site. This was evident in the results of the soil analysis in 2009 and 2010. Tisdale and Nelson, (1975), Ndaeyo *et al.* (2005), Makinde *et al.* (2007) and Uko et al (2009) noted that crop response to fertilizer application is affected by nutrient reserve in the soil. According to them, crops respond more to fertilizer application in soils with very low nutrient content than soils with high nutrient reserve. Organic fertilizer apart from releasing nutrient elements to the soil has also been shown to improve other soil chemical and physical properties which enhance crop growth and development (Ogbonna, 2008; Dauda *et al.*, 2008; Stevenson and Ardakani, 1972; Uko *et*

al., 2009). This may be responsible for the better performance recorded in plants that had combination of poultry manure and inorganic fertilizer than crops that received either sole poultry manure or sole inorganic fertilizer treatments. This agrees with results obtained in other crops (Ullah *et al.,* 2008; Ogbonna, 2008; Bayu *et al.,* 2006; Ndaeyo *et al.,* 2005; Uko et al., 2009). Dei (1975) attributed this to increased efficiency in the utilization of inorganic fertilizers as a result of reduced leaching losses of nutrients. In addition, poultry manure has also been reported to increase soil pH (Udoh *et al.,* 2005; Ullah *et al.,* 2008), hence the acidic soil of the experimental site which might have caused the unavailability of nutrient elements to the crop was checked by the limiting potential of organic manure.

The significant performance of fluted pumpkin in 2009 and 2010 over the control in growth and yield parameters could be due to the fact that poultry manure in combination with NPK fertilizer contained essential nutrient elements associated with high photosynthetic activities and this promoted roots and vegetable growth (Jahn *et al.,* 2004; Dauda, *et al.,* 2008). The increase in average number of pods, per plot, weight of pod per plot and length of pod (cm) could be attributed to the ability of combined application to promote vigorous growth, increase meristematic and physiological activities in the plants due to supply of plant nutrients and improvement in the soil properties, thereby, resulting in the synthesis of more photo-assimilates which are used in producing pods.

CONCLUSION

The study suggested that for the cultivation of fluted pumpkin in an ultisol, a combination of 600kg/ha of NPK fertilizer + 2t/ha of poultry manure may be use. Also considering the economic implication in sourcing inorganic fertilizer and the effect on environment, decreasing rate of application to 200kg/ha of NPK fertilizer + 2t/ha of poultry manure is recommended for flute pumpkin production. The study also suggested that more experiment should be done on higher rates of poultry manure and lower rates of NPK fertilizer on the crop.

Table 3: Effect of organic and inorganic fertilizer on the vine length (cm) of fluted pumpkin in 2009 and 2010

Treatments	2009 Weeks after planting					2010 Weeks after planting				
	2	4	6	8	10	2	4	6	8	10
2t/ha of Pm	204.8	394.7	582.9	622.0	820.3	202.6	345.1	503.2	623.2	820.5
200kg/ha of NPK	211.2	353.6	522.3	690.8	851.9	212.1	354.2	523.1	689.8	853.4
200kg/ha 2t/ha of Pm	214.8	340.4	491.4	653.8	988.0	215.7	349.2	492.5	651.2	982.2
400kg/ha of NPK	251.1	377.0	521.4	696.6	857.9	2601.1	377.3	522.3	697.4	853.7
400kg/ha of NPK + 2t/h of Pm	257.7	412.5	581.4	772.4	929.7	265.2	415.2	582.1	775.1	927.6
600kg/ha of NPK	302.6	450.2	612.4	775.9	943.3	301.2	348.3	613.3	772.3	943.2
600kg/ha of NK + 2t/ha Pm	314.0	476.6	655.7	850.4	1024..2	315.3	478.4	566.2	847.8	1002.4
Control	208.3	370.8	535.8	601.4	808.5	201.3	302.1	491.5	603.4	818.8
LSD ($\rho \leq 0.05$)	**74.99**	**ns**	**96.58**	**90.38**	**ns**	**74.90**	**ns**	**95.58**	**98.38**	**ns**

Pm = poultry manure
Ns = Not significant

Table 4: Effect of organic and inorganic fertilizer on number of leaves per plant of fluted pumpkin in 2009 and 2010

Treatments	2009 Weeks after planting					2010 Weeks after planting				
	2	4	6	8	10	2	4	6	8	10
2t/ha of Pm	25.3	42.7	60.3	74.2	86.8	24.3	42.6	60.4	73.9	87.2
200kg/ha of NPK	27.7	46.8	64.7	78.5	92.2	26.9	47.2	65.1	79.7	99.3
200kg/ha 2t/ha of Pm	24.5	41.8	60.0	76.2	88.7	24.8	41.6	61.0	75.5	89.6
400kg/ha of NPK	32.5	50.3	67.5	80.3	92.7	32.7	51.1	66.6	81.2	93.1
400kg/ha of NPK + 2t/h of Pm	33.7	54.2	72.2	85.3	97.0	34.1	55.2	73.1	86.1	97.1
600kg/ha of NPK	33.2	53.5	71.2	84.3	96.7	33.8	53.4	71.4	84.4	96.7
600kg/ha of NK + 2t/ha of Pm	35.7	60.2	77.3	89.8	103.5	35.6	60.3	78.1	89.9	104.1
Control	23.2	39.0	57.2	70.8	83.0	20.7	39.2	56.3	70.3	82.9
LSD ($\rho \leq 0.05$)	**8.60**	**8.59**	**8.62**	**8.58**	**9.61**	**8.66**	**8.59**	**8.52**	**8.57**	**9.63**

Pm = Poultry Manure; Ns = Not Significant

Table 5: Effect of organic and inorganic fertilizer on internode length (cm) of fluted pumpkin in 2009 and 2010

	2009 Weeks after planting					2010 Weeks after planting				
Treatments	**2**	**4**	**6**	**8**	**10**	**2**	**4**	**6**	**8**	**10**
2t/ha of Pm	4.98	6.79	7.51	8.50	8.67	3.97	6.78	7.31	8.52	8.60
200kg/ha of NPK	4.87	6.63	7.40	8.31	8.40	4.06	6.66	7.41	8.34	8.35
200kg/ha 2t/ha of Pm	4.74	6.67	6.88	8.52	9.12	4.73	6.56	6.72	8.55	09.04
400kg/ha of NPK	5.21	7.55	6.71	8.80	8.37	5.22	7.53	6.70	6.81	8.31
400kg/ha of NPK + 2t/h of Pm	5.51	8.39	8.54	8.96	9.46	5.53	8.34	8.55	8.94	9.45
600kg/ha of NPK	4.71	8.64	7.44	8.09	8.40	4.73	8.66	7.32	8.07	8.41
600kg/ha of NK + 2t/ha of Pm	5.21	9.08	8.89	.47	10.54	5.22	9.01	8.87	9.45	10.52
Control	4.87	5.07	6.03	7.81	8.01	3.21	5.02	6.05	7.09	7.51
LSD ($\rho \leq 0.05$)	**ns**	**1.48**	**ns**	**ns**	**ns**	**ns**	**1.34**	**ns**	**ns**	**ns**

Pm = Poultry Manure
Ns = Not Significant

Table 6: Effect of organic and inorganic fertilizer on number of vines per plant of fluted pumpkin in 2009 and 2010

	2009 Weeks after planting					2010 Weeks after planting				
Treatments	**2**	**4**	**6**	**8**	**10**	**2**	**4**	**6**	**8**	**10**
2t/ha of Pm	1.29	1.42	1.85	2.49	2.74	1.23	1.41	1.86	2.45	2.73
200kg/ha of NPK	1.39	1.49	1.79	2.30	2.75	1.34	1.47	1.78	2.29	2.74
200kg/ha 2t/ha of Pm	1.20	1.41	1.68	2.45	2.83	1.18	1.40	1.58	2.44	2.82
400kg/ha of NPK	1.39	1.55	1.87	2.49	2.73	1.36	1.51	1.86	2.47	2.71
400kg/ha of NPK + 2t/h of Pm	1.53	1.77	2.15	2.82	2.97	1.54	1.73	2.12	2.80	2.93
600kg/ha of NPK	1.36	1.55	1.91	2.45	2.81	1.38	1.53	1.90	2.45	2.79
600kg/ha of NK + 2t/ha Pm	1.26	1.63	2.07	2.61	2.91	1.28	1.64	2.05	2.60	2.90
Control	1.22	1.45	1.73	2.25	2.57	1.12	1.44	1.71	2.21	2.58
LSD ($\rho \leq 0.05$)	**0.19**	**ns**	**ns**	**ns**	**ns**	**0.11**	**ns**	**ns**	**ns**	**ns**

Pm = Poultry Manure; Ns = Not Significant

Table 7: Effect of organic and inorganic fertilizer on average yield and yield component of fluted pumpkin

Treatments	2009			2010		
	Average number of pods per plant	**Average length of pod per plant (cm)**	**Average weight of pod per plant (kg)**	**Average number of pods per plant**	**Average length of pod per plant (cm)**	**Average weight of pod per plant (kg)**
2t/ha of Pm	5.0	8.63	61.70	5.10	8.70	60.90
200kg/ha of NPK	4.3	9.9	66.70	4.50	9.90	66.5
200kg/ha 2t/ha of Pm	5.6	12.36	66.00	5.90	12.4	65.9
400kg/ha of NPK	4.0	10.93	61.70	4.10	11.2	60.9
400kg/ha of NPK + 2t/h of Pm	9.3	9.60	74.00	9.30	9.40	74.1
600kg/ha of NPK	7.0	8.57	56.30	7.10	8.60	55.2
600kg/ha of NK + 2t/ha Pm	10.0	13.17	81.70	11.10	13.5	80.70
Control	4.0	8.23	53.00	5.50	8.20	52.6
LSD ($\rho \leq 0.05$)	**3.55**	**ns**	**ns**	**3.55**	**ns**	**ns**

Pm = Poultry Manure

Ns = Not Significant

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