EFFECT OF FERTILIZER APPLICATION RATES ON THE GROWTH AND YIELD OF FLUTED PUMPKIN (*Telfaria occidentalis* Hook F.) IN ASABA, DELTA STATE, SOUTHEAST NIGERIA

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Abstact: Field studies was conducted to evaluate the effect of different rates of NPK (15:15:15) fertilizer application on the performance of fluted pumpkin (*Telfairia occidentalis* Hook F) in the teaching and research farm of Delta State University Abraka, Asaba campus. Four different rates of NPK 15:15:15 (0, 100, 200 and 300 kilogram per hectare) fertilizer were used as the treatments for the experiment which was fitted into a randomized complete block design (RCBD) and replicated three times. Data were collected on leaf area, leaf number, stem girth and weight of leaves. The result showed no significant difference between the application of 200 kg/ha and 300 kg/ha though the 300 kg/ha had the highest mean value, this was followed by 100 kg/ha and control which were not significantly different from each other. The vegetative growth increased with increase in fertilizer level. However, this study recommends the use of 200 kg/ha of NPK 15:15:15 fertilizer since it did not differ significantly from 300 kg/ha that had more input.

Keyword: Fluted pumpkin, fertilizer, vegetative growth, and yield.

Introduction

Fluted pumpkin (*Telfairia occidentalis* Hook F), Ugu (Ibo), Ubon (Efik), Umwenkhen (Edo), Iroko (Yoruba) is eaten in different parts of southern Nigeria. It is a curcubit and it belongs to the family curcubitacea. It is believed to be indigenous to East Central and West Africa, (Howes, 1950). Fluted pumpkin is named after Charles Telfair (1778-1833), an Irish botanist. Fluted pumpkin is a perennial woody climber grown for its leaves and seeds which are very nutritious (Sanni, 1982, Achinewhu 1983). The female plants have longer vegetative growth and development and bear the fruit that contains the highly nutritious seeds than the males (Oyolu, 1977).

The propagation of fluted pumpkin has been limited to the use of whole seeds. The seeds are always in short supply at planting time and this has been a limiting factor in its production. The seeds do not store well after harvest. In this respect, the seed could be classified as recalcitrant since it cannot be dried without causing damage or loss in viability (Roberts and King, 1981). The seeds can survive a few weeks or month in the pod but will not store for more than a few days after extraction.

Majority of Nigerians have of recent increasingly appreciated the need to be closer to nature and evolve different methods of food production and conservation of land in order to attain the much needed self sufficiency in food production in the years to come. The awareness has generated great concern and need for detailed studies on the basic principles of growing vegetables and comparison between varieties as well as to different locations on the basis of their yield and growth rate.

Fluted pumpkin is a vegetable with high dietary value and so is produced and consumed in most parts of Nigeria. Telfaria, although known to be a neglected vegetable crop is considered one of the best tropical greens (Giami *et al.*, 2003). Green leaf vegetables are important sources of vitamins which are very much affordable to both rich and poor. It has also been revealed that leaf vegetables are cheap sources of minerals, proteins and vitamins (Abaelu, 1999; Oyenuga, 1968).

The composition of soil nutrient to a very large extent determines how efficiently environmental factors such as sunlight and moisture are utilized in crop production. Therefore, the relevance of fertilizer application and its optimum use is an essential agronomic practice (Martin, 2004). Sobulo and Osiname (1981) also indicated that nitrogen has been the most limiting nutrient in all ecological zones of western Nigeria, and that all arable crops benefit from applied nitrogen (N).

Many literature on improve vegetable production and comparative trials on similar crops revealed yield responses to nitrogen fertilization. Birbal *et al.* (2014) for instance applied four levels of nitrogen and observed that the application of 75 kg and 100 kg/ha have significantly better yield of fluted pumpkin and water melon fruits than 50 kg N/ha and the control treatment, and thus further advised for more research to be carried out on other different rates of Nitrogen fertilizer, hence the objective of this study is to evaluate the effectiveness of different rates of NPK on the yield and performance of *Telfairia occidentalis*.

Materials and Methods

The experiment was carried out in 2010 at the teaching and research farm of Delta State University Abraka, Asaba campus located in Oshimili South Local Government area of Delta state, which falls between latitude $06^0$14'N and Longitude $06^0$49'E. The experiment was laid out in a randomized complete block design (RCBD) with four treatments three replicates; each plot measuring 2 × 2 m wide separated by 1m furrow to prevent boarder effect, seed were planted one per hole and total of five seed were planted per plot. Soil sample was collected and analyzed for physiochemical properties prior to planting. Manual clearing was done and the soil was pulverized with a hoe. Fluted pumpkin seeds were planted one seed per hole at the spacing of 0.5 × 0.5 m, application of NPK (15:15:15) fertilizer using the different rates of 0, 100, 200 and 300 kilogram per hectare, followed by other agronomic

practices such as weeding, training the fluted pumpkin vine to stake and controlling insect.

Data collection

Data were collected on the growth parameters such as leaf area, leaf numbers, stem girth and leaf weight at 2 weeks interval starting from week six after planting, leaf numbers were collected by counting the numbers of fully opened leaves. The leaf area was calculated by measuring Leaf length and leaf width then multiplied by a correlation factor of 0.75 (Duke and Dulellier, 1993). The stem girth was measured using Vanier caliper.

Data on growth parameters were analyzed using Genstat release 8.1 statistical package and the variables collected were tested for significance with one way analysis of variance (ANOVA) procedure in a randomized complete block design. The treatment mean comparison was done using least significant difference (LSD)

Results and Discussion

The physicochemical properties of the soil in study area are given in Table 1. The results showed that the texture of the soil was sandy clay, and was acidic in nature with the pH of 4.9. The organic matter content was low 0.12 gkg^{-1}, total nitrogen was low (0.05 gkg^{-1}). The available Phosphorous and potassium were equally low with values of 9.36 $mgkg^{-1}$ and 0.18 $cmol/kg^{-1}$, respectively. The cation exchange capacity was low. Generally the soil fertility was low based on the above fertility indices.

Table 1: Physiochemical properties of soil of the study area results

Particle Size Distribution	**(%)**
Sand	73.0
Silt	11.1
Clay	15.9
Texture	sandy clay
Soil pH	4.9
Organic matter	**0.12 gkg^{-11}**
Total nitrogen	0.05 gkg^{-11}
Available P	9.36 $mgkg^{-11}$
Exchangeable Cation (cmo/kg^{-1})	
Ca^{++}	1.86
Mg^{++}	1.43
K^{+}	0.18
Na^{+}	0.12
CEC	8.65
Micro-nutrients (mg/g)	
Zn^{++}	5.56
Cu^{++}	1.2
Fe^{++}	5.92
Mn^{++}	5.06

Effect of NPK 15:15:15 fertilizer on total leaf area

The results observed at six weeks after planting (6 WAP) indicated that the total leaf area increased with increasing rates of NPK fertilizer and age of plant (Table 2). There was no significant difference among the treatment of 200 kg/ha and 300 kg/ha fertilizer application and also that of 100 kg/ha and 200 kg/ha, although both 300 kg/ha and 200 kg/ha were significantly different from the application of the 0 kg and 100 kg/ha. The highest mean value was observed at the 300 kg/ha while the lowest mean value was from the 0 kg/ha which was the control. This result showed that plant response to the NPK application agrees with a similar research by Birbal *et al.* (2014), in which four levels of nitrogen fertilizer was applied on water melon, in the research findings 75 kg/ha of nitrogen fertilizer gave significantly ($P< 0.05$) better yield than that of 50 kgN/ha as well as the control. At 8WAP, 300 kg/ha had the highest mean value of 1803.0 cm which was not significantly different from the 200 kg, although, it was significantly different from 0 kg/ha and 100 kg/ha, while the 200 kg/ha was not significantly different from 100 kg/ha ($P<0.05$). The lowest mean value was observed at the 0 kg. At 10 WAP, the 300 kg/ha fertilizer had the highest mean value but was not significantly different from the 200 kg/ha. There was also no significant difference between the 100 kg/ha and 200 kg/ha. The lowest mean value was obtained from the 0 kg/ha, while at 12 WAP, 300 n kg/ha had the highest mean value but not significantly different from the 200 kg/ha; although, it was significantly different from the 0 kg/ha and 100 k g/ha. Meanwhile the 0 kg/ha and the 100 kg/ha had no significant difference. The results were also in accordance with the report of Abbas and Mehdi (2014) that for optimum vegetable growth and development of fluted pumpkin, adequate fertilization is required.

Table 2: Effect of NPK 15:15:15 fertilizer levels application on total leaf area weeks after application in cm^2

Treatment	**6**	**8**	**10**	**12**
0 kg/ha	934.9	1090.6	1237.4	1341.0
100 kg/ha	1202.4	1409.7	1542.9	1725.0
200 kg/ha	1565.8	1656.4	1821.3	2077.0
300 kg/ha	1636.8	1803.0	2033.7	2400.0
LSD at 0.05	294.7	301.33	289.13	501.39

Effect of NPK 15:15:15 fertilizer application on number leaves

From the results observed at 6 WAP, the leaf number increased with increasing rates of NPK fertilizer at 300 kg/ha which had the highest mean value of 115.0, although it has no significant difference with the 200 kg/ha and 100 kg/ha, and also there was no significant difference between the 0 kg/ha and 100 kg/ha. The lowest mean value was observed from the 0 kg ($P \leq 0.05$). At 8 WAP, 300 kg/ha had the highest mean value but was not significantly different from 200 kg/ha. It was also observed that there was no significant difference between 0 kg/ha and 100 kg/ha. The lowest mean value was observed from the 0 kg/ha treatment. This agrees with Akoroda (1990) which says that increasing levels of fertilizers brings about more vegetative growth which may be as a result of improved cell activities, enhanced cell multiplication and enlargement which result into luxuriant growth.

Table 3: Effect of NPK 15:15:15 fertilizer levels application on leaf number weeks after application

Treatment	**6**	**8**	**10**	**12**
0 kg/ha	81.0	91.0	101.3	109.3
100 kg/ha	96.0	102.3	114.3	123.0
200 kg/ha	104.0	123.7	124.7	134.0
300 kg/ha	115.0	125.3	132.7	141.0
LSD at 0.05	20.18	21.91	19.36	18.52

Finally at the 12 WAP, there was no significant differences among the 100 kg/ha, 200 kg/ha and 300 kg/ha except the 0 kg/ha, although the highest mean value was obtained from the 300kg/ha followed by the 200 kg/ha while the lowest mean value was observed at the 0 kg/ha.

It was also observed that there was no significant difference between 0 kg/ha and 100 kg/ha application as shown in Table 3.

Effect of NPK 15:15:15 fertilizer levels of application on stem girth weeks after application

At 6 WAP, the stem girth which resulted from the application of 300 kg/ha NPK was significantly different from other treatments with the highest mean value of 3.0 followed by 200 kg/ha and the lowest mean value was observed from the 0 kg/ha which was the control. The 0 kg/ha, 100 kg/ha and 200 kg/ha were not significantly different from each other. At 8WAP, 300 kg/ha application also differs significantly from the other treatments and has the highest mean value. There was no significant difference among the 0 kg/ha, 100 kg/ha and 200 kg/ha application. The result at 10 WAP and 12 WAP followed the same trend as depicted in Table 4.

Table 4: Effect of NPK 15:15:15 fertilizer levels of aspplication on stem girth weeks after application

Treatment	6	8	10	12
0 kg/ha	2.0	2.5	2.6	2.9
100 kg/ha	2.3	2.6	2.8	3.0
200 kg/ha	2.4	2.7	2.8	3.0
300 kg/ha	3.0	3.2	3.5	3.6
LSD at 0.05	0.274	0.3052	0.2726	0.5872

Table 5: Effect of NPK 15:15:15 fertilizer level of application on leaf weight

Treatment	Weight at the end of the Experiment (kg)
0 kg/ha	5.05
100 kg/ha	6.07
200 kg/ha	10.23
300 kg/ha	11.01
LSD at 0.05	3.94

Effect of NPK 15:15:15 fertilizer application on leaf weight

Table 5 shows that there was no significant difference between the 200 kg/ha and 300 kg/ha applications of NPK fertilizer, although both were significantly different from 0 kg/ha and 100 kg/ha. The highest mean value was observed for 300 kg/ha while the lowest value was observed at 0 kg/ha.

Conclusions

The study revealed that fluted pumpkin respond greatly to NPK fertilizer application. It was shown that increasing levels of fertilizers brought about more vegetative growth in the plant, which may be as a result of improved cell activities, enhanced cell multiplication and enlargement of all that resulted into luxuriant growth. It was discovered that the effect of 300 kg/ha of NPK 15: 15: 15 and 200 kg/ha of NPK 15:15:15 did not differ significantly from one another, although 300 kg/ha had greater mean values (2400 cm^2) for total leaf area at twelve weeks while 200 kg/ha had (2077.0 cm^2) and also for leaf number 300 kg/ha had (141.0) and 200 kg/ha had (134.0). This also applies to the leaf weight with 300 kg/ha having 11.0 kg and 200 kg/ha having 10.23 kg/ha. The 0 kg/ha and 100 kg/ha had lower mean values in the course of this experiment. The study therefore recommends 200 kg/ha of NPK 15:15:15 fertilizer for economic reasons since the cost effect of production is much reduced for the farmers.

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