



Effect of Fertilizer on Growth and Yield of Three Varieties of Sweet Potato (*Ipomea batata*) in Igbariam, South East Nigeria

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Abstract: A field experiment was conducted at Research Farm of National Root Crops Research Institute Sub-Station, Igbariam to study the effect of NPK 15:15:15 fertilizer application rates on the growth and yield of three varieties of sweet potato (Umuspol, Ex-Igbariam and Tis87/0087) during 2023 cropping season. The experiment was set up as 4 x 3 factorial laid in a randomized complete block design (RCBD) with three replications. The main factor comprises combination of four levels of fertilizer rates (0, 200, 400 and 600 NPK 15:15:15 kg/ha) while the sub-factor consisted of three varieties of sweet potato (Umuspol, Ex-Igbariam and Tis87/0087). Data collected on the growth and yield of the crop were subjected to analysis of variance (ANOVA) using Genstat 4th edition statistical software. The significant mean were separated using the Fisher's least significant difference (F-LSD) at 5% probability level. The result obtained indicated that Umuspol variety vine length, number of leaves and branches significantly had the highest values as 151.3cm, 160.9, and 14.9 respectively. While, Tis87/0087 had the lowest values of vine length, number of leaves and number of branches as 32.5cm, 46.3, 6.5 respectively. Fertilizer application rate at 200 kg/ha significantly influenced the length of tuber, width of tuber and tuber weight with highest values recorded in as 18.3cm, 10.1cm and 2.8kg/ha.

Keywords: Potatoes, tubers, varieties, yield, fertilizer.

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Introduction

Sweet potato (*Ipomoea batatas*) is believed to have originated from Tropical America (Gichuki *et al.*, 2003). The status of sweet potato in most parts of the Tropics is that of a minor secondary crop. However, its cultivation is increasing as it gives high yield and also required minimum attention during cultivation. It is undeniably, one of the most important food crops due to its high yield and nutrient value (Williams *et al.*, 2013). Despite the excellent quality of sweet potato in achieving household food security the maximum yield has not been obtained in Nigeria especially in Anambra state where Anambra East happens to be the major sweet potato producing Local Area. In recent times the production rate of sweet potato has been on a decrease despite numerous introduction and production of improved varieties of the crop. The decrease can be attributed primarily to methods of soil cultivation as well as fertilizer application rate. Wrong methods of these practices can consequently lead to the decline in the crop yield. Sweet potato removes appreciable quantities of plant nutrients from the soil, hence incorporation of considerable amount of organic manure or inorganic fertilizer during planting is recommended to maintain soil productivity. Selection of good cultivars or varieties is good steps toward maximum production alongside proper soil management are keys to sustainable agriculture (Simmons and Natziger, 2010).

Materials and Methods

The Research was carried out at Research Farm of National Roots Crops Research Institute sub-station Igbariam, Anambra State in 2023 cropping seasons. Igbariam lies between latitude 14° 65'N and longitude 12° 35' E. The experiment was set up as a 4x3 factorial laid in randomized complete block design (RCBD) with three replications. The treatment comprised all possible combination of four levels 0, 200, 400, 600, kg/ha of NPK (15:15:15) fertilizer, and three varieties of potato (Umuspol, Ex-Igbariam and Tis87/0087). The Field was manually prepared by making ridges. The experimental field was marked out into three blocks of 30x4m. Each block was further divided into 12 experimental plots of 2x4m (8m). The blocks was separated from each other by 1m path. The vines of sweet potato varieties were obtained from the National Root Crop Research Institute Umudike. The NPK fertilizer was sourced from Agricultural Development Program (ADP) Awka Anambra State, Ministry of Agriculture.

Data Collection

Growth parameters:

- Vine length (cm): This was done using measuring tape and is the distance from the ground level to the tip of the longest vine.

- Number of leaves per plant: The number of leaves per plant was obtained by counting the leaves of each selected plant within the plot after which their means was calculated and recorded.
- Number of branches per plant: This was obtained by counting the number of branches of each selected plant within the plot after which their mean was recorded.

Yield parameter

- Roots length per plots: This was obtained by measuring of the roots of each selected plants within the plot with measuring tape and recorded.
- Root width per plot: This was determined by measuring the roots using tape round the harvested tuber, after which they are weighed on weighing balance.
- Weight of roots (kg): This was determined by weighing the matured roots using weighing balance.

Data Analysis

All data collected were subjected to analysis of variance using Gen. Stat. Release 10.3. Significant difference among means was separated using Fisher’s Least Significant Different (LSD) at 5% level of probability.

Results

Effect of potato varieties and Fertilizer application rates on Sweet Potato Vine Length.

The effect of potato variety and fertilizer rates on sweet potato vine length at 8, 10, 12 and 14 weeks after planting (WAP) is shown in Table 1. The result obtained indicated that the potato varieties and fertilizer rate had significant effect on sweet potato vine length. This result also showed that Umuspol gave the highest sweet potato vine length (151.3 cm) while Tis87/0087 recorded the lowest vine length (32.5 cm). Fertilizer rate at 200 kg/ha recorded highest vine length (166.1 cm) at 8, 10, 12 and 14 WAP, while 0 kg/ha recorded the lowest vine length (30.3 cm). The interaction effect of potato varieties and fertilizer application rates on sweet potato on vine length was not significant (P<0.05).

Effect of potato varieties and fertilizer application rates on sweet potato number of leaves

Umuspol had the highest number of leaves (160.9) while Tis87/0087 recorded the lowest number of leaves (130.5) at 12 WAP (Table 2). Fertilizer application rates, indicated that the highest number of leaves (148.4) were observed at 200 kg/ha while 0 kg/ha record the least number of leaves (100.6). The interaction effect of potato varieties and fertilizer application rates on sweet potato number of leaves was not significant. (P<0.05).

Table 1: Effect of varieties and fertilizer rates on potato vine length at 8, 10, 12 and 14 weeks after planting (WAP) in 2023 cropping season at Igbariam.

Treatments	Potato vine length (cm)			
	8WAS	10WAS	12WAS	14WAS
Varieties				
Umuspol	39.3	78.8	118.9	151.3
Ex-Igbariam	35.3	68.8	90.3	131.7
Tis87/0087	32.5	72.9	111.3	123.7
Mean	35.7	73.5	106.3	135.5
LSD	3.3	6.6	16.8	7.8
Fertilizer rates (kg)				
0	30.3	60.8	90.4	117.3
200	44.1	92.5	126.7	166.1
400	32.5	73.1	105.6	128.3
600	35.9	67.6	104.6	130.5
Mean	35.6	73.5	106.8	135.5
LSD	3.0	7.7	10	9.1
Interaction				
V x FR	NS	NS	NS	NS

Note: NS = Not significant, * = Significant at 0.05%, V= varieties, FR= fertilizer rate

Table 2: Effect of varieties and fertilizer rates on number of leaves and branches at 8 and 12 weeks after planting (WAP) in 2023 cropping season at Igbariam.

Treatments	Number of leaves		Number of branches	
	8WAS	12WAS	8WAS	12WAS
Varieties				
Umuspol	85.2	160.9	6.8	14.9
Ex-Igbariam	56.2	141.2	6.7	11.2
Tis87/0087	46.3	130.5	6.5	10.5
Mean	62.5	144.2	6.6	12.2
LSD	3.3	6.6	NS	3.8
Fertilizer rates (kg)				
0	44.2	100.6	5.0	7.1
200	50.3	148.4	6.7	11.8
400	48.2	137.1	6.6	10.2
600	52.3	147.0	6.2	10.5
Mean	48.7	133.2	6.1	10.8
LSD	3.8	7.7	NS	3.1
Interaction				
V x FR	NS	NS	NS	NS

Note: NS = Not significant, * = Significant at 0.05%, V= varieties, FR= fertilizer rate

Effect of potato varieties and Fertilizer application rates on number of sweet potato branches at 8 and 12WAP

The effect of potato varieties and fertilizer application rates on number of branches of sweet potato at 8 and 12 weeks after planting is presented in Table 2. The result obtained showed that Umuspol had the highest number of branches (13.9) while Tis87/0087 had the least number of branches (10.5) both at 8 and 12 WAP. Fertilizer application rates, indicated that at 200kg/ha the highest number of branches (11.2) was obtained at 12 WAP while the lowest number of branches in 0 kg/ha as (7.1). The interaction effect of potato varieties and fertilizer application rates on number of branches shows no significant difference at 8 and 12 WAP.

Effect of potato varieties and fertilizer application rates on tuber width and tuber length (cm) of sweet potato.

The result obtained showed also that Umuspol gave the highest tuber width (13.4 cm) at 16WAP while Ex-Igbariam had the lowest tuber width (10.3 cm) at 16 WAP. For the tuber length at 16 WAP. Umuspol gave the highest (19.1 cm) while Tis87/0087 recorded the lowest as (14.1 cm). Under the fertilizer application rate the highest tuber width at 200 kg /ha (10.1 cm) and tuber length was recorded at 200 kg /ha (18.3 cm) and while 0 kg/ha fertilizer application rate gave the lowest tuber width and length at 16 WAP (7.4 cm and 13.6 cm) respectively.

Tuber weight

The effect of potato varieties and fertilizer application rate on tuber weight was significant. The result obtained indicated that the highest tuber weight was gotten under Umuspol (2.9 kg) (Table 3) and Tis87/0087 recorded the lowest weight of tuber (1/6 kg). Under the fertilizer application rate the highest tuber weigh was at 200 kg /ha (2.8 kg) and while 0 kg/ha fertilizer application rate gave the lowest weight of tuger (2.0 kg).

Table 3: Effect of varieties and fertilizer rates on potato length and potato width at 16 weeks after planting (WAP) in 2023 cropping season at Igbariam.

Treatments	Tuber length (cm)	Tuber width (cm)	Tuber weight (kg)
	16WAP	16WAP	16WAP
Varieties			
Umuspol	19.1	13.4	2.9
1Ex-Igbariam	16.7	10.3	2.6
Tis87/0087	14.1	10.4	1.6
Mean	16.6	11.3	2.3
LSD	3.1	2.2	0.8

Fertilizer rates (kg)			
0	13.6	7.4	2.0
200	18.3	10.1	2.8
400	17.7	8.3	1.9
600	18.1	7.9	2.7
Mean	16.9	8.4	2.4
LSD	3.2	2.0	0.7
Interaction			
V x FR	NS	NS	NS

Note: NS = Not significant, * = Significant at 0.05%, V= varieties, FR= fertilizer rate

Discussion

The highest values for vine length were obtained from control and 200 kg/ha NPK fertilizer application rates at 8, 10, and 14 WAP. These results are corroborate with the findings by Kareem (2013) where potatoes vine length was observed to decrease at NPK rates above 200 kg/ha. This was in agreement with reports of Rashid and Waithaka (2009) who also stated that vine production in sweet potato was not significant affected by NPK and when applied at higher levels it led to the production of shorter vines. The highest number of branches was recorded at Umuspol while Tis87/0087 gave the lowest number of branches at 8 and 12 WAP. The result indicated that potato varieties had significant effect on weight of roots (kg) in the cropping seasons. This result equally showed that Umuspol produced the highest tuber weight while Tis87/0087 produced the lowest weight of roots. This result agreed with the fining of Ennin *et al.* (2003), who reported 38% increase in sweet potato yield. Similarly, Brobbey (2015) recommended that planting method and variety plays vital roles in production of sweet potato. Fertilizer application rates showed significant effect on weight of roots in thecropping season where 200 kg/ha produced highest weight of roots while 0 kg/ha produced the lowest weight of roots. This result was in agreement with the findings of Uwah, *et al.* (2013), who stated that NPK fertilizer increases the yield of sweet potato through the formation of large sized tuber roots and that sweet potato yield increased with an increase in the rate of NPK fertilizer from 60 kg/ha to 150 kg/ha.

Conclusion and Recommendation

This study indicated that Umuspol produced the highest in most growth and yield parameters and the application of NPK fertilizer had the potential of increasing the growth and yield of sweet potato as well. The greatest growth and yield were obtained with 200 kg/ha. For optimum sweet potato production a combination of good variety like Umuspol and 200 kg/ha is recommended for Igbariam, Anambra State.

References

1. Brobbey, A. (2015). *Growth, yield and quality factors of sweetpotato (Ipomoea batatas (L) Lam) as affected by seedbed type and fertilizer application* (Doctoral dissertation).
2. Ennin, S.A, Dapaah, H.K, Asafu-Agyei, J.N (2003). Land preparation for increased sweet potato production in Ghana. Paper presented at the 13th Symposium of the International Society for Tropical Root Crops (ISTRC-World Branch), held from 10th– 14th November, 2003 at Arusha, Tanzania, Pp. 14.
3. Gichuki, S.T., Berenyi, M., Zhang, D., Hermann, M., Schmidt, J., Glossl, J. (2003). Genetic diversity in sweet potato *Ipomoea batatas*(L) in relationship to geographic sources as assessed with RAPD markers, *Genetic Resources and Crop Evaluation*, 50, 429-437.
4. Kareem, I. (2013). Growth, Yield and Phosphorus Uptake of Sweet Potato (*Ipomoea batatas*) Under the Influence of Phosphorus Fertilizers. *Research Journal of Chemical and Environmental Sciences* 1 : 50- 55.
5. Rashid, K., Waithaka, K. (2009). The effect of phosphorus fertilization on growth and tuberization of sweet potato, *Ipomoea batatas* L. ISHS Acta Horticulturae 153.
6. Simmons, F.W. and Nafziger, E.D. (2010). Illinois Agronomy Handbook. In: Soil Management and Tillage. USDA, Washington DC.
7. Uwah, D. F., Undie, U. L., John, N. M. and Ukoha, G. O. (2013). Growth and yield response of improved sweet potato (*Ipomoea batatas* (L.) Lam) varieties to different rates of potassium fertilizer in Calabar, Nigeria. *Journal of Agricultural Science* 5(7) pages 61 – 69.
8. Williams, D.J., Edwards, D., Hamernig, I. Jian, L., James, A.P., John, S.K. and Tapseu, L. C.(2013): Vegetables containing phytochemicals with potentials anti-obesity properties: A review. *Food Research International*.52: 232-333.