EFFECT OF FERTILIZER SOURCES AND PROPAGULE NODE NUMBER ON THE YIELD, AND FOLIAR DISEASES OF ORANGE-FLESHED SWEET POTATO (KING-J) IN OWERRI NIGERIA.

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ABSTRACT
The effect of fertilizer sources and propagule node number on the, yield, and foliar diseases of orange fleshed sweetpotato (king-J) were investigated at the Teaching and Research Farm of Federal University of Technology, Owerri Nigeria in 2016 and 2017 planting seasons respectively. Three (3) vine nodes: 2, 4 and 6 as well as three (3) sources of fertilizer: 0 (control), poultry manure 10 t ha^{-1} and NPK 15:15:15 400 kg ha^{-1},respectively were combined in a 3 x 3 factorial experiment fitted into RCBD giving a total of 9 treatment combinations replicated 3times and it gave 27 treatment plots. Data on soil at the beginning and at the end of each of the experiments were collected and analyzed. Data on the yield and foliar diseases of sweetpotato were also collected and statistically analyzed using Genstart software. Analysis of variance (ANOVA) at 5% level of probability was used to test treatment effect. The result showed that the study site was slightly acidic (p^H 4.99 and 5.19) and low in Nitrogen (0.13 and 0.12) in 2016 and 2017. At the end of the experiment the acidity was raised from 4.99 to 5.72, and 5.19 to 6.22 in 2016 and 2017, respectively. Result of the investigation revealed that fertilizer sources were statically significant on sweetpotato vine length, yield in kg ha^{-1}, leafspot andleaf blight disease severity as well. Propagule with 4 nodes applied with 400kg ha^{-1} NPK had the longest vines 70.20cm and 79.20cm, as well as lowest leaf spot and blight disease severity 1.15, 1.48; 1.19, 1.49 in 2016 and 2017 planting season respectively. However interaction of propagule with 4 nodes and 10 t ha^{-1} poultry manure produced the highest total fresh tuber yield 28.17 t ha^{-1} and 37.17 t ha^{-1} in 2016 and 2017 respectively.

INTRODUCTION

Crop production is dependent on soil fertility stability, the supply of adequate nutrients and quality of plant material used for optimum crop yield. Inadequate nutrient supply and poor soil structure in most cases are some of the major constraints in our agricultural production system. These constraints seriously affect the resource poor farmers that practice low- input agriculture. In our farming communities, farmers use chemical fertilizers to overcome some of the constraints. In our farming communities, farmers use chemical fertilizers to overcome some of the constraints. However, this does not help the soil as a natural body housing many micro and macro organisms that sustain soil ecosystem. Thus the use of organic manures to meet the nutrient requirement of crops would be an inevitable practice in the years to come for sustainable low input agriculture. Organic manures generally improve the soil physical, chemical and biological properties including moisture holding capacity, thus resulting in enhanced crop productivity along with maintaining the quality of crop produce (Eghball *et al.,* 2002). Many studies have shown that application of inorganic and/or organic fertilizers increase productivity mainly because they contain considerable quantities of plant nutrients including micro nutrients which have benefits for plant growth (Ibeawuchi *et al.,* 2006).

Sweet potato (*Ipomoea batatas*L.) belongs to family *Convolvulaceae* and order Polemoniales[3]. It is undeniable, one of the most important food crops due to its high yield and nutritive value (Folquer, F. 1974). The area of production and the productivity of sweet potato are increasing globally.

Generally Sweetpotato is a herbaceous vine and perennial in nature but normally grown as annual crop. It has long thin stem which trails along the soil surface and continues its vegetative growth, by penetrating it roots that are adventitious in nature. Some of the adventitious roots are irregularly swollen to form tuber due to accumulation of starch. Sweetpotato is usually propagated by vine cutting. Orange-Fleshed Sweetpotato (OFSP) is an improved breed of sweetpotato (*Ipomeabatatas*[L.] *Lam.*) Cultivated in tropical and sub-tropical regions of the world for food, fodder and source of income especially among the rural dwellers (Adebisi *et al.,* 2015)and (Mitra, S. 2012). It can be grown in wide range of agro-ecological zones and soil types. Although the majority of sweet potato varieties are high in carbohydrates, Orange Fleshed Sweet Potato (OFSP) varieties also provide vitamins A and C (Laban *et al.,* 2015) Despite this remarkable potential of the crop, Vitamin A deficiency (VAD) is widespread and the most common cause for young children blindness in the developing world (Low *et al.,* 2007). But among the cheapest and richest sources of vitamin A, are the orange-fleshed sweetpotato (OFSP) varieties, which are rich in beta carotene and are well accepted by young children (Low *et al.,* 2007a)

MATERIALS AND METHODS

The experiment was conducted at the Teaching and Research Farm of the School of Agriculture and Agricultural Technology, Federal University of Technology Owerri Imo state, Nigeria in April 2016 and repeated in 2017 cropping seasons. The site is located on latitude $07^0$02'N and longitude $06^0$29'E at a height of 55m above sea level. Owerri is within the rainforest zone of Nigeria which ecologically is characterized with more than 2500mm annual rainfall, 27^0C – 32^0C average minimal and maximum annual temperatures and 86% - 91% relative humidity. Most soils of the study area are Ultisol (Onweremadu *et al.,* 2007)

Experimental Treatment

The vines used for the experiment were obtained from the sweetpotato multiplication farm of the National Root Crop Research Institute, Umudike (NRCRI).The treatments comprised of factors A and B. Factor A being orange fleshed sweetpotato propagules cuttings of 2, 4 and 6 nodes respectively while factor B represents 3 fertilizer sources which include No fertilizer (control), NPK 15:15:15 fertilizer and Poultry manure.

Experimental Design and Layout

The experiment was a 3 x 3 factorial fitted into a randomized complete block design (RCBD) giving 9 treatments and replicated 3 times. With the three (3) replicates i.e. blocks, ridges were made in each block for planting of the potato vines and placements of the fertilizer treatments. The 9 treatments were randomized within each block among the plots within the 3 blocks giving a total of 27 treatment plots. The experimental site covered a total land area of 15m x 39m. Experimental plot measured 3m x 3m.

DATA COLLECTION

Data was collected based on the following parameter

Vine length (cm):The sweetpotato vine length was measured using a measuring tape placed from the ground to the tip of the vine at 6, 8 and 10 weeks after planting.

Tuber yield (kg^{-1}):The total fresh tuber yields were determined by combining the weights of the marketable and the unmarketable tuberous root fresh yields.

Leafspot and blight disease severity: These were obtained using visual observation and scoring according to the format of Ford and Hedwitt (1980)

Table:1 Disease Severity Assessment

Severity (%)	Scale	Interpretation
0	0	No infection
1-20	1	Slight infection
21-40	2	Moderate infection
41-60	3	Extensive infection
61-80	4	Very extensive infection
81-100	5	Roots completely infected

Data Analysis: Data collected were statistically analyzed using analysis of variance (ANOVA). Means were separated using Fishers Least Significant difference at $LSD_{0.05}$ at 5% probability level.

RESULTS AND DISCUSSION

Table 2 showed that Vine length, which indicates the growth pattern or plant morphological types of orange-fleshed sweetpotato. Fertilizer and node numbers were significant (p=0) in sweetpotato vine length. The longest vine observed are the cuttings With 4 and 6 nodes probably because they had enough time to grow more vegetative tops. This was similar to the findings of (Ekpe *et al.,* 2002) who reported that more number of nodes 4 to 6 induced vigorous growth of vine length.

Table 3 showed that fertilizer significantly influence fresh tuber yield. However the significance of total fresh tuber yield was achieved with application of 10 t ha^{-1} poultry manure. Similar results were reported by (Agyarko *et al.,* 2014) with incorporation of organic manure on sweetpotato yield. This also shows that tubers obtained from sweetpotato applied with poultry manure were larger and heavier than those of the pppcontrol. This is in line with the findings of (Yeng *et al.,* 2012) who obtained larger tuber weight of sweet potato with application poultry manure which could be as a result of improved soil physicochemical properties leading to the release of nutrients for the uptake by the sweet potato.

The result in Table 4 and 5 showed the effect of number of nodes and fertilizer source on the leafspot and blight diseases severity. Here the number of node, fertilizer source and their interaction significantly influenced Disease severity. This result could be attributed to the growth rate of the plant due to the application of both poultry manure and NPK. The application of nutrients for plant uptake increases the plant ability to resist the attack of pest and diseases. This result is in agreement with the findings of (Ihejirika*et al.,* 2009) who reported that addition of nutrient generally reduced the susceptibility of plant to pathogen up to the level required for optimum growth.

CONCLUSION

Based on the result from this investigation, 400 kg ha^{-1} NPK significantly produced the highest growth parameters as well as lowest leafspot and bacteria blight disease severity of orange fleshed sweetpotato while poultry manure 10 t ha^{-1} gave the highest yield. Also, 4 nodes sweetpotato vine equally significantly produced the highest growth parameters and yield but lowest leafspot and bacterial blight disease severity of orange fleshed sweetpotato. The interaction of fertilizer source and number of nodes did not have any significant effect on growth parameter and yield of orange-fleshed sweetpotato,

Table 2: Effect of fertilizer sources and propagule node number on sweet potato vine length (cm) at 6, 8 and 10 weeks after planting in 2016 and 2017.

Number of nodes	Fertilizer sources 2016			Mean	Fertilizer sources 2017			Mean
	Poultry manure 10,000 t ha^{-1}	**NPK 400 kg ha^{-1}**	**Control 0**		**Poultry manure 10,000 t ha^{-1}**	**NPK 400 kg ha^{-1}**	**Control 0**	
Vine length at 6 WAP								
2	27.10	34.10	23.30	**28.10**	37.10	43.10	31.30	**37.17**
4	42.40	50.40	26.60	**39.80**	52.40	59.40	34.60	**48.80**
6	49.90	53.80	33.50	**45.70**	59.90	62.80	41.50	**54.73**
Mean	**39.80**	**46.10**	**27.80**		**49.80**	**55.10**	**35.80**	
Vine length at 8 WAP								
2	52.10	59.10	43.30	**60.50**	62.10	68.10	51.30	**60.50**
4	67.40	75.40	51.60	**73.80**	77.40	84.40	59.60	**73.80**
6	74.90	78.80	58.50	**79.73**	84.90	87.80	66.50	**79.73**
Mean	**64.80**	**71.10**	**51.13**		**74.80**	**80.10**	**59.13**	
Vine length at 10 WAP								
2	77.10	84.10	73.30	**78.10**	87.10	93.10	81.30	**87.17**
4	92.40	100.40	76.60	**89.80**	102.40	109.40	84.60	**98.80**
6	99.90	95.70	83.50	**9.00**	109.90	104.70	91.50	**102.03**
Mean	**89.80**	**93.40**	**77.80**		**99.80**	**102.40**	**85.80**	
$LSD_{0.05}$ Number of node	**10.83**	**9.30**	**10.83**		**12.01**	**11.50**	**11.02**	
$LSD_{0.05}$ Fertilizer	**10.83**	**9.30**	**10.83**		**11.23**	**10.50**	**10.90**	
$LSD_{0.05}$ Number of node x fertilizer	**NS**	**NS**	**NS**		**NS**	**NS**	**NS**	

Table 3: Effect of fertilizer sources and propagule node number on sweet potato on total fresh tuber yield kg ha^{-1}, weight of marketable and unmarketable tuber kg ha^{-1} in 2016 and 2017.

Number of nodes	Fertilizer sources 2016			Mean	Fertilizer sources 2017			Mean
	Poultry manure 10,000 t ha^{-1}	**NPK 400 kg ha^{-1}**	**Control 0**		**Poultry manure 10,000 t ha^{-1}**	**NPK 400 kg ha^{-1}**	**Control 0**	
Fresh tuber Yield kg ha^{-1}								
2	26.33	20.22	7.54	**18.03**	35.33	27.22	13.54	**25.36**
4	29.79	28.11	7.13	**21.68**	38.79	35.11	13.13	**29.01**
6	28.39	26.96	12.69	**22.68**	37.39	33.96	18.69	**30.01**
Mean	**28.17**	**25.10**	**9.12**		**37.17**	**32.10**	**15.12**	
Weight of marketable tuber								
	19.02	18.53	3.96	**13.83**	28.02	25.53	9.96	**21.70**
2	21.04	20.11	3.40	**14.85**	30.04	27.11	9.40	**22.18**
4	20.14	18.80	4.75	**14.57**	29.14	25.80	10.75	**21.90**
6	**20.07**	**19.15**	**4.04**		2**9.07**	**26.15**	**10.04**	
Mean								
Weight of unmarketable tuber								
2	4.80	3.73	2.83	**3.79**	13.80	10.73	8.83	**11.12**
4	6.50	5.19	3.02	**4.90**	15.50	12.19	9.02	**12.24**
6	5.41	5.19	2.16	**4.50**	14.41	12.46	8.61	**11.83**
Mean	**5.57**	**4.80**	**2.82**		**14.57**	**11.80**	**8.82**	
$LSD_{0.05}$ Number of node	**NS**	**NS**	**NS**		**NS**	**NS**	**NS**	
$LSD_{0.05}$ Fertilizer	**1.48**	**1.29**	**5.06**		**5.14**	**3.40**	**6.01**	
$LSD_{0.05}$ Number of node x fertilizer	**NS**	**NS**	**NS**		**NS**	**NS**	**NS**	

Table 4: Effect of fertilizer sources and propagule node number on the leafspot disease severity of sweetpotato at 4, 8 and 12 weeks after planting in 2016 and 2017.

Number of nodes	Fertilizer sources 2016			Mean	Fertilizer sources 2017			Mean
	Poultry manure 10,000 t ha^{-1}	**NPK 400 kg ha^{-1}**	**Control 0**		**Poultry manure 10,000 t ha^{-1}**	**NPK 400 kg ha^{-1}**	**Control 0**	
Leaf spot at 4 WAP								
2	1.20	0.70	1.70	**1.20**	1.50	1.00	2.00	**1.50**
4	1.30	0.70	1.80	**1.27**	1.60	1.00	2.10	**1.57**
6	1.10	0.80	1.20	**1.03**	1.40	1.10	1.50	**1.33**
Mean	**1.20**	**0.73**	**1.57**		**1.50**	**1.03**	**1.87**	
Leaf spot at 8 WAP								
2	1.80	1.20	3.50	**2.17**	2.10	1.50	3.80	**2.47**
4	1.70	1.10	3.30	**2.03**	2.00	1.40	3.60	**2.33**
6	1.90	1.40	1.60	**1.63**	2.20	1.70	1.90	**1.93**
Mean	**1.80**	**1.23**	**3.07**		**2.10**	**1.53**	**3.10**	
Leaf spot at 12WAP								
2	3.70	1.60	4.20	**2.87**	3.10	1.90	4.50	**3.17**
4	2.90	1.40	3.90	**2.73**	3.20	1.70	4.20	**3.03**
6	2.70	1.70	3.70	**2.40**	3.00	2.00	3.10	**2.70**
Mean	**3.70**	**1.50**	**3.63**		3.10	1.87	3.93	
$LSD_{0.05}$ Number of node	**0.31**	**0.65**	**0.05**		**0.61**	**0.95**	**0.35**	
$LSD_{0.05}$ Fertilizer	**0.71**	**1.22**	**0.09**		**1.01**	**1.52**	**0.21**	
$LSD_{0.05}$ Number of node x fertilizer	**0.90**	**1.03**	**0.05**		**1.20**	**1.33**	**0.25**	

Table 5: Effect of fertilizer sources and propagule node number on the leaf blight disease severity of sweetpotato at 4, 8 and 12 weeks after planting in 2016 and 2017.

Number of nodes	Fertilizer sources 2016			Mean	Fertilizer sources 2017			Mean
	Poultry manure 10,000 t ha^{-1}	**NPK 400 kg ha^{-1}**	**Control 0**		**Poultry manure 10,000 t ha^{-1}**	**NPK 400 kg ha^{-1}**	**Control 0**	
Bacteria blight at 4 WAP								
2	1.20	0.70	2.50	**1.47**	1.50	1.00	2.80	**1.77**
4	1.10	0.70	2.30	**1.37**	1.40	1.00	2.60	**1.67**
6	0.90	1.00	1.40	**1.10**	1.20	1.30	1.70	**1.40**
Mean	**1.07**	**0.80**	**2.07**		**1.37**	**1.10**	**2.37**	
Bacteria blight at 8 WAP								
2	1.70	1.00	2.90	**1.87**	2.00	1.30	3.20	**2.17**
4	1.90	1.20	3.50	**2.20**	2.20	1.50	3.80	**2.50**
6	1.80	1.30	1.60	**1.57**	2.10	1.60	1.90	**1.87**
Mean	**1.80**	**1.17**	**2.67**		**2.10**	**1.47**	**2.97**	
Bacteria blight at 12WAP								
2	2.70	1.50	4.30	**2.83**	3.00	1.80	4.60	**3.13**
4	2.80	1.50	4.60	**2.97**	3.10	1.80	4.90	**3.27**
6	3.00	1.80	2.40	**2.40**	3.30	2.10	2.70	**2.70**
Mean	**2.83**	**1.60**	**3.76**		**3.13**	**1.90**	**4.06**	
$LSD_{0.05}$ Number of node	**0.82**	**1.52**	**0.25**		**1.12**	**1.82**	**0.55**	
$LSD_{0.05}$ Fertilizer	**0.74**	**1.65**	**0.65**		**1.04**	**1.95**	**0.95**	
$LSD_{0.05}$ Number of node x fertilizer	**0.71**	**1.45**	**0.55**		**1.01**	**1.75**	**0.85**	

REFERENCE

[1] Adebisi, B.A., Phorbee, O.O., Chima, B.N., Njoku, J.C., Iheonu, M.E., Adegoke, A.A., Chima, I.P., Low, J.W., and Mbabu, A.N. (2015). Orange fleshed sweetpotato: production, processing and utilization. A community training manual. *Helen Keller Internal, Nigeria and International Potato Centre, Nigeria.*

[2] Agyarko, K., Dapaah, H.K., Buah, S. and Frimpong, K.A. (2014) Sweet Potato (*Ipomoea batatas*) Yield Parameters, Soil Chemical Properties and Cost Benefit Ratios Following Incorporation of Poultry Manure and Inorganic NPK Fertilizers in Low Nutrient Ghanaian Soils. *International Journal of Plant & Soil Science3 (2): 129-138*.

[3] Eghball, B.D, Ginting G.A, and Shapiro, J.S. (2002): Manure as carbon source for soil improvement and crop production site specific application. *Proceedings Great Plan Soil Fertility Conference, 9:22-28.*

[4] Ekpe A. M., Elmundo, E.M, Alcantara C.G, and Pepania, J.C (2002). *Performance of three High yielding sweet potato varieties in Response to different organic fertilizers.Philippines: MOSCAT.*

[5] Folquer, F. (1974). Varietal efficiency in the spring production of sweetpotato seeds (*Ipomoea batatas L Lam.) Field Crop Abstracts* 29, 881.

[6] Ibeawuchi I.I, Onweremmadu E.U, and Oti N.N. (2006). Effects of poultry manure on green (*Amaranthuscruentus*) and water leaf (*Talinumtriangulare)* on degraded ultisol of Owerri South Eastern Nigeria. *Java* 2006; 5(1) 53-6.

[7] Ihejirika, G.O, Ibeawuchi, I.I, Obiefuna, J.C, Obilo, O.P and Nkwocha, V. I. (2009). Organic soil amendments as a protectant for kola seedling transplant against some field diseases in kola based cropping systems. Intl. journal of Agric and Rural Development (IJARD), vol. 12. 100-109.

[8] Laban, T.F., K. Peace, M. Robert, K. Maggiore, M. Hellen and J. Muhumuza, 2015. Participatory agronomic performance and sensory evaluation of selected orange-fleshed sweet potato varieties in south western Uganda. *Global J. Sci. Frontier Res.*, 15: 25-30.

[9] Low, J., Arimond, M. Osman, N., Cunguara, B., Zone, F. and Tschirley, D. (2007a). A food –based approach introducing orange-fleshed sweetpotatoes increased vitamin A intake and serum retinol concentrations in young children in rural Mozambique. *Journal of Nutrition., 137:1320-1327.*

[10] Mitra, S. (2012). Effect of planting materials on growth and yield of sweet potato. *Journal of Root Crops*, 16(2): 119-122.

[11] Oggema, J.N., M.G. Kinyua, J.P. Ouma and J.O. Owuoche, (2007). Agronomic performance of locally adapted sweet potato (*Ipomoea batatas*(L.) Lam.) cultivarsderived from tissue culture regenerated plants. *Afr. J. Biotechnol.*, 6: 1418-1425.

[12] Onweremadu,E.U; Oti, N.N., Ibeawuchi, I.I. and Obilo, O.P. (2007). Effect of dehydrated pig manure on maize yield on a degraded soil of Owerri, southeastern Nigeria. *Proceedings of the 28th annual conference of the Agricultural Society of Nigeria. Pp.81-86.*

[13] Wahau, T.A.T (1999). *Applied statistics for scientific studies. Africa-Link-Books*. Ibadan, Nsukka. Pp.151-154.

[14] Yeng, S.B., Agyarko, K., Dapaah, H.K., Adomako, W.J. and Asare, E. (2012). Growth and yield of sweetpotato (*Ipomoea batatas(*L) Lam) as influenced by Integrated application of chicken manure and inorganic fertilizer. *African Journal of Agricultural Research Vol. 7(*39). Pp. 5387-5395.

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