PRODUCTIVITY RESPONSE OF SWEET POTATO VARIETIES TO DIFFERENT FERTILIZER TYPES AND PLANT POPULATIONS IN A HUMID TROPICAL ENVIRONMENT.

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ABSTRACT
The yield of sweet potato is mostly constrained by soil fertility and poor cultural management. A field study was conducted to evaluate the effect of plant population and fertilizer type on the growth and yield of sweet potato (*Ipomoea batatas* (L.) Lam) varieties at the experimental farm of the Faculty of Agriculture, University of Benin, Benin City, Nigeria. The study involved five varieties (Mother Delight, Odunkun, A04, King J and D7), four plant populations (20,000, 25,000, 33,333 and 50,000 plants per hectare (pph)) and five fertilizer types (control, NPK, poultry manure, kitchen waste and cattle dung) laid out in a 5 x 4 x 5 factorial arrangement fitted into randomized complete block design with three replications. Growth characters were significantly (P<0.05) influenced by variety, plant population and fertilizer type. Variety only significantly influenced tuber girth. Tuber girth, size and weight decreased significantly increase in plant population. Fertilizer application significantly enhanced tuber girth, number of tuber per plant, tuber weight and yield. Plots fertilized with kitchen waste had the highest tuber weight (1835 g) and tuber yield (36 t ha^{-1}). A plant population of 50,000 fertilized with kitchen waste had the highest tuber yield of 50.50 t ha^{-1}. All varieties had similar cost. D7 variety had the highest gross margin, net farm income, gross margin, returned per naira invested and Benefit: cost ratio. Plant population of 33,333 gave the highest gross margin, net farm income, returned per naira invested and Benefit: cost ration. Therefore, D7 variety together with population of 33,333 plants and kitchen waste compost are thereby suggested for sweet potato growers for sustainable of the crop in the humid tropical environment.

Keywords: Fertilizer type, economic analysis, growth characters, soil properties, tuber yield components.

INTRODUCTION

Sweet potato (*Ipomoea batatas* (L.) Lam) a member of Convovulaceae family is one of the most widely grown root crops in the world. The crop is widely cultivated for its enlarged edible storage roots which provide high amount of starch to staple diets. Apart from being consumed as food, it can also be fed to livestock or processed industrially into alcohol, starch, glucose, noodles, candy, desserts and flours.

Nigeria is the largest producer of sweet potato in Africa and second in the world after China. Approximately 212,840 hectares were subjected to sweet potato production with a mean yield of 9.80 t ha^{-1} (BNARDA, 2008). This productivity is too low despite the fact that the crop has the potential to greatly contribute to food security and farmers' income (Tewe*et al*., 2003). The yield of sweet potato is known to be mostly limited by soil fertility and poor cultural management (lack of proper weed control, insect pests, improper use of fertilizer, lack of improved varieties, sub-optimal plant density, etc.). Soil rarely contain adequate amounts of all nutrients at all times because socio-economic and demographic pressures continue to compete and deprived agricultural sector of arable land leading to continuous cultivation of available land which depletes soil fertility status. Unfortunately, the limited arable land use continuously and intensively is expected to produce enough to satisfy the ever increasing food and raw materials needs of the nation.

Sustainable sweet potato production in Nigeria is a great concern to all. This explain why farmers in attempt to achieve this, adopt many strategies including the use of non-organic inputs. This creates a lot of environmental problems as they are not environmentally friendly and in harmony with ecosystem. The use of organic input has potential to sustain crop yield and guarantee environmental safety. Adequate population has been reported by several scientists to be of advantage in crop production (Binalfew, 2012; Obalum*et al.,* 2017).

Therefore, it is in the view of this study that sweet potato production is to be sustained in Nigeria; farmers need to intensify the use of organic input technologies such as use of improved varieties, application of organic waste, botanical for crop pest and disease control, adoption of appropriate plant density that would out-compete weeds. A variety performs differently under different agro-climatic conditions and various varieties of the same species grown even in the same environment often yield differently (Comrie, 1997). Choosing best sweet potato variety is one of the most critical components of sweet potato production. Hence, the present research was conducted to evaluate agronomic performance of sweet potato varieties as influenced by different fertilizer types and plant population in a humid tropical environment.

MATERIALS AND METHODS

The trial was conducted at the Experimental farm of the Faculty of Agriculture, University of Benin, Benin City, Nigeria (Latitude 6^0 44´ N and Longitude 5^0 40´ E) located in the humid rainforest at an elevation of 162 m.The area is characterized by a bimodal rainfall pattern with a long rainy season which commences in March and the short rainy season that extends from

September to late October after a short dry spell in August. The dominant soil order in the studied area is ultisols developed from coastal plain sand.

The pre-cropping physical and chemical properties of the experimental site showed the soil pH 5.80, organic C (16.80 g kg^{-1}), total N (0.88 g kg^{-1}), available P (6.24 mg kg^{-1}), exchangeable Ca (0.86 cmol kg^{-1}), Mg (0.40 cmol kg^{-1}), K (0.21 cmol kg^{-1}), exchangeable acidity (0.16 cmol kg^{-1}) and textural class (sandy loam – sand (88.6 %), silt (6.40 %) and clay (5.0 %)). The rice husk analysis showed pH 6.67, organic C (25 g kg^{-1}), total N (13 g kg^{-1}), available P (12.45 mg kg^{-1}), Ca (0.70 %), Mg (0.28 %), K (1.18 %) and Na (0.32 %). The proximate nutrient composition of the kitchen waste was pH 10.7, organic C (48 g kg^{-1}, total N 19.7 g kg^{-1}, available P13.2 g kg^{-1}, a 4.2%, Mg 1.56 and Na 1.08 %. Cattle dung on analysis had a pH of 6.50 with 27.8 g kg^{-1} organic C, 14.5 g kg^{-1} Total N, 13.60 g kg^{-1} available P, 1.33 % Ca, 0.52 % Mg, 0.60 % K and 0.20 % Na.

The study involved five varieties (Mother Delight, Odunkun, A04, King J and D7), four plant populations (20,000, 25,000, 33,333 and 50,000 plants per hectare (pph)) and five fertilizer types (control, NPK, rice husk, kitchen waste and cattle dung) laid out in a 5 x 4 x 5 factorial arrangement fitted into randomized complete block design with three replications. NPK was applied at 400 kg ha^{-1} split equally at 2 and 4 weeks after planting (WAP) while rice husk, kitchen waste and cattle dung were decomposed under for eight weeks before application and applied at 15 t ha^{-1} 4 weeks before planting for equilibration.

Vine cuttings of about 40 cm long of various varieties were planted at inter-row and intra-row of 50 x 100 cm (20,000 pph), 40 x 100 cm (25,000 cm), 30 x 100 cm (33,333 pph) and 20 x 100 cm (50,000 pph) as per treatment. The vines were planted at an angle of 45° and a planting depth of 5 cm. The plots were irrigated immediately after planting.Missing plots were supplied 8 days after planting.Weeds were controlled manually as at when due. The plants were sprayed with a mixture of neem leaf extract and garlic against lepidopterous larvae and fungus diseases. Sweet potato tubers were harvested at 20 WAP after extension drying up of most of the leaves and vines.

Data were collected on growth parameters (vine length, vine girth, number of leaves and leaf area index) at 4 and 8 WAP. Sweet potato leaf area (LA) was estimated using Ogoke*et al.* (2003) formula as follows:

LA = (LW × 0.42) × N

Where L is the leaf length, W is leaf width and N is number of leaves. From the leaf area, LAI was computed as shown:

LAI = Leaf area/Land area (Remison, 1997)

At harvest, data were collected on tuber length, tuber girth, number of tubers per plant, tuber size, tuber weight and tuber yield. Tuber weight was determined by weighing all harvested tubers within each net plot of 1 x 1 m in kg and divided by the number of plants within the net plot. Tuber

Yield was estimated thus:

Tuber yield = kg $plant^{-1}$/1,000.

Data collected were subjected to analysis of variance using the Genstat version 8.1 and differences between treatment means were compared using least significant different at 0.05 level of probability.

The gross margin, profitability and viability ratio were used to determine the profitability of the variety, plant population and fertilizer type on sweet potato production.

GM = Total revenue (TR) – Total variable cost (TVC) --- (1)

i.e. TR P*Q = PQ ---- (2)

Total cost (TC) = TVC + Total fixed cost (TFC) --- (3)

Net profit or Net farm income (NFC) = TR –TC i.e. GM – TFC --- (4)

Returned per N invested = $\frac{GM}{TVC}$ ------- (5)

Benefit: cost ratio = $\frac{TR}{TC}$ -------------- (6)

RESULTS

Influence of plant population and fertilizer type on the above ground growth of sweet potato varieties

The growth of sweet varieties influenced by different plant populations and fertilizer types are presented in Table 1. At 4 WAP, Mother Delight, A04, King J and D7 varieties had similar vine lengths but significantly ($P<0.05$) shorter than Odunkun variety. However, at 8 WAP, the shorter vines were observed in King J but only significantly shorter than Mother Delight and Odunkun varieties. Plant population had no significant ($P>0.05$) influenced on vine length at 4 and 8 WAP. At both 4 and 8 WAP, control plants had the shortest vines while plots treated with kitchen waste had the longest vines.

At 4 WAP, the thicket vine were observed in Odunkun but was not higher than King J. At 8 WAP, A04 had the thickest vines which were not significantly thicker than D7. There was no significant effect of plant population on vine girth. At 4 and 8 WAP, plants which received kitchen waste treatment had the thickest vines but similar to both NPK and cattle dung at 4 WP and with NPK at 8 WAP.

Mother delight had the fewest number of leaves m^{-2} at 4 WAP. However, only Odunkun, A04 and King J had higher number of leaves than Mother Delight. Number of leaves was similar among varieties at 8 WAP. Number of leaves increased significantly increase in plant population at 4 and 8 WAP. The highest number of leaves m^{-2} was recorded for 50,000 pph. The highest number of leaves m-2 was recorded for plants fertilized with kitchen waste at 4 WAP. At 8 WP, all fertilized had similar number of leaves, but significantly higher than unfertilized plants.

At 4 WAP, the highest LAI was observed in A04 but not significantly higher than Odunkun and D7 varieties. Variety had no significant effect on LAI at 8 WAP. Generally as plant population increase, LAI increase at both 4 and 8 WAP. Plant population of 50,000 pph had highest LAI. Kitchen waste had highest LAI at 4 WAP but 8 WAP, kitchen waste and NPK had the highest LAI.

Table 1: Growth of sweet potato varieties as influenced by different plant populations and fertilizer types

Treatment	Vine length (cm) Weeks after planting		Vine girth (cm) Weeks after planting		Number of leaves Weeks after planting		Leaf area index Weeks after planting	
	4	8	4	8	4	8	4	8
Variety								
Mother Delight	10.89	133.10	0.82	1.50	24.94	246	0.23	2.72
Odunkun	16.93	121.60	1.01	1.58	33.76	226	0.39	2.67
A04	12.08	112.70	0.87	1.79	31.96	197	0.50	2.40
King J	12.27	88.00	0.99	1.62	31.93	203	0.38	3.45
D7	11.30	116.7	0.88	1.69	27.22	179	0.31	2.34
$LSD_{(0.05)}$	3.494	20.390	0.105	0.137	6.036	ns	0.182	ns
Plant population (pph)								
20,000	13.68	106.70	0.94	1.54	20.16	107	0.14	0.79
25,000	11.54	119.80	0.91	1.71	23.08	211	0.19	2.17
33,333	13.19	112.80	0.89	1.63	31.33	180	0.34	2.22
50,000	12.46	118.70	0.92	1.67	45.50	344	0.79	5.61
$LSD_{(0.05)}$	ns	ns	ns	ns	4.501	79.7	0.143	1.355
Fertilizer type								
Control	5.20	73.30	0.61	1.33	19.11	121	0.11	1.12
NPK	13.08	112.90	0.98	1.75	31.79	228	0.39	3.04
Kitchen waste	17.48	142.80	1.07	1.85	37.46	270	0.61	4.19
Rice husk	14.18	112.90	0.94	1.57	31.41	216	0.35	2.42
Cattle dung	13.53	120.10	0.98	1.67	30.05	216	0.35	2.82
$LSD_{(0.05)}$	3.266	19.400	0.091	0.126	5.757	92.5	0.176	1.614
Interaction								
V x P	ns		ns	ns	ns	ns	ns	ns
V x F	ns		ns	ns	ns	ns	ns	ns
P x F	ns		ns	ns	ns	ns	ns	ns
V x P x F	ns		ns	ns	ns	ns	ns	ns

Variety - P, Plant population - P, Fertilizer type - F, ns - not significant at 0.05 level of probability

Influence of plant population and fertilizer type on tuberization indices of sweet potato varieties

The tuberization indices of sweet potato varieties as influenced by plant population and fertilizer type is presented in Table 2. Mother Delight had the thickest tubers but were only significantly thicker than A04 and King J. The data show that plant population of 20,000 had the thickest tubers but similar to 25,000 pph. Plots fertilized with kitchen waste had the thickest tubers but were not significantly different from those produced from plots fertilized with NPK.

Variety and plant population had no significantly influenced on number of tuber per plant. All fertilized plants had similar number of tuber per plant. However, only plots fertilized with kitchen waste had higher number of tubers per plant than unfertilized plants. Tuber size was similar among varieties. Tuber size decreased with increasing plant population. Plots with a population of 20,000 plants had the heaviest tubers which was only significantly higher than a population of 50,000 plants.

Variety had no significant influenced on tuber weight per plant as all varieties had similar tuber weight values. Generally as plant population increase, tuber weight per plant decreased progressively. Plant population of 20,000 plants had the highest tuber weight but had similar values with 25,000 and 33,333 pph. There was no significant effect of variety and plant population on tuber yield. Control and plants fertilized with NPK, rice husk and cattle dung had similar tuber yield values but significantly lower than plants treated with kitchen waste. The interaction of plant population and fertilizer was significant. A plant population of 50,000 fertilized with kitchen waste had the highest tuber yield of 50.50 t ha^{-1} (fig. 1).

Economic Analysis

The economics of sweet potato production as influenced by variety, plant population and fertilizer type are presented in Tables 3a, b and c. Variable and total cost were similar for all varieties but increased with plant population and fertilizer application. The highest total cost values for plant population and fertilizer type were observed on 50,000 pph and NPK treated plants, respectively. D7 variety, 50,000 pph and kitchen waste treated plants had the highest revenue with ₦1, 275,000.00, 1,465,000.00 and 1,800,000.00, respectively. Gross margin increased with plant population but climax at 33,333 pph and declined at 50,000 pph. All fertilized plants had higher gross margin than unfertilized plants. All returned per naira invested and benefit: cost ratio values were positives. The returned per naira invested and benefit: cost ratio were highest with D7 variety, plant population of 33,333 and kitchen waste treated plants.

Table 2: Influence of plant population and fertilizer type on tuberization indices of sweet potato varieties

Treatment	Tuber girth (cm)	No. of tuber	Tuber size (g)	Tuber weight (g)	Tuber yield (t ha^{-1})
Variety					
Mother dellight	9.97	5.27	251	1224.	24.0
Odunkun	9.34	3.93	211	903	17.9
A04	8.44	4.42	200	1194	23.9
King J	8.36	4.52	249	1216	24.6
D7	9.08	4.68	235	1345	25.5
$LSD_{(0.05)}$	1.181	ns	ns	ns	ns
Plant population (pph)					
20,000	10.03	5.11	277	1535	18.1
25,000	9.37	4.47	239	1379	21.7
33,333	8.65	4.60	222	1079	26.8
50,000	8.51	4.43	170	890	29.30
$LSD_{(0.05)}$	1.056	ns	73.0	463.9	ns
Fertilizer type					
Control	7.30	3.38	170	775	15.0
NPK	9.64	4.38	234	1086	21.7
Kitchen waste	10.66	5.98	273	1835	36.0
Rice husk	8.91	4.50	255	1050	20.5
Cattle dung	8.70	4.57	214	1135	22.6
$LSD_{(0.05)}$	1.181	1.285	ns	518.6	10.11
Interaction					
V x P	Ns	ns	ns	ns	ns
V x F	Ns	ns	ns	ns	ns
P x F	Ns	ns	ns	ns	10.27
V x P x F	Ns	ns	ns	ns	ns

Variety - P, Plant population - P, Fertilizer type - F, ns - not significant at 0.05 level of probability

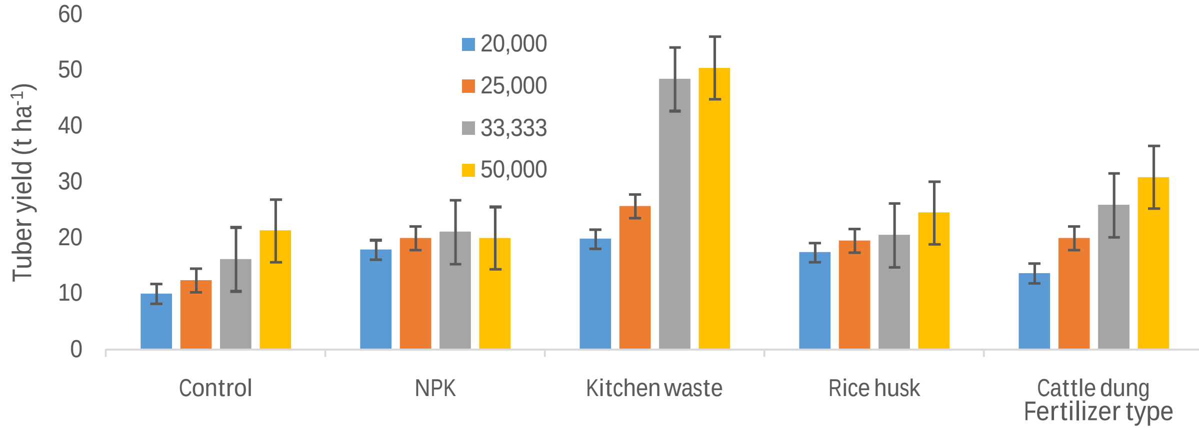

Fig. 1: Interaction of plant population and fertilizer type on the tuber yield of sweet potato

Table 3a: Economics of sweet potato production as influenced by variety

Item of cost and return	Variety				
(₦ ha^{-1})	Mother Delight	Odunkun	A04	King J	D7
Variable cost					
Planting materials	24,691.96	24,691.96	24,691.96	24,691.96	24,691.96
Land preparation	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00
Planting	14,814.81	14,814.81	14,814.81	14,814.81	14,814.81
Weeding	40,000.00	40,000.00	40,000.00	40,000.00	40,000.00
Vine lifting	33,333.33	33,333.33	33,333.33	33,333.33	33,333.33
Fertilizer material	28,000.00	28,000.00	28,000.00	28,000.00	28,000.00
Fertilizer application	14,814.81	14,814.81	14,814.81	14,814.81	14,814.81
Harvesting	37,037.04	37,037.04	37,037.04	37,037.04	37,037.04
Total variable cost	548,246.20	548,246.20	548,246.20	548,246.20	548,246.20
Fixed cost					
OP	54,824.62	54,824.62	54,824.62	54,824.62	54,824.62
Land rent	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00
Depreciation of tools	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00
Total fixed cost	34,834.62	34,834.62	34,834.62	34,834.62	34,834.62
Total cost	623,070.82	623,070.82	623,070.82	623,070.82	623,070.82
Output (t ha^{-1})	44.00	17.90	23.90	24.60	25.50
Revenue (N 50 kg^{-1})	1,200,000.00	895,000	1,195,000.00	1,230,000.00	1,275,000.00
Gross margin	651,753.80	346,753.80	646,753.80	681,753.80	726,753.80
Net farm return	576,929.18	271,292.18	571,929.18	606,929.18	651,929.18
Returned per naira invested	1.19	0.63	1.18	1.24	1.33
Benefit: cost ratio	1.93	1.44	1,92	1.97	2.05

OP - Opportunity cost of running capital: 10 % of variable cost

Table 3b: Economics of sweet potato production as influenced by plant population

Item of cost and return	Plant population per hectare (pph)			
(₦ ha^{-1})	20,000	25000	33,333	50,000
Variable cost				
Planting materials	133,333.00	166,666.25	222,219.44	333,332.50
Land preparation	100,000.00	100,000.00	100,000.00	100,000.00
Planting	8,000.00	10,000.00	13,333.00	20,000.00
Weeding	40,000.00	40,000.00	40,000.00	40,000.00
Vine lifting	18,000.00	22,500.00	29,970.00	45,000.00
Fertilizer material	28,000.00	28,000.00	28,000.00	28,000.00
Fertilizer application	8,000.00	10,000.00	13,333.00	20,000.00
Harvesting	20,000.00	25,000.00	33,333.00	50,000.00
Total variable cost	373,333.00	424,666.25	510,518.44	674,665.50
Fixed cost				
OP	37,333.30	42,466.63	51,051.84	67,466.55
Land rent	10,000.00	10,000.00	10,000.00	10,000.00
Depreciation of tools	10,000.00	10,000.00	10,000.00	10,000.00
Total fixed cost	37,333.30	62,466.63	71,051.82	87,466.55
Total cost	430,666.30	487,132.88	581,570.26	762,132.05
Output (t ha^{-1})	18.10	21.70	26.80	29.30
Revenue (N 50 kg^{-1})	905,000.00	1,005,000.00	1,340,000.00	1,465,000.00
Gross margin	531,666.70	580,333.75	829,481.56	790,334.50
Net farm return	474,333.70	517,867.12	758,429.74	702,867.75
Returned per naira invested	1.42	1.37	1.62	1.17
Benefit: cost ratio	2.10	1.19	2.30	1.92

OP **-** Opportunity cost of running capital: 10 % of variable cost

Table 3c: Economics of sweet potato production as influenced by fertilizer type

Item of cost and return	Fertilizer type				
(₦ ha^{-1})	Control	NPK	Kitchen waste	Rice husk	Cattle dung
Variable cost					
Planting materials	246,912.96	246,912.96	246,912.96	246,912.96	246,912.96
Land preparation	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00
Planting	14,814.81	14,814.81	14,814.81	14,814.81	14,814.81
Weeding	40,000.00	40,000.00	40,000.00	40,000.00	40,000.00
Vine lifting	333,333.33	33,333.33	33,333.33	33,333.33	33,333.33
Fertilizer material	0.00	48,000.00	28,000.00	25,000.00	22,000.00
Fertilizer application	0.00	14,814.81	14,814.81	14,814.81	14,814.81
Harvesting	37,037.04	37,037.04	37,037.04	37,037.04	37,037.04
Total variable cost	520,246.28	568,246.28	548,246.28	545,246.28	546,246.28
Fixed cost					
OP	52,024.63	56,824.63	54,824.63	54,524.63	54,625.63

Land rent	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00
Depreciation of tools	10,000.00	10,000.00	10,000.00	10,000.00	100,000.00
Total fixed cost	72,024.63	76,824.63	74,824.63	54,524.63	74,624.63
Total cost	572,270.00	645,070.91	623,070.91	599,770.91	620870.91
Output (t ha^{-1})	15.00	21.70	36.00	20.50	22.60
Revenue (N 50 kg^{-1})	750,000.00	1,085,000.00	1,800,000.00	1,025,000.00	1,130,000.00
Gross margin	229,753.72	516,753.72	1,251,153.72	479,753.72	583,753.72
Net farm return	157,729.09	4,398,929.09	1,176,929.09	425,229.09	509,129.09
Returned per naira invested	0.44	0.91	2.28	0.88	1.07
Benefit: cost ratio	1.27	1.68	2.89	1.71	1.82

OP - Opportunity cost of running capital: 10 % of variable cost

DISCUSSION

Vine length, number of leaves, LAI and tuber girth exhibited some degree of variability among varieties evaluated. This could be mainly due to genetic makeup rather than environment. This finding is similar to the observation of Jilani and Ghator (2003)reported that the various varieties of the same species grown on the same environment gave different growth and yield characters.

This present study demonstrated that plant population influenced some growth and yield of sweet potato components in a humid ultisols environment.However, increasing plant population did not increase the tuber yield of this tuberizing crop.The increase in number of leaves m^{-2} and LAI with increasing plant population indicates an increase in leaf photosynthetic activity due to closer spacing (Law-Ogbomo and Osaigbovo, 2014). In the present study, plant population influenced tuber girth, tuber size and tuber weight per plant, in an inverse manner though. The increase in tuber weight per plant with a decrease in plant population was probably due to less intra-specific competition for growth resources among plants. In plots with low population and showing high tuber weight per plant, unrestricted access to such resources might have even prevailed. Muoneke and Asiegbu (1996) reported decreases in some yield components of okra including pod yield per plant as density increased.Abdissa*et al.* (2011) reported decreases in tuber weight with less access to photosynthetic light. This shows that the lower the plant population and hence competition for especiallyphotosynthetic light the higher are the chances of partitioning of assimilates to the storage organ which, in the case of sweet potato, is the tuber (Wubanechi, 2014).

All fertilized plants exhibited thicker and longer vines resulting in higher number of leaves m^{-2} and LAI. Higher LAI implied higher amount of radiation was intercepted leading to an increase in tuber yield over control plants. Unfertilized plants had lower number of leaves and LAI resulting from shorter and thinner vines contributing to reduction in tuberization indices in comparison to fertilized plants. The higher tuberization indices accrued to fertilized plants were probably accounted for by additional nutrient availability from the applied soil amendment (Udo*et al*., 2005). Low native fertility of the site as indicated through the soil laboratory analysis probably resulted in poor availability of nutrients to plants resulting in low tuberization indices of the unfertilized plots.The significant increase in tuber yield with fertilizerapplication will translate to enhanced farm income.

This study clearly showed that sweet potato productivity can be increased in humid Ultisols through adoption of the appropriate variety, planting at higher population and fertilizer application. This can further beproven by economic analysis of the study. Despite the high cost of production associated with theapplication of fertilizer input and the use of higher plant population due to additional use of fertilizerinputs and additional quantity of planting material, sweet potato production in the humid Ultisols wasviable. There is positive relationship between tuber yield improvement and economic viability in sweetpotato production. Return per naira invested is an indication of viability and the optimum yield wasobtained D7 variety, 33,333pph and kitchen waste which the highest had returned per nairainvested.The maximum return per naira invested indicated the point of profit maximizationand beyond that point, diminishing return set in.

CONCLUSION

This present study had demonstrated that growth and tuberization indices of sweet potato varieties were influenced by plant population and fertilizer type. Thicker tubers were observed in Mother Delight, Odunkun and D7 varieties. Tuber girth, size and weight was most enhanced at the lowest plant population but the yield was similar among plant populations. Kitchen waste had the best growth and tuberization indices among fertilizer types. The returned per naira invested and benefit: cost ratio were highest with D7 variety, plant population of 33,333 and kitchen waste treated plants. Based on this findings, sweet potato growers should adopt D7, cropped at 50,000 pph and fertilized with kitchen waste for sustainable production of the crop.

ACKNOWLEDGEMENT
We grateful to TETFUND and we wish to thank her for funding this research work.

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