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Research Article

Field Evaluation of Elite Sweet Potato (*Ipomoea batatas* (L.) Lam) Varieties in Humid Rainforest of Calabar, Nigeria

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Abstract

Background and Objective: There is an upsurge in the consumption of sweet potato locally, hence creating a niche market for tubers and other sweet potato products. To encourage the participation of farmers and increase earnings from its cultivation, there is the need to evaluate and identify sweet potato genotypes with high root yielding capacity for possible incorporation in the local farming systems within the vicinity of Calabar, south eastern Nigeria. **Materials and Methods:** Two years field experiments were conducted in 2015 and 2016 cropping seasons at the Teaching and Research Farm, University of Calabar, Nigeria to evaluate the performance of 15 open pollinated elite sweet potato varieties at field evaluation trial stage for yield related traits and incorporation into local farming systems. The sweet potato varieties were EA/11/025, Kwara, UM/11/001, buttermilk, EA/11/003, NRS/12/060, Solomon, CIP/990004-2, EA/11/002, NRSP/12/095, CIP/420068, AYT/08/055, A0/109, A09/7A and a local check variety TIS/87/0087, sourced from National Root Crops Research Institute (NRCRI), Umudike, Abia state. **Results:** Variety SOLOMON had the highest tuber yield among varieties studied, although statistically similar to the tuber yields of varieties A0/109, UM/11/001, A09/7A, EA/11/003, CIP/420068, EA/11/002, EA/11/025, buttermilk and the National check variety which were adjudged outstanding in performance in the moderate yielding class of 11-18 t ha⁻¹. **Conclusion:** Varieties SOLOMON, A0/109, UM/11/001, A09/7A, EA/11/003, CIP/420068, EA/11/002, EA/11/025 and buttermilk had good biomass, leaf area index and vine length as well as the most prolific in tuber production similar to the National check variety. Therefore, these varieties could be selected for incorporation into the local farming systems.

Key words: Sweet potato, elite varieties, open pollinated, yield trial, humid-rainforest

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Sweet potato (*Ipomoea batatas* (L.) Lam), ranks 5th in importance after rice, wheat, maize and cassava in developing countries¹ and second after cassava among roots and tubers². It is important in promoting nutritional security particularly in areas with poor soils³. A member of Convolvulaceae family, it is widely grown in the tropical, sub-tropical and frost-free temperate climatic zones of the world⁴. Sweet potato provides food to a large segment of the world's population, especially in the tropics where the bulk of the crop is cultivated and consumed⁵. It can be planted sole or intercropped with other staples as an effective field weed growth suppressor⁶. Sweet potato is among the world's most versatile food crops grown generally for its storage roots⁷, with a short life cycle of 3-4 months⁸ and may be grown twice or thrice a year⁹ with proper sequencing. The roots, leaves and tender vines have economic and nutritional value¹⁰ for humans and livestock^{8,11}. High photosynthetic efficiency¹² results in high energy yields per unit area per unit time, thus it has potential to stem global malnutrition and hunger¹¹. Use of vines in planting is convenient and increases availability of tubers for human consumption¹³. According to Nwankwo *et al.*¹⁴, sweet potato can be made into pasty dough (*fufu*) or used in composite flour for pastries and confectionery. Breeders have developed orange and purple fleshed sweet potato varieties which are naturally bio-fortified with anthocyanins and beta carotenes essential for combating vitamin A deficiency in children^{15,16}. Products such as starch, syrup glucose, citric acid, monosodium glutamate and ethanol are synthesized from the roots¹¹.

Tuber yields of sweet potato vary greatly according to cultivars, local climatic conditions and cultural techniques¹⁷. Chinaka¹⁸ reported average yields of 4 t ha⁻¹, while Horton¹⁹ reported yields of 13 t ha⁻¹. Uwah *et al.*²⁰ obtained highest yield of 3.89 t ha⁻¹ while Nwankwo *et al.*¹⁴ reported yield ranges of 18-30 t ha⁻¹. According to Ezulike *et al.*²¹, there is a decrease in tuber yield from the south east zone with average root tuber yields of 7-3.5 t ha⁻¹ in the north-east zone. According to Njoku *et al.*²², yields in farmer's plots are generally low due to the use of local genotypes and could be increased with improved varieties¹³. Evaluation of open pollinated newly developed genotypes is continuous at the Root Crops Research Institute, Nigeria (having a mandate for sweet potato improvement), to identify promising or interesting genotypes with high root yields and other desirable agronomic traits for farmers in southeastern Nigeria. According to Bassey²³, promising clones would be selected after further yield evaluations in different ecological zones of

Nigeria. The Federal Government of Nigeria's school feeding programme relies heavily on sweet potato, hence there is an upsurge in the consumption of sweet potato locally, creating a niche market for tubers and other sweet potato products. To facilitate the involvement of farmers and increase earnings from its cultivation, this study was conducted to evaluate and identify sweet potato genotypes with high root yielding capacity for inclusion in the local farming systems within Calabar and its immediate environs in south eastern Nigeria.

MATERIALS AND METHODS

Study site information: Field trials were conducted from August-December, 2015 and 2016 at the Teaching and Research Farm of the University of Calabar, Calabar, located along the humid coastal regions of south eastern Nigeria (4°57', 8°19' and 37 m a.s.l.).

Soil sampling and laboratory analysis: Soil was sampled at 0-30 cm prior to land preparation using a soil auger, bulked, air dried and sieved through a 2 mm mesh sieve. A composite sample was analyzed for physico-chemical properties using standard procedures²⁴.

Experimental designs, treatment and field layout: The experiment was laid out following a randomized complete block design. Treatment included 14 elite sweet potato varieties recommended for the rainforest agro-ecology namely; EA/11/025, KWARA, UM/11/001, buttermilk, EA/11/003, NRS/12/060, SOLOMON, CIP/990004-2, EA/11/002, NRSP/12/095, CIP/420068, AYT/08/055, A0/109, A09/7A plus a national check variety TIS/87/0087, sourced from National Root Crops Research Institute (NRCRI), Umudike, Abia state. Each treatment was replicated three times, giving a total of 45 experimental units. Gross plots measured 3 × 3 m separated by 1.0 m lanes on all sides. In each plot, three 3 m long ridges were made with a net plot measuring 3 × 1.2 m for growth and yield data estimation.

Preparation of experimental materials/agronomic practices: Vine cuttings of 30 cm length with 6-7 nodes from the terminal shoot, having the lower leaves removed were inserted into the ground to half their length at 45°. The cuttings were spaced 30 × 100 cm, at one cutting per stand to give 30 plants per plot and 33,333 plants per ha. The N.P.K. 15-15-15 at the rate of 400 kg ha⁻¹ was applied once at two weeks after planting (WAP) by side banding, 10 cm away from the cuttings.

Data collection: Data were collected on vine length (measured from the soil mark to the apex of the vine using a flexible measuring tape in cm) and leaf area index at 11 weeks after planting following the procedure of Islam²⁵. The leaf area was computed using the formula:

$$(\text{Length} \times \text{Width of leaves}) \times \text{Total number of leaves per plant}$$

The result was then multiplied by a correction factor of 0.47962 and divided by the plant spacing to obtain leaf area index as illustrated by Islam²⁵. Biomass was computed from the weight of fresh vines and leaves immediately after harvest and expressed in kg ha⁻¹. Yield and yield related data were obtained at harvest. The total yield of tubers was measured at harvest and expressed in kg ha⁻¹. Harvested tubers were cured and numerical data was taken for number of large roots, number of small roots, total number of tubers, average number of tubers per plant, marketable tuber yield (roots >150 g), unmarketable tubers (roots <150 g) and total yield of tubers as well as the mean tuber yield in kg ha⁻¹ for both years.

Data analysis: Data were subjected to a two-way analysis of variance for randomized block design and means compared using Least Significant Difference test at 5% probability using procedure outlined by Gomez and Gomez²⁶.

RESULTS

Physico-chemical properties of top soil and meteorological information of the experimental site in Calabar: Soil at the experimental site was classified as sandy loam in both years, with other characteristics as articulated in Table 1. The average rainfall for Calabar in 2015 was 257.05 mm compared to 2016 rainfall of 190.7 mm, giving a percentage difference of 26.01% (Table 2). However, the average of relative humidity and monthly mean temperature were however relatively similar in both years.

Vine length, leaf area index and biomass yield (t ha⁻¹) of sweet potato varieties: Table 3 shows that the vine length, leaf area index and the biomass yield of sweet potato variety SOLOMON was statistically similar ($p > 0.05$) to vine length of varieties A0/109, UM/11/001, A09/7A, EA/11/003, CIP/420068, EA/11/002, EA/11/025, buttermilk, AYT/08/055 and the National check variety but significantly higher ($p < 0.05$) than vine length of varieties CIP/99004-2, NRSP/12/095,

Table 1: Physico-chemical properties of top soil at the experimental site in Calabar, Nigeria

Composition	2015	2016
Physical composition (%)		
Sand	75.00	76.30
Silt	18.20	17.40
Clay	6.80	6.30
Textural class	Sandy loam	Sandy loam
Chemical characteristics		
pH	5.00	5.20
Organic carbon (%)	1.35	1.38
Total Nitrogen (%)	0.12	0.12
Available phosphorus (mg kg ⁻¹)	31.75	31.85
Exchangeable bases (cmol kg⁻¹)		
Calcium	4.20	4.12
Magnesium	2.00	2.09
Potassium	0.11	0.12
Sodium	0.08	0.08
Aluminum	0.36	0.37
Hydrogen	0.52	0.51
Effective cation exchange capacity	7.57	7.57
Base saturation (%)	87	87

NRS/12/060, KWARA 2 in both years. Vine length of SOLOMON (244.9 and 128.0 cm) in both years was the highest amongst varieties tested, closely followed by the check variety (242.5 and 119.1 cm) while vine length of sweet potato KWARA (64.2 and 47.2 cm) checked in as the shortest vine length among the varieties. Similarly, the leaf area index (5.71 and 1.61) and biomass yield (4.95 and 1.61 t ha⁻¹) for variety SOLOMON in both years followed the same trend, with KWARA having the least values for both leaf area index (2.35 and 0.86) and biomass yield (3.16 and 0.86).

Vine mortality (%), number of large roots per plot, number of small roots per plot, total number of tubers, mean of tubers per plant of sweet potato varieties:

Table 4 showed that except for vine mortality in 2016, the results were significantly different in all of the metric characters studied. Some varieties outperformed the National check variety (TIS/87/0087), which had the lowest percent vine mortality rate (1.33%) amongst all the varieties tested while varieties A0/109 (7.33%), EA/11/025 (7.67%) and buttermilk (6.00%) checked in as the highest ($p \leq 0.05$) for vine mortality in 2015 only. The number of large roots per plot was statistically similar among varieties SOLOMON (10.33), buttermilk (11.00) and the check variety (7.67) but significantly higher than number of large roots among other varieties studied. The number of small roots per plot for buttermilk in 2015 (22.67), A09/7A (14.00) and KWARA 2 (11.00) in 2016 was significantly higher ($p \leq 0.05$) than the check (6.00 and 5.60) and other varieties, with variety

Table 2: Meteorological observations of Calabar for 2015 and 2016 cropping seasons

Months	Total rainfall (mm)		Relative humidity (%)		Monthly mean temp (°C)	
	2015	2016	2015	2016	2015	2016
January	30.29	0.00	82.00	69.00	34.2	33.7
February	85.16	3.50	85.00	78.00	35.3	35.2
March	176.83	194.90	83.00	87.00	34.0	32.6
April	226.34	203.40	83.00	87.00	33.1	32.4
May	345.18	421.10	85.00	86.00	31.5	32.1
June	401.71	261.00	88.00	88.00	29.8	30.6
July	508.67	445.60	90.00	91.00	28.9	29.3
August	501.42	299.20	91.00	93.00	28.2	28.7
September	368.15	363.30	89.00	91.00	28.9	29.3
October	278.24	95.10	86.00	87.00	31.6	30.9
November	143.01	1.20	85.00	87.00	30.9	31.9
December	28.06	0.60	83.00	83.00	30.5	33.2
Mean	257.75	190.70	85.83	85.60	31.4	31.7

NIMET: Nigeria Meteorological Agency, Margaret Ekpo International Airport, Calabar

Table 3: Vine length (cm), leaf area index and biomass yield (t ha⁻¹) of sweet potato varieties in Calabar, Nigeria

Varieties	Vine length (cm)		Leaf area index		Biomass yield (t ha ⁻¹)	
	2015	2016	2015	2016	2015	2016
SOLOMON	244.90	128.0	5.71	1.61	4.95	1.61
A0/109	230.00	118.1	3.93	1.58	4.49	1.58
UM/11/001	221.30	114.1	3.84	1.56	4.49	1.56
A09/7A	205.80	104.0	3.69	1.41	4.47	1.41
EA/11/003	180.70	95.8	3.59	1.36	4.47	1.36
CIP/420068	180.50	92.0	3.58	1.35	4.38	1.35
EA/11/002	169.50	86.3	3.55	1.30	4.22	1.30
EA/11/025	165.40	82.5	3.14	1.20	4.18	1.20
Buttermilk	158.10	82.5	3.11	1.19	4.11	1.19
AYT/08/055	154.00	80.8	3.05	1.14	4.08	1.14
CIP/99004-2	124.60	73.6	2.99	1.11	3.85	1.11
NRSP/12/095	113.00	68.6	2.85	1.06	3.73	1.06
NRS/12/060	101.50	61.1	2.67	1.02	3.71	1.02
KWARA 2	64.20	47.2	2.35	0.86	3.16	0.86
TIS/87/0087	242.50	119.1	4.50	1.61	4.94	1.61
LSD 0.05	91.16	39.2	1.74	0.42	0.90	0.42

Table 4: Vine mortality (%), number of large roots per plot, number of small roots per plot, total number of tubers, mean of tubers per plant as affected by sweet potato varieties in Calabar, Nigeria

Varieties	Vine mortality (%)		Number of large roots per plot		Number of small roots per plot		Total number of tubers		Mean of tubers per plant	
	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
SOLOMON	4.33	4.67	10.33	5.67	9.00	6.67	19.33	12.33	1.33	1.30
A0/109	7.33	2.00	4.00	4.33	5.00	3.67	7.00	8.00	1.00	1.00
UM/11/001	4.67	3.67	2.33	4.33	6.33	5.33	8.67	9.67	3.27	2.70
A09/7A	2.67	3.35	7.67	8.67	8.67	14.00	16.33	22.67	1.00	0.80
EA/11/003	3.00	3.00	3.00	2.35	8.00	5.00	11.00	7.35	1.40	1.43
CIP/420068	2.00	3.67	3.00	2.33	4.33	2.67	6.33	5.00	3.43	2.57
EA/11/002	2.33	3.00	1.33	1.67	8.00	5.00	9.33	6.67	2.67	2.83
EA/11/025	7.67	3.00	9.00	5.00	7.67	6.00	16.67	11.00	1.00	0.87
Buttermilk	6.00	3.67	11.00	8.00	22.67	6.00	27.00	14.00	1.00	0.87
AYT/08/055	3.67	2.33	2.00	3.00	9.33	4.00	13.33	7.00	1.00	1.07
CIP/99004-2	5.33	3.33	1.67	2.00	6.33	4.33	8.00	6.33	1.00	0.87
NRSP/12/095	4.33	4.00	3.00	2.00	4.67	4.00	7.67	6.00	1.00	0.50
NRS/12/060	3.67	2.00	1.67	2.67	5.33	4.00	7.00	6.67	1.00	0.77
KWARA 2	2.67	3.67	7.33	3.67	10.00	11.00	17.33	14.67	4.07	4.67
TIS/87/0087	1.33	2.00	7.67	3.00	6.00	5.67	13.67	8.67	1.00	0.57
LSD 0.05	3.76	NS	5.57	3.59	6.02	5.78	7.28	7.20	1.80	1.85

Table 5: Marketable tuber yield (t ha⁻¹), unmarketable tuber yield (t ha⁻¹), total tuber yield (t ha⁻¹) and mean tuber yield as affected by sweet potato varieties in Calabar, Nigeria

Varieties	Marketable tuber yield (t ha ⁻¹)		Unmarketable tuber yield (t ha ⁻¹)		Total tuber yield (t ha ⁻¹)		Mean tuber yield
	2015	2016	2015	2016	2015	2016	
SOLOMON	7.35	20.57	1.74	2.04	9.08	22.61	15.85
A0/109	7.25	4.86	6.60	8.36	13.85	13.22	13.54
UM/11/001	10.11	7.90	2.59	4.66	12.70	12.56	12.63
A09/7A	5.95	9.82	4.59	4.50	10.51	14.32	12.42
EA/11/003	7.58	7.70	5.22	3.44	12.81	11.14	11.98
CIP/420068	7.25	9.17	4.18	2.75	11.43	11.92	11.68
EA/11/002	7.62	9.60	1.99	2.93	9.61	12.53	11.07
EA/11/025	6.03	5.14	6.77	2.98	12.79	8.12	10.46
Buttermilk	7.62	6.34	2.10	4.17	9.72	10.52	10.12
AYT/08/055	6.15	9.99	0.89	2.55	7.05	12.54	9.80
CIP/99004-2	8.17	6.60	1.97	1.91	10.14	8.51	9.33
NRSP/12/095	7.50	5.50	3.08	1.94	10.58	7.44	9.01
NRS/12/060	6.85	5.32	1.28	1.72	8.13	7.04	7.59
KWARA 2	3.37	6.42	2.29	2.55	5.66	8.96	7.31
TIS/87/0087	8.97	7.04	3.17	10.46	12.14	17.50	14.82
LSD 0.05	2.53	7.52	2.88	3.49	3.68	8.62	6.15

CIP/420068 having the lowest (2.67) number of small roots per plot. Buttermilk had significantly higher ($p \leq 0.05$) total number of tubers (27.00) than all other varieties in 2015. Several other varieties such as SOLOMON, A09/7A, EA/11/025 and KWARA 2 were statistically at par with the national check variety for total number of tubers during the same year. In 2016 however, A09/7A (22.67) significantly ($p \leq 0.05$) outpaced the National check variety (8.67) in total number of tubers which was statistically at par with other sweet potato varieties studied. There were significant differences among varieties for number of tubers per plant. Statistically similar number of tubers per plant occurred among varieties KWARA 2, CIP/420068, UM/11/001, EA/11/002, significantly superior ($p \leq 0.05$) to the National check variety in 2015. In 2016 however, KWARA 2 alone (4.67) of all sweet potato varieties studied outperformed the National check variety (0.57).

Marketable tuber yield (t ha⁻¹), unmarketable tuber yield (t ha⁻¹), total tuber yield (t ha⁻¹) and mean tuber yield of sweet potato varieties: Table 5 shows that the marketable tuber yield was statistically at par $p > 0.05$ among all other varieties which were significantly higher ($p \leq 0.05$) than KWARA 2 (3.37 t ha⁻¹) in 2015. During the 2016 cropping season, SOLOMON alone had the highest marketable tuber yield (20.57 t ha⁻¹) being significantly higher ($p \leq 0.05$) than marketable tuber yield observed for the National check variety (7.04 t ha⁻¹) which was in turn statistically at par with all other varieties tested, with A0/109 checking in with the

least marketable tuber yield (4.86 t ha⁻¹). In 2015, the unmarketable tuber yield of A0/109 and EA/11/025 (6.60 and 6.77 t ha⁻¹), respectively, were statistically similar ($p > 0.05$) and significantly higher ($p \leq 0.05$) than the unmarketable tuber yield of TIS/87/0087-the National check variety (3.17 t ha⁻¹). In 2016 however, the national check variety had the highest unmarketable tuber yield (10.46 t ha⁻¹), which was statistically similar to sweet potato varieties A0/109 (8.36 t ha⁻¹), whereas, variety NRS/12/060 presented the lowest (1.72 t ha⁻¹) unmarketable tuber yield value among the tested varieties. Varieties EA/11/003, A0/109, EA/11/025, UM/11/001, CIP/420068, NRSP/12/095, A09/7A and CIP/99004-2 presented total tuber yield (t ha⁻¹) which was statistically at par with the National check variety (TIS/87/0087) and significantly higher ($p \leq 0.05$) than other sweet potato varieties in 2015. In 2016, variety SOLOMON (22.61 t ha⁻¹) had significantly higher total tuber yield ($p \leq 0.05$) compared to all other varieties. The National check variety and other varieties such as A09/7A, A0/109, UM/11/001, AYT/08/055, EA/11/003, buttermilk, EA/11/002 and CIP/420068 were statistically at par in total tuber yield but significantly higher than varieties KWARA 2, CIP/99004-2, EA/11/025, NRSP/12/095 and NRS/12/060 with yield 7.04 t ha⁻¹ being the least. The following varieties SOLOMON, A0/109, UM/11/001, A09/7A, EA/11/003, CIP/420068, EA/11/002, EA/11/025 and buttermilk displayed average of two years tuber yield which was statistically similar to the national check variety for both years and superior ($p \leq 0.05$) to other varieties.

DISCUSSION

The performance of the various sweet potato varieties studied presents useful metric indicators for successful selection of prolific varieties. The yields recorded from varieties tested during the trial ranged from 7-16 t ha⁻¹. Variety SOLOMON seemingly had the highest average tuber yield (15.85 t ha⁻¹) closely followed by the National check variety TIS/87/0087 with mean tuber yield (14.82 t ha⁻¹). Average sweet potato yield on farmer's field for south eastern Nigeria is put at 7 t ha⁻¹, according to Ezulike *et al.*²¹. In the present study, the national check variety yielded an average of 14.82 t ha⁻¹, favourably competing with some of the elite varieties. Based on the National Agricultural Research Organization (NARO) yield classification criteria, three root tuber classes were specified for the varieties as follows: High yielding (18-30 t ha⁻¹), moderate yielding (11 – 17 t ha⁻¹) and low yielding genotypes (<11 t ha⁻¹). From the results, it was observed that none of the varieties entered the top yielding class. Eight entrants however polled into the moderate yielding group, namely SOLOMON, A0/109, UM/11/001, A09/7A, EA/11/003, CIP/420068, EA/11/002 and the National check variety TIS/87/0087. The remaining seven varieties namely EA/11/025, buttermilk, AYT/08/055, CIP/97/004-2, NRSP/12/095, NRS/12/060 and KWARA2 were in the low yielding category. The varieties in the moderate yielding class can comfortably be incorporated into farmer's fields in the local farming systems, while those that performed below the National check variety, namely EA/11/025, buttermilk, AYT/08/055, CIP/97/004-2, NRSP/12/095, NRS/12/060 and KWARA2 will be discarded. The choice of varieties for yield trials and incorporation into local farmer fields is dependent on yield proliferation and agronomic efficiency of the varieties or genotypes under consideration. According to Njoku *et al.*²², yield remains the most important deciding factor, determining choice of sweet potato genotypes for cultivation. This is naturally the economic portion of the crop that can be sold for financial benefits of the farm enterprise.

According to Antiaobong and Bassey¹³, yield is an important agronomic index which reflects environmental adaptability of any genotype. Varieties that performed creditably in the trial are therefore, adjudged adaptable to the environmental conditions prevalent at the test location of Calabar. Suitable environmental conditions prevalent at the test site are important for performance of sweet potato. The average rainfall in 2015 was 26.01% higher than 2016 (Table 4). Coupled with a higher leaf area index plus vine length and high photosynthetic efficiency as had been earlier reported by Kapinga *et al.*¹², the moderate yielding varieties

exhibited a high source potential and powerful sink ability²⁷, that maximized the favourable environmental conditions. The high performing varieties will be placed in a sweet potato expansion programme to enhance the production of planting materials for distribution to local farmers in the state. However, to achieve the full potentials of these selected varieties, some agronomic studies such as tillage and fertilizer trials should be conducted to ascertain optimum conditions for their production.

CONCLUSION

Varieties with good biomass, leaf area index and vine length were most prolific in tuber production. Sweet potato variety SOLOMON had the highest mean tuber yield, although not significantly different from yields obtained from varieties A0/109, UM/11/001, A09/7A, EA/11/003, CIP/420068, EA/11/002, EA/11/025 and buttermilk. Yields from the mentioned varieties were statistically similar to the National check variety. Therefore, the varieties were selected for incorporating into the local farming systems.

SIGNIFICANCE STATEMENT

The study shows that sweet potato variety SOLOMON was the most outstanding, though not significantly different from varieties A0/109, UM/11/001, A09/7A, EA/11/003, CIP/420068, EA/11/002, EA/11/025 and buttermilk. These varieties expressed good biomass, as well as prolific tuber yield. Therefore, these varieties could be selected for incorporation into the local farming systems and may provide resource poor farmers additional food sources and reliable food security.

REFERENCES

1. Som, D., 2007. Handbook of Horticulture. India Council of Agricultural Research, New Delhi, India, pp: 512-516.
2. Ray, R.C. and V. Ravi, 2005. Post harvest spoilage of sweetpotato in tropics and control measures. Crit. Rev. Food Sci. Nutr., 45: 623-644.
3. Srinivas, T., 2009. Economics of Sweet Potato Production and Marketing. In: The Sweet Potato, Loebenstein, G. and G. Thottapilly (Eds.), Spring Science Business Media, Germany, pp: 436-447.
4. Onwueme, I.C. and T.D. Sinha, 1991. Field Crop Production in Tropical Africa: Principles and Practice. Technical Centre for Agriculture and Rural Cooperation, Ede, The Netherlands, ISBN-13: 9789290810865, pp: 267-275.

5. Opeke, L.K., 2006. Essentials of Crop Farming. Spectrum Books Ltd., Ibadan, Nigeria, pp: 140-145.
6. Eneji, A.E., A.A. Agboola and O. Isola, 1995. The weed suppressive ability of sweet potato in a cassava + maize + sweet potato intercrop. Niger. J. Weed Sci., 8: 13-18.
7. Tortoe, C., M. Obodai and W. Amoa-Awua, 2010. Microbial deterioration of white variety sweet potato (*Ipomoea batatas*) under different storage structures. Int. J. Plant Biol., 1: 10-15.
8. Anyaegbunam, H.N., G.N. Asumugha, E.O. Mbanasor, T.O. Ezulike and K.I. Nwosu, 2008. Guide to improved sweet potato production in Nigeria. National Root Crops Research Institute, Umudike, pp: 1-9.
9. Antiaobong, E.E. and E.E. Bassey, 2009. Characterization and evaluation of six sweet potato varieties (*Ipomoea batatas* (L.) Lam) for quantitative and qualitative characters and tolerance to *Cylas puncticollis*, Boh in high humid environment of Southeastern Nigeria. J. Agric. Res. Policies, 4: 17-21.
10. Okonkwo, J.C., 2002. Effect of time of introducing soybean into potato on the performance of potato/soybean intercrop in Jos Plateau, Nigeria. J. Sustain. Agric. Environ., 4: 185-191.
11. Nedunchezhiyan, M., G. Byji and S.K. Jata, 2012. Sweet potato agronomy. Fruit Vegetable Cereal Sci. Biotechnol., 6: 1-10.
12. Kapinga, R.E., P.T. Ewell and S.C. Jeremiah, 1997. Sweet potato in Tanzania farming and food systems: Implication for research. Ministry of Agriculture and Livestock Development, Tanzania/International Potato Centre (CIP), Nairobi, Kenya, pp: 47.
13. Antiaobong, E.E. and E.E. Bassey, 2008. Constraints and prospects of sweet potato (*Ipomoea batatas* L.) production in humid environment of southeastern Nigeria. Proceedings of the 2nd African Regional Conference on Sustainable Agriculture, November 4-7, 2008, Governor's office Annex, Uyo, Nigeria, pp: 68-72.
14. Nwankwo, I.I.M., E.E. Bassey and S.O. Afuape, 2014. Yield evaluation of open pollinated sweet potato (*Ipomoea batatas* (L.) Lam) genotypes in humid environment of Umudike, Nigeria. Global J. Biol. Agric. Health Sci., 3: 199-204.
15. Korieocha, D.S., M.C. Ogbonna, C.C. Nwokocha, T.N.C. Echendu and E.O.A. Okorocho, 2009. Effects of time of herbicide application and sweet potato morpho-types on the effectiveness of herbicide on weeds. Proceedings of the 43rd Annual Conference of Agricultural Society of Nigeria, October 20-23, 2009, National Universities Commission, Abuja, Nigeria, pp: 12-16.
16. Ezeocha, V.C., E. Oti, V.U. Ezigbo and N.E. Ekeledo, 2010. Effect of storage conditions and duration of storage on the chemical composition of two varieties of orange fleshed sweet potato. Niger. Agric. J., 41: 75-79.
17. Antiaobong, E.E., 2007. Life cycle, economic threshold and control of sweet potato weevils, *Cylas puncticollis* Boh (*Coleoptera: Curculionidae*) in Akwa Ibom State, Nigeria. Ph.D. Thesis, Michael Okpara University of Agriculture, Umudike, Nigeria.
18. Chinaka, C.C., 1983. Sweet potato production. Extension Bulletin No. 7, AERLS, National Root Crops Research Institute (NRCRI), Umudike, Nigeria, pp: 7-8.
19. Horton, D., 1988. Underground Crops. Winrock International Institute for Agricultural Development, Morrilton, USA, pp: 22-23.
20. Uwah, D.F., U.L. Undie, N.M. John and G.O. Ukoha, 2013. Growth and yield response of improved sweet potato (*Ipomoea batatas* (L.) Lam) varieties to different rates of potassium fertilizer in Calabar, Nigeria. J. Agric. Sci., 5: 61-69.
21. Ezulike, T.O., S.C. Anioke and S.O. Odurukwe, 2001. Integrated Control of Sweet Potato Weevil (*Cylas puncticollis*, Boh) in South Eastern Nigeria. In: Root Crops in the 21st Century. Proceedings of the 7th Triennial Symposium of the International Society for Tropical Root Crops, African Branch, held at the Centre International des Conference, Cotonou, Benin, 11-17 October, 1998, Akoroda, M.O. and J.M. Ngev (Eds.), Centre International, Cotonou, Benin, pp: 645-648.
22. Njoku, J.C., C.O. Muoneke, P.I. Okocha and F. Ekeleme, 2009. Effect of propagule size and intra-row spacing on the growth and yield of sweetpotato in a humid agro-ecological zone. Niger. Agric. J., 40: 115-124.
23. Bassey, E.E., 2012. Response of improved varieties of sweet potato (*Ipomoea batatas* (L.) Lam) to early and late cropping seasons in southeastern Nigeria. Proceedings of the 36th Annual Conference of Genetic Society of Nigeria, October 15-18, 2012, University of Calabar, Nigeria, pp: 170-177.
24. IITA., 1982. Selected methods of soil and plant analysis. International Institute of Tropical Agriculture (IITA), Manual Series No.7, Ibadan, Nigeria.
25. Islam, M.R., 2008. Estimation of leaf area of sweet potato using image software. M.Sc. Thesis, Bangladesh Agricultural University, Mymensingh.
26. Gomez, K.A. and A.A. Gomez, 1984. Statistical Procedures for Agricultural Research. John Wiley and Sons Inc., New York, USA., pp: 138-239.
27. Tewe, O.O., O.O. Abu, E.F. Ojieniyi and H.N. Nwokocha, 2001. Status of Sweet Potato Production Utilization and Marketing in Nigeria. In: Root Crop in the 21st Century. Proceedings of the 7th Triennial Symposium of the International Society for Tropical Root Crops, African Branch, held at the Centre International des Conference, Cotonou, Benin, 11-17 October, 1998, Akoroda, M.O. and J.M. Ngeve (Eds.), UTA, UK, pp: 65-74.