Effect of Variety on Growth and Forage Yield of Orange Fleshed Sweet Potato (OFSP) on Tropical Humid Soil: Implication for Animal and Human Nutrition.

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ABSTRACT

The study was conducted to determine the effect of OFSP variety on growth and forage yield in humid soil: Implication for animal and human nutrition. The experiment was carried out in The Teaching and Research Farm, Federal College of Education (Technical) Omoku during the first farming season. The design adopted for the study was randomized complete block design (RCBD) with two (2) treatments (solo gold and mother's delight) each replicated three (3) times and lasted ninety (90) days. The length of planting materials was thirty centmetres (30cm), planted at a distance of 10m by 75 cm, weeding was done once and data were collected on the following sprouting, number of leaf and branches, vine length, fresh tuber yield and fresh forage yield. The data were summarized and subjected to mean, percentage and t-test .It was observed that the breeding lines had more 50% (solo gold, 56% and mother's delight,60% sprouting from the first seven (7) days after planting (DAP) and continued to above 80% at 21DAP (solo gold, 84.67% and mother's delight, 85.2%). The growth parameters mean number of leaves, number of branches and vine length showed numerical difference between varieties. The fresh tuber and forage yields were significantly different at 0.5 % probability. It was concluded OFSP varieties have unique characteristics the meet human nutrition demands. Solo gold (UMUSPO 4) had low fresh tuber yield but high forage yield and vegetative growth. Mother's delight (UMUSPO 3) had high fresh tuber yield but low fresh forage. OFSP is recommended for farmers in Omoku depending on the products needed, solo gold breeding line should be cultivated for leafy vegetable and mother's delight for tuber.

INTRODUCTION

Nutrition and health are greatly related, good nutrition is a forerunner of healthiness and wellbeing. In recessed economy witness in Nigeria and other parts of the world in last ten years quality nutrition for both human and animals has been a subject in many health discourses. In feeding, qualitative nutrition is been replaced by quantitative nutrition leading to various deficiencies and mal – nutrition. Today, there are numerous ill- health conditions which could have been remedied through good nutrition.

To bridge the cap, between nutrition and health of farm animals and human, researchers have developed bio-fortified crop varieties from existing ones so that their consumption by man and farm animals boost their growth and wellbeing. Bio-fortification is biotech strategy enhances the nutritional / food value of staple food crops by increasing the density of vitamins and minerals in the crops through either conventional plan breeding or genetic engineering. Bio- fortified staples play a serious role in food security through high yielding, early maturing, general improvement in quantity and quality, wider distribution in different agro-ecological areas and other specific characteristics. Some of the staples with bio-fortified lines are bêta- cassava, yellow maize, cowpea and sweet potato.

Sweet potato (*Ipomoea batatas* L.) is well known tuber crop in the Sub Saharan Africa (Low *et al*., 2009) and one of the most important versatile food crops. Sweet potato has nutritional advantage for the rural and urban dwellers (Ingabire and Hilda, 2011) and grows in kind of marginal soils, wide adaptation with high yielding and high resistance to drought (Lu *et al*., 2006). There are many varieties of sweet potato grown in more than 115 countries over the world (Aina *et al*., 2012; Aywa *et al*, 2013; FAOSTAT, 2019) The bio-fortified sweet potato line is called orange fleshed sweet potato (OFSP) and was developed by Centre for International Potato Centre (CIP) and distributed by Agricultural Research Council of Nigeria (ARCN). OFSP variety of sweet potato was developed through conventional breeding in 1995 and is gaining popularity in different agro-ecological zones due to its cultivars characteristics. National Root Research Institute, Umudike has developed many genotype breeding lines of OFSP (Kanu, Afuape,

Ezeocha, and Nwafor (2018). King J (UMUSPO1) was released in December, 2012 while mother's Delight (UMUSPO3) was released in June 2013.

Hernández Suárez *et al*. (2016) reported that SP also provides the substantial quantities of selected vitamins (Vitamin C and Pro-vitamin A ,PVA), specific minerals (potassium, magnesium, and calcium), and various bioactive compounds (phenolic acids and anthocyanins [ACN]) for consumers. Van Jaarsveld ***et al***., (2006) reported that purple- and orange-fleshed cultivars possess higher quantities of phenolic acids and anthocyanins (CAN) and carotenes in comparison with white-fleshed cultivars. OFSP possesses the characteristic of attractive sweet taste and eye-pleasing yellow to orange color to children in comparison with potato varieties (Kaguongo, 2012) and a good source of non- digestible dietary fiber, specific minerals, different vitamins, and antioxidants (Endrias, Negussie, and Gulelat, 2016; Rodrigues, Barbosa, and Barbosa, 2016). The OFSP varieties have additional advantages like early maturing (3- 4 months), resistance to weevils attack and sweet potato viral disease and can be easily processed into valued chain products. Tuber may be processed into different kinds of valued chain products including flour, chips, crisp, puree and juice. It serves as a cover crop, suppressing weed growth; leaves are consumed when green by humans and livestock. The leaves may be processed into hay, silage and products for feeding farm animals. Dr Kirimi Sindi, the county manager International Potato Centre (CIP), says pregnant, lactating women and children under five (especially children under two) are the most affected by malnutrition in general. The reason for this is the high nutrients needed at these stages, but when consumed, the potato can correct that. He notes that only 125 grams of orange-fleshed sweet potato (OFSP) can supply the recommended daily allowance of vitamin A for children and lactating women and also a family of five could generate an adequate annual supply of vitamin A from a 500 square metre plot (The news Times, 2018, January 28).

The significance of OFSP in fighting mal-nutrition and ill- health in human particularly among children and women of reproductive age in Nigeria and other third world countries is not debatable. It improves digestion, gain weight, immune system and prevent vitamin A deficiency. It is antidote for stomach ulcer, diabetes, dehydration, arthritis, bronchitis and inflammation (Mitra 2012). It is a crop for food security and can stop and fight hunger. This crop has not registered its presence in many agro-ecological zones of the country hence undermining its production and utilization. The main cultivars in Nigeria identified by common(local) names and scientific codes are *king J'* (UMUSPO1), *Mother's delight* (UMUSPO3) and Solo gold (UMUSPO4) but which of these varieties is adaptable to Omoku agro-ecological zone in terms of growth and forage yield to meet human and animal nutrition. This experiment was carried out to answer the question of which variety of OFSP that should be cultivated in Omoku agro-ecological zone. As King J (UMUSPO1) is more popular *Mother's delight* (UMUSPO3) and Solo gold (UMUSPO4) were used for the study.

MATERIALS AND METHODS

The experiment was carried out at Teaching and Research Farm of Department of Agricultural Education Federal College of Education (Technical), Omoku Rivers State.

The study was experimental design adopted was randomized complete block design (RCBD) with two treatments each replicated three (3) times and experiment lasted 90 days. The treatments were UMUSPO1 *(king J*) and UMUSPO 3 (*Mother delight*) vines as planting materials. The experiment area for experiment measured 30 by 10m and experimental area was divided into 6 experimental plots each measuring 5 by 10 m and each plot has 8 beds measuring 4 by 1m.

OFSP varieties- King j and mother delight vines were obtained from National Root Crop Institute, Umudike. The length of planting vines was 30cm and planted at distance of 75cm by 100cm on raised beds on second week of May 2022. Weeding was done once and supplying was also done 15 days after planting (DAP).

Measurement were collected on the following parameters

i Rate of sprouting by counting sprouting against non- sprouting at 7, 14 and 21 days after planting (DAP). Rate of sprouting = $number\ sprouting / number\ planted$ X 100

ii Number of leaves by counting at 7, 14 and 21 days after planting (DAP)
iii. Vine length measured 7, 14 and 21 days after planting (DAP)
iv. Number of branches at 7, 14 and 21 days after planting (DAP)
v. The fresh tuber yield was determined immediately after harvesting using measuring scale.
vi. The fresh forage yield was done by proper assembling of the vegetative parts and weighing using measuring scale.

All data collected was subjected percentage, mean, t- test analysis at 0.5 % probability

RESULT AND DISCUSSION

The rate of sprouting of different OFSP varieties is presented on Table 1. The result indicated 56 and 60% respectively for solo gold and mother delight at 7 days after planting (DAP). At 14 DAP the rate of sprouting are 71.2% and 72% for solo gold and mother delight respectively and also at 21 DAP, the rate of sprouting are 85.2% and 84.67% for solo gold and mother's delight, It could be deduced that two varieties (breeding lines) have higher capacity to sprout irrespective of the agro-ecological conditions but there was numerical difference between varieties and progressive increase in sprouting rate from 7 days to 21days. It could also be inferred that the planting vines (30cm) had sufficient number of nodes to effect positive sprouting and the vines handing strategy contributed to rate of sprouting of OFSP.

Table 1 Effect of variety of sprouting rate of OFSP in humid soil

Day After Planting/Varieties	**Solo gold Mean**	**%**	**Mother's delight Mean**	**%**
7DAP	24.00	56	22.40	60
14 DAP	28.8	71.2	28.48	72
21 DAP	*33.87*	*84.67*	*34.08*	*85.2*

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The observed results are similar to the observation reported by Puran and Ronell (2014) reported that vine cutting with 3 to 5 nodes achieve better germination and survival. The assumption is that large cutting has a higher opportunity for sprouting and development due to the presence of more nodes and higher carbohydrate reserve.

Table 2 Effect of Variety on Some Growth Parameters of OFSP

Days After Planting/Varieties	Solo Gold			Mother's Delight		
	Mean no. of leaves	Mean no.of branches	Mean vine length (cm)	Mean no.of leaves	Mean no.of branches	Mean vine length(cm)
7DAP	3.4	-	7.20	2.86	-	2.25
14DAP	7.5	1	16.30	6.4	-	13.23
21 DAPS	15.21	3	28.85	12.82	1	25.45

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Table 2 shows the growth parameters of different varieties of OFSP; mean number of leaves are 3.4,7.5 and 15.21 at 7,14 and 21 days after planting for solo gold whereas 2.86,6.4and 12.82 at the same period for mother's delight respectively . Solo gold had more leaves than mother's delight but the generally increased in number from 7 to 21 days after planting. The number of branches is 0, 1 and 3 at 7, 14and 21 days after planting for solo gold, also 0, 0 and 1 for mother 's delight during the same period respectively. The mean vine lengths are 7.20, 16.30 and 28.85cm for solo gold at 7, 14 and 21 days after planting whereas 2.25 , 13.23 and 25.45cm for mother's delight at 7,14 and 21 days after planting. It may be deduced that solo gold displays numerical increment in all the growth parameters measured. The observed may not only attributes of agro-ecosystem but genes related factors because two breeding lines differ in their genotype. The results are in agreement with Kapinga *et al.* (2010) and Egbe *et al*.(2012) reported variation in vine length and attributed it to differences in genetic make-up of the sweet potato varieties.

Table 3 t-test analysis of fresh tuber yield of different varieties of OFSP in humid soil

Varieties	Mean	S.D	N	df	S.E	t_{cal}	t_{tab}	Decision rule
Solo gold	3.08	1.61	3	5	1.15	6.23	2.57	significant
Mother's delight	10.28	3.76	3					

S.D means Standard deviation, N means total number, t_{cal} means t-calculated, t_{tab} means t-table value, S.E means standard error, df means degree of freedom.

Information on Table 3 shows the summarized *t*- test fresh yield of solo gold and mothers delight varieties of OFSP. The calculated t value 6.23 is greater than the table value 2.57. In conclusion, there is significant difference between the fresh yield weight of solo gold and mother's delight. The observed result may be due to the different genetic makeup of the two breeding lines. The differences in

means show that mother's delight does in Omoku soil. The result is in tandem with the report by Pakkies *et al*.(2019) that there always variation in yield among varieties of the crop due to the translocation of manufactured food to storage or the path way of photosynthetic activities.

Table 4 t-test analysis of fresh forage yield of different varieties of OFSP in humid soil

Varieties	Mean	S.D	N	df	S.E	t_{cal}	t_{tab}	Decision rule
Solo gold	600	100	3	5	51.81	8.164	2.57	significant
Mother's delight	117	112.93	3					

S.D means Standard deviation, N means total number, t_{-cal} means t-calculated, t_{-tab} means t-table value, S.E means standard error, df means degree of freedom.

Information on Table 3 shows the summarized *t*- test fresh yield of solo gold and mothers delight varieties of OFSP. The calculated t value 8.164 is greater than the table value 2.57. In conclusion, there is significant difference between the fresh yield weight of solo gold and mother's delight. The observed result may be due to the different genetic makeup of the two breeding lines. The differences in means forage yield show that solo gold produces more forage than mother's delight and should be cultivated for feeding in Omoku.

CONCLUSION

OFSP varieties have unique characteristics the meet human nutrition demands. Solo gold (UMUSPO 4) had low fresh tuber yield but high forage yield and vegetative growth. Mother's delight (UMUSPO 3) had high fresh tuber yield but low fresh forage. OFSP is recommended for farmers in Omoku depending on the products needed, solo gold breeding line should be cultivated for leafy vegetable and mother's delight for tuber. The vine length for planting should be about 30cm or more to enhance sprouting and root development.

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