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Research Article

Pattern of Dry Matter Distribution, Yield and Nutritional Composition of some Orange-Fleshed Sweet Potato Accessions in Jos-Plateau, Nigeria

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The orange-fleshed sweet potato contains β-carotene, a precursor of Vitamin A. There is, therefore, the need to promote the cultivation and consumption of the OFSP. Twelve accessions of the orange-fleshed sweet potato, namely, F2M5/3, Ng – Jay, MD, F1M1/4, ELINDA, SOUL, AI2IB, TIS. 87/0087/08, KWARA/00, F1M4/11, SOLO – 1/100 and SOLO – 1/144, were evaluated for dry matter distribution, yield potentials and nutritional composition in the Jos-Plateau environment, Nigeria in 2016, using the randomized complete block design with four replications. Proximate analysis was carried out to determine the nutrient composition of the accessions using standard procedures. Results showed that total dry matter increased with time up to 90 DAP and thereafter decreased in all but accessions F2M5/3, SOUL and SOLO-1/100. The proportion of dry matter in the leaves and stems was generally higher than in the tubers at the early stages of growth in all the accessions. At the end of the growing season, however, the dry matter partitioned to the tubers was generally higher than in the leaves and the stems. Total tuber yield was highest in the accession Ng-Jay (8.2 t/ha) and lowest in the accession ELINDA (2.0 t/ha). Except for calcium, all other nutrient elements varied with accession. The highest fat and β-carotene contents were observed in the accession SOLO-1/144. The OFSP accessions used in this study showed promising potentials for high yields and nutritional composition in the Jos-Plateau environment. They are, therefore, recommended for further screening and selection.

Keywords: Orange-fleshed sweet potato (OFSP), β-carotene, yield, dry matter, tuber.

INTRODUCTION

Sweet potato (*Ipomoea batatas* (L.) Lam.) is a dicotyledonous plant that belongs to the morning glory family, Convolvulaceae. It is a vegetable with roots that are sweet-tasting, starchy and tuberous. It is native to the tropical regions in America (Tewe *et al.,* 2003). Sweet potato is a root crop native to the tropics and requires warm days and nights for optimum growth and root development. It yields more and better-quality roots on well drained, light, sandy loam or silt loam soils (Gad and George, 2009).

Sweet potato is used as food and is reckoned to be one of the world's most important food crops and the tuber has been reported to be high in food value, fibre and energy (ACIAR, 2012). Sweet potatoes have been reported to contain a high level of vitamins A, C, B6, potassium, phosphorus and niacin (Nedunchezhiyan *et al.,* 2012). Johnson and Pace (2010) reported that the leaves of sweet potato contain high amounts of vitamins, minerals, antioxidants, dietary fibre and essential fatty acids which play a vital role in promoting health.

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According to Philpott *et al*. (2004), the three distinct cultivars of sweet potato available for commercial production include orange/copper skin with orange flesh, white/cream skin with white/cream flesh and red/purple skin with cream/white flesh. Most of the sweet potato cultivars are landraces that are white, cream or purple-fleshed with low beta-carotene content.

Orange-fleshed sweet potato has a nutritional advantage over white- or cream-fleshed sweet potato because their beta-carotene and, therefore, vitamin A content is higher. This is evidenced by the deep-orange colour of the tuber flesh, which is related to the higher beta-carotene and vitamin A content. The highest beta-carotene and vitamin A contents are found in the deepest or brightest orange-fleshed clones (Stathers *et al*., 2013).

In addition to providing high levels of vitamin A, orange-fleshed sweet potato roots contain high levels of vitamins B, C, E and K, all of which help protect the human body and enhance recovery from illness. Orange-fleshed sweet potato tubers also have high carbohydrate content, which is responsible for the production of high edible energy per hectare per day compared to other common sources of carbohydrate such as rice and maize (Stathers *et al*., 2013).

Sweet potato is widely grown and consumed traditionally in its white-fleshed form, which does not offer the nutritional benefit of the orange-fleshed varieties. There is a need to increase the availability of the beta-carotene-rich orange-fleshed varieties. The cultivation of orange-fleshed sweet potato genotypes with higher yields could improve the socio-economic conditions of the farming community as well as their nutritional status (Attaluri *et al.,* 2010).

In Nigeria, most of the sweet potato landraces have white-fleshed tubers with negligible amount of the pro-vitamin A pigment. However, Ijeh and Ukpabi (2004) reported that a popular local yellow-fleshed landrace (known as “Ex-Igbariam”) has appreciable but relatively limited quantity of β-carotene (3 µg/g fresh root sample). Researchers have, therefore, advocated the necessity of an increase in the production and consumption of the orange-fleshed sweet potato (Stathers *et al.,* 2013). The objective of this study was to evaluate the pattern of dry matter distribution, yield potential and nutritional composition of some OFSP accessions in the Jos-Plateau environment.

MATERIALS AND METHODS

The research was carried out in the field and in the laboratory. The field experiment was carried out at the Potato sub-Station of the National Root Crops Research Institute (NRCRI), Kuru, Plateau State (Latitude 09º44’N, Longitude 08º 47’E, Altitude 1,293.3 m above sea level). The laboratory analysis was carried out in the Biochemistry Laboratory of the National Veterinary Research Institute (NVRI), Kuru, Plateau State and the Sheda Science and Technology Complex (SHESTCO), Sheda, Abuja. Twelve (12) accessions of orange-fleshed sweet potato were sourced from the National Root Crops Research Institute (NRCRI), Umudike, Abia State. These include F2M5/3, Ng – Jay, MD, F1M1/4, ELINDA, SOUL, AI2IB, TIS.87/0087/08, KWARA/00, F1M4/11, SOLO – 1/100 and SOLO – 1/144.

The accessions were laid out in a randomized complete block design (RCBD) with four replications. The fourth replication was used for the growth analysis studies. Ridging and plot mapping were done manually on July 6, 2016. The net plot size was 3 m x 3 m (9 m^2) while the gross plot size was 48 m x 17 m (816 m^2).

Planting was done on July 7, 2016. For each accession, 30 cuttings of about 30 cm long were planted in each plot at inter- and intra-row-spacings of 1 m and 0.3 m, respectively, giving a total of 33, 333 plants per hectare. Fertilizer (NPK 15:15:15) was applied at the rate of 400 kg/ha (0.56 kg per plot) four weeks after planting (WAP) (Alleman, 2004). The plots were weeded manually at 31 and 66 days after planting (DAP) and then earthed up at 67 DAP.

Dry Matter Accumulation and Distribution

The total dry matter accumulated over time and the percentage distribution to the various parts (leaves, stems and roots) were computed at 45, 90 and 120 days after planting.

Total Tuber Yield

All the tubers harvested from each plot were weighed and the weight was converted to the equivalent in tonnes per hectare before the analysis.

PROXIMATE ANALYSIS

Proximate analysis was carried out at the Biochemistry Department of the National Veterinary Research Institute (NVRI), Vom, Plateau State and the Sheda Science and Technology Complex (SHESTCO), Sheda, Abuja. Each accession was analysed in duplicates for moisture, crude fibre, crude fat, ash, carbohydrate, calcium, phosphorus and β-carotene contents.

Ten (10) grammes of the freshly harvested tubers of each of the twelve accessions was taken to the laboratory for nutrient analysis using the standard methods of the Association of Official Analytical Chemists (AOAC, 2000).

Moisture Content: Ten (10) grammes of tubers was taken from the harvested tubers in each plot, shredded and dried in a moisture-extraction oven at 130ºC to constant weight. Moisture content was calculated as:

$$\text{Moisture Content} = \frac{\text{Fresh weight - dry weight}}{\text{Fresh weight}} \times 100$$

Fat Content: The determination of the fat content was carried out by the acid hydrolysis method. Two (2) g of samples was weighed and digested in hydrochloric acid. The digests were then transferred to Monjonnier flasks where the fat was extracted with ether. The ether extract was transferred into previously dried and weighed flasks; the ether was evaporated while the fat was dried and weighed. The fat content was then recorded.

Ash Content: Prepared samples were weighed into porcelain crucibles, which had been weighed. The samples were transferred to a muffle furnace and ashed at 550°C for 8 hours. The crucibles were allowed to cool in desiccators and then weighed; the ash content was then recorded.

Protein Content: The protein content was determined by Kjeldahl method. By this method, the N in the protein is converted to ammonium sulphate digestion. The salt on steam distillation liberates ammonia which is collected in boric acid solution and titrated against standard acid. One (1) ml of 0.1 N acid is equivalent to 1.40 mg N. It is assumed that the N is derived from protein containing 16% N, and by multiplying the N figure by 100/16 or 6.25, an approximate protein value is obtained (AOAC, 2000).

Total Carbohydrate Content: The total carbohydrate content was determined by difference, thus:

Total carbohydrate = 100 - (% fat + % protein + % moisture + % ash).

Mineral Composition: The minerals analyzed from the samples were phosphorus and calcium. The phosphorus and calcium contents were determined through UV spectrophotometry Inductively Coupled Plasma (ICP) according to AOAC (2000).

Beta-carotene: Beta-carotene was determined by UV Spectrophotometric method; the carotene content in each sample was estimated by acetone-petroleum ether extraction followed by spectrophotometric measurement. The extraction of carotenoid was performed by grinding the processed potato sample in a mortar and pestle, filtration through a sintered glass filter under vacuum and separation from acetone to petroleum ether. The petroleum eluent adjusted to a specific volume was read at 450 nm in a spectrophotometer for the concentration of total carotenoids. Results were expressed in milligrams per 100 g of fresh weight (FW) (mg/100g).

Data Analysis

Data collected were analyzed using the one-way analysis of variance (ANOVA) test. The Statistical Package for Social Science (SPSS, 17.0 version) was used. Means were separated using the Duncan’s new Multiple-Range Test at 5% level of probability (Little and Hills, 1977).

RESULTS

Dry Matter Accumulation and Distribution

The pattern of dry matter accumulation and partitioning into leaves, stems and tubers of some accessions of orange-fleshed sweet potato grown in Vom in 2016 is shown in Tables 1a and 1b.

The results show that more dry matter was accumulated in the leaves and stems than in the tubers at the early stages of growth; however, more dry matter was distributed to the tubers at the later stages of growth. In high-yielding accessions, more assimilates were translocated to the tubers than the leaves and stems. In the accession Ng-Jay, for example, more assimilates were translocated to the tubers at the end of the cropping season than to the leaves and stem.

Table 1(a): Dry matter accumulation (g) and distribution in twelve accessions of orange –fleshed sweet potato grown in Vom in 2016

Accession	LEAVES			STEM			TUBER			Total DM		
	Growth Stage (Days After Planting)											
	45	90	120	45	90	120	45	90	120	45	90	120
F2M5/3	5.18	13.77	4.26	1.48	5.33	2.56	1.53	8.16	22.42	8.19	27.27	29.24
Ng – Jay	4.53	10.67	1.81	2.24	7.45	1.88	2.61	21.45	29.68	9.37	39.57	33.37
MD	1.85	9.36	1.41	0.61	9.72	1.21	0.92	4.31	6.56	3.37	23.38	9.17
F1M1/4	4.95	14.72	1.26	2.05	4.92	1.61	1.68	2.91	16.63	8.68	22.54	19.50
ELINDA	2.17	10.57	2.42	1.58	4.50	4.10	0.60	4.84	4.94	4.35	19.92	11.47
SOUL	2.03	8.27	7.82	1.18	8.28	9.27	1.41	8.17	20.98	4.63	24.72	38.08
AI2IB	4.23	7.43	5.28	2.06	7.98	6.87	1.07	25.21	24.98	7.37	40.61	37.14
TIS 87/0087/08	4.45	6.88	5.03	2.93	3.94	4.26	1.60	12.69	15.09	8.98	23.51	24.38
KWARA/00	6.11	22.08	10.97	2.75	8.16	5.89	3.72	20.16	31.04	12.58	50.40	47.90
F1M4/11	1.76	9.55	1.38	1.02	8.97	4.45	0.67	18.18	17.97	3.45	36.70	23.79
SOLO – 1/100	8.51	18.53	6.44	3.70	8.33	6.34	1.98	12.87	29.37	14.19	39.73	42.14
SOLO – 1/144	7.42	21.24	5.16	3.90	6.11	0.97	2.56	16.14	13.23	13.88	43.49	19.37
SE ±	0.64	1.54	0.87	0.30	0.56	0.75	0.26	2.13	2.50	1.11	2.94	3.50

Table 1(b): Percentage distribution of total dry matter accumulated in different parts of twelve accessions of orange –fleshed sweet potato grown in Vom in 2016

Accession	LEAVES			STEM			TUBER		
	Growth Stage (Days After Planting)								
	45	90	120	45	90	120	45	90	120
F2M5/3	63.25	50.50	14.57	18.07	19.55	8.76	18.68	29.95	76.67
Ng – Jay	48.25	26.96	5.42	23.91	18.83	5.63	27.84	54.21	88.95
MD	54.80	40.03	15.32	18.00	41.57	13.18	27.20	18.40	71.50
F1M1/4	57.03	65.30	6.46	23.62	21.80	8.26	19.35	12.90	85.28
ELINDA	49.89	53.06	21.18	36.32	22.59	35.75	13.79	24.35	43.07
SOUL	43.86	33.45	20.53	25.49	33.50	24.38	30.65	33.05	55.09
AI2IB	57.49	18.30	14.22	27.99	19.65	18.50	14.52	62.05	67.28
TIS 87/0087/08	49.55	29.26	20.63	32.63	16.76	17.48	17.82	53.98	61.89
KWARA/00	48.57	43.81	22.90	21.86	16.19	12.30	29.57	40.00	64.80
F1M4/11	51.01	26.02	5.80	29.57	24.44	18.70	19.42	49.54	75.50
SOLO – 1/100	59.97	46.64	15.28	26.07	20.97	15.02	13.96	32.39	69.70
SOLO – 1/144	53.46	48.83	26.65	28.10	14.05	5.02	18.44	37.12	68.33

Total Tuber Yield

Table 2 shows the total tuber yield of ten orange-fleshed sweet potato accessions grown in Vom in 2016. The highest total tuber yield of 8.2 t/ha was observed in the accession Ng-Jay, but this did not differ significantly from accessions SOLO- 1/100 (6.9 t/ha), SOLO-1/144 (6.1 t/ha) and F2M5/3 (6.0 t/ha). The lowest total tuber yield of 2.1 t/ha was observed in the accession ELINDA.

Table 2: Total tuber yield (t/ha) in ten accessions of orange-fleshed sweet potato in Vom in 2016

Accession	Total Tuber Yield (t/ha)
F2M5/3	5.99[ab]
Ng – Jay	8.18[a]
MD	2.51[c]
F1M1/4	3.37[bc]
ELINDA	2.08[c]
SOUL	2.65[c]
AI2IB	2.46[c]
TIS 87/0087/08	3.56[bc]
KWARA/00	3.35[bc]
F1M4/11	2.33[c]
SOLO – 1/100	6.90[a]
SOLO – 1/144	6.10[ab]
CV (%)	42.13

Means followed by the same letter(s) within the same column are not significantly different at 5% level of probability (Duncan's new Mutiple-Range Test).

Nutritional Composition

Table 3 shows the result of the nutritional composition of some orange-fleshed sweet potato accessions grown in Vom in 2016. The accessions differed significantly (P< 0.05) in carbohydrate, moisture, fats, protein, dietary fibre, phosphorus, ash and beta carotene contents, but were statistically similar in the calcium content.

The carbohydrate content observed in the accessions SOLO-1/100 (65.19 g/100 g), SOLO-1/144 (60.73 g/100 g) and F1M4/11 (56.55 g/100 g) differed significantly from the other accessions, which were statistically similar.

The highest ash content of 1.98 g/100 g was observed in the accession SOLO-1/144, which was similar to clones F2M5/3 (1.1 g/100 g) and F1M4/11 (0.98 g/100 g). The highest moisture content of 67.3 % was observed in the accession ELINDA, which differed significantly from accessions SOLO-1/100 (29.2 %), SOLO-1/144 (31.5 %) and F1M4/11 (37.4 %).

The protein content was highest in the accession SOUL (3.8 g/ 100 g), and this was followed by accessions F2M5/3 (3.1g/100 g), KWARA/00 (3.1 g/ 100 g), TIS87/0087/08 (2.9 g/100 g), AI2IB (2.7g/100 g) and F1M4/11 (2.7 g/100 g). The lowest protein content of 1.56 g/100 g was observed in the accession ELINDA.

The highest crude fibre content of 3.0 g/ 100 g was observed in the accession TIS. 87/0087/08, which differed significantly from the other accessions. The accession SOLO-1/144 had the highest fat content of 1.0 g/ 100 g, which differed significantly (P = 0.05) from accessions F2M5/3 (0.2 g/100 g), Ng – Jay (0.2 g/100 g) and MD (0.4 g/100 g).

Phosphorus was highest in the accession AI2IB (0.16g/ 100 g), which differed significantly from accessions F2M5/3 (0.03 g/ 100 g), Ng –Jay (0.03 g/ 100 g), MD (0.02 g/ 100 g) and F1M1/4 (0.02g/ 100 g). Calcium content was highest in the accessions KWARA/00 (0.32 g/ 100 g) and SOLO-1/144 (0.32 g/ 100g), and these differed significantly from the other accessions.

The β-carotene content was highest in the accession SOLO-1/144(5.43 mg/ 100 g), which was significantly different from all the other accessions. The lowest β-carotene content of 0.86 mg/ 100 g was observed in the accession SOLO-1/100.

Table 3: Nutritional composition of ten orange-fleshed sweet potato accessions grown in Vom in 2016

Accession	Carbohydrate (g/100g)	Ash (g/100g)	Moisture (%)	Protein (g/100g)	Fibre (g/100g)	Fat (g/100g)	Phosphorus (g/100g)	Calcium (g/100g)	β-Carotene (mg/100g)
F2M5/3	30.27^{b}	1.05^{ab}	63.40^{a}	3.07^{ab}	2.00^{ab}	0.19^{d}	0.03^{b}	0.22^{a}	2.06^{cde}
Ng – Jay	35.53^{b}	0.78^{b}	59.03^{a}	2.46^{ab}	2.01^{ab}	0.21^{d}	0.03^{b}	0.27^{a}	1.68^{cdef}
MD	29.80^{b}	0.73^{b}	64.74^{a}	2.40^{ab}	2.00^{ab}	0.36^{cd}	0.02^{b}	0.22^{a}	1.50^{def}
F1M1/4	29.91^{b}	0.65^{b}	65.10^{a}	2.13^{ab}	1.50^{ab}	0.71^{abcd}	0.02^{b}	0.28^{a}	1.63^{cdef}
ELINDA	28.38^{b}	0.78^{b}	67.73^{a}	1.56^{b}	1.00^{b}	0.56^{abcd}	0.05^{ab}	0.23^{a}	2.55^{bc}
SOUL	38.75^{b}	0.90^{b}	55.98^{a}	3.82^{a}	1.50^{ab}	0.56^{abcd}	0.07^{ab}	0.29^{a}	3.25^{b}
AI2IB	26.84^{b}	0.68^{b}	66.98^{a}	2.66^{ab}	2.05^{ab}	0.81^{abc}	0.16^{a}	0.20^{a}	1.18^{ef}
TIS 87/0087/08	31.37^{b}	0.90^{b}	61.25^{a}	2.90^{ab}	3.00^{a}	0.59^{abcd}	0.05^{ab}	0.28^{a}	1.87^{cdef}
KWARA/00	28.49^{b}	0.78^{b}	56.20^{a}	3.12^{ab}	2.01^{ab}	0.47^{bcd}	0.10^{ab}	0.32^{a}	2.53^{bcd}
F1M4/11	56.55^{a}	0.98^{ab}	37.35^{b}	2.66^{ab}	1.53^{ab}	0.95^{ab}	0.08^{ab}	0.27^{a}	2.53^{bcd}
SOLO – 1/100	65.19^{a}	0.83^{b}	29.20^{b}	2.29^{ab}	2.00^{ab}	0.50^{abcd}	0.05^{ab}	0.22^{a}	0.86^{f}
SOLO – 1/144	60.73^{a}	1.98^{a}	31.53^{b}	2.74^{ab}	2.00^{ab}	1.04^{a}	0.07^{ab}	0.32^{a}	5.43^{a}
CV (%)	13.39	48.54	14.21	32.93	36.35	35.51	78.60	70.96	19.58

Means followed by the same letter(s) within the same column are not significantly different at 5% level of probability (Duncan's new Multiple -Range Test).

DISCUSSION

Namo (2005) observed that the rate of translocation of assimilates from the source (leaves) to the sink (tubers) is a major limiting factor to yield potentials in sweet potato. High-yielding accessions partitioned more assimilates to the tubers than the leaves and stems as observed in the accessions Ng-Jay, SOLO -1/144 and SOLO -1/100, which were also observed to have high root-top ratios (Mbwaga, 2007).

Yield is a quantitative trait which is influenced by both genotypic and environmental factors (Njoku *et al.*, 2009). Differences in yield due to genotypic differences have been reported in other sweet potato trials (Nedunchezhiyan *et al*., 2008; Kathabwalika *et al*., 2013; Rahman *et al.*, 2013).

Based on the National Agricultural Research Organization (NARO) yield classification criteria, sweet potato can be grouped into three tuber yield classes: high-yielding (18-30 t/ha), moderate-yielding (11-17 t/ha) and low-yielding genotypes (<11 t/ha) (Nwankwo *et al.*, 2014). None of the accessions used in this study fell within the high- and moderate-yielding classes. This might be due to the fact these accessions were newly introduced to the Jos-Plateau environment and the high fertilizer rate used, which might have favoured the growth of the vines at the expense of tubers.

Ingabire and Vasanthakaalam (2011) observed that the ash content in the fresh sweet potato tubers was between 0.40 g/100 g and 0.44 g/100 g. However, a higher total ash content (ranging from 0.65 g/100 g to 1.98 g/100 g) was observed in the orange-fleshed sweet potato accessions used in the present study. The ash content of sweet potato can be influenced by factors like soil and climatic conditions (Abbasi *et al*., 2011). The high ash content indicates that the accessions used in this study are rich in mineral salts and could be recommended for preventing or curing hunger in children and lactating mothers.

Like other tuberous root crops, sweet potato is known for its low-fat content, as observed in this study. The results obtained in this study with fat content of between 0.19 g/100 g and 1.04 g/100 g corroborated the findings of Mu *et al.* (2009) who reported a fat content of between 0.20 g/100 g and 1.5 g/100 g. The low-fat content indicates that the accessions used in this study cannot be considered as a good source of fat.

Protein content in the diets of low-income groups in developing countries is derived mostly from foods of vegetable origin. The average total protein content of sweet potato is as low as 1.5% (fw) and 5% (dw) (Benjamin, 2007); however, it is superior to tuberous root crops like cassava, plantain, taro but inferior to potato, yam and cereals. The accessions used in this study had protein content higher than 1.00% and could be considered as a good source of protein for especially rural dwellers who may not afford high-cost animal or plant proteins.

Dietary fibre is believed to reduce the incidence of colon cancer, diabetes, heart and certain digestive diseases (Huang *et al.***,** 1999). The results obtained in this study revealed that fibre content ranged between 1.00 g/100 g and 3.00 g/100 g. This corroborates the findings of Huang *et al.* (1999) who reported a fibre content of between 2.01

g/100g and 3.87 g/100g fresh weight of sweet potato tubers. Accessions with high fibre content could be a good source of dietary fibre. Accessions SOLO-1/144, Ng-Jay, F2M5/3 and TIS. 87/0087/08 had high fibre content, and could be considered as a good source of dietary fibre.

It has been reported that high carbohydrate in food serves as a source of energy to human beings and may serve as substrates for the production of aromatic amino acids and phenolic compounds through the shikimic acid pathway. The shikimate pathway leads to essential amino acids, such as tryptophan and phenylalanine synthetization (Eleazu and Ironua, 2015). Olayiwola *et al*. (2009), Eleazu and Ironua (2015) and Mohammad *et al*. (2016) reported carbohydrate contents ranging between 21.00 g/100 g and 68.37g/100 g, which is comparable with the carbohydrate contents range of 26.84 g/100 g to 65.19 g/100 g observed in this study. The high carbohydrate content in these accessions indicates that they are a good source of energy to human beings.

Calcium is the basic mineral component of bones and teeth. It takes part in blood coagulation processes and it is essential for the proper functioning of nerves and muscle contraction. In this study, the calcium content observed ranged between 0.22 and 0.30 g/100 g and this corroborates the findings of Colato *et al*. (2011) and Marczak *et al*. (2014) who reported a calcium content of 0.22 g/100 g and 0.30 g/100 g, respectively, on fresh weight basis. Hiroshi *et al*. (2000) noted that calcium content in sweet potato is generally low due to the high levels of oxalic and phytic acids, which account for the slow release of calcium for biological activities. Oxalic acid, phytic acid and phosphates interfere with calcium absorption because of the formation of complexes with calcium. Therefore, results of this study suggest that orange-fleshed sweet potatoes are not a good source of calcium.

Phosphorus acts as a buffer in maintaining normal pH in the human blood. Many enzymes and hormones contain phosphorus as a structural component. Haemoglobin depends upon phosphorus contained in its structure for proper functioning (Benjamin, 2007). In this study, the phosphorus content observed ranged between 0.02 g/100 g and 0.16 g/100 g. These values are low when compared to the recommended dietary allowance of 8.00 g per day for both children and adults (WHO, 2012). Therefore, the OFSP accessions used in this study cannot be considered as a good source of phosphorus.

In this study, the β-carotene content ranged between 0.86 mg/100g to 5.43 mg/100 g and this corroborates the findings of Burgos *et al*. (2001) and Hagenimana *et al*. (1999), who reported a β-carotene content range of between 0.56 mg/100g to 18.55 mg/100 g and 0.39 to 8.82 mg/100 g, respectively, in orange-fleshed sweet potato accessions. There is a potential for orange-fleshed sweet potatoes to boost vitamin A intake. Carrots, sweet potatoes and leafy vegetables contain high levels of β-carotene (Ingabire and Vasanthakaalam, 2011). The accession SOLO – 1/144 with the highest β-carotene content in this study could be recommended as a source of β-carotene to address vitamin A deficiency especially in young children and pregnant women.

CONCLUSION

Results of this study have shown that the tuberous root yield of the twelve orange-fleshed sweet potato accessions varied with genotype. Results of the dry matter accumulation and partitioning showed that the proportion of dry matter in the leaves and stems decreased with time, while that of the tubers increased. In high-yielding accessions like Ng-Jay, SOLO-1/100 and SOLO-1/144, more dry matter was translocated to the tubers at the end of the growing season. The accession Ng-Jay had the highest total tuber yield while accession ELINDA had the lowest.

Results of the proximate analysis revealed that carbohydrate, ash, moisture, protein, fibre, fat, phosphorous and beta-carotene varied with accession. The accessions did not differ significantly in calcium content. The accession SOLO-1/144 had the highest β-carotene content while SOLO-1/100 had the lowest. The accession SOLO – 1/144 could be recommended as a source of β-carotene to combat Vitamin A deficiency at the community level, especially in young children and pregnant women.

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