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Research Paper

Acceptability and proximate composition of some sweet potato genotypes: Implication of breeding for food security and industrial quality

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Abstract. Proximate composition of fifteen (15) fresh roots of sweet potato genotypes: NRSP/O5/3D, CIP440293, CIP440163, NRSP/05/022, NRSP/05/10D, CIP199004-2,NRSP/05/3B, Centinnial,199034-1, 87/0087, NRSP/05/5A, Ex-Igbariam, Shaba, NRSP/05/7C and Ex-Oyunga, comprising white, cream-yellow and orange-fleshed sweet potato (OFSP) were evaluated using standard methods of analysis. A 20-member sensory panel were used to evaluate some sensory attributes such as colour, aroma, taste, mouth feel and general acceptability of chips made from these sweet potato using deep frying and boiling processing methods. The dry matter ranged from 28.87%-CIP440293 to 40.90-NRSP/05/3B; flour yield had the range of 21.15 to 33.57% for genotypes CIP440293 and 87/0087 respectively; starch yield was from 13.16 to 22.90% for CIP440293 and NRSP/05/7C while total fat content ranged from 1.02 (Ex-Igbariam) to 1.72 (CIP440293) g/100 g and crude fiber had a range of 0.67 to 2.00g/100g, ash content ranged from 0.50 to 1.52 g/100 g in genotypes Centinnial and NRSP/05/5A, respectively. Over 70% of the genotypes were high in both flour and starch yield, which is a good indication of Industrial potential use of these sweet potato. They had low to high crude protein content, which ranged from 3.94 (NRSP/05/022) to 6.93% (Centinnial). The results of the sensory evaluation show that, the colour of the root matters most (genotypes Ex-Igbariam and CIP440293 in particular) to the sensory panel which was an indication of the consumers' preference and breeding attribute. On general acceptability, all the genotypes were acceptable in fried form but some were not in boiled form.

Keywords: Sweet potato, sensory evaluation, genotypes, food security and proximate.

INTRODUCTION

Sweet potato (*Ipomoea batatas* Lam) is cultivated throughout the tropics and warm temperate regions of the world for its starchy roots, which can provide nutrition, besides energy. Some cultivars which are orange/yellow fleshed are very rich in carotenoids and a good dietary source of β-carotene from which the human body synthesizes the vitamin A (Low and Van, 2008). It is a crop that thrives very well in both temperate and tropical climates (Woolfe, 1992). The edible tuberous roots is either long and tapered, ovoid or round with a skin colour ranging from white, brown, purple or red and flesh colour ranging from white, pale cream, orange or purple. Roots and tubers produce large quantities of energy per day in comparison with cereals (Padmaja, 2009).

Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (WHO, 1995). Food security is assumed to occur when all people at all times have access to enough food that is affordable, safe

and healthy, culturally acceptable meets specific dietary needs, obtained in a dignified manner, produced in ways that are environmentally sound and socially just (WHO, 1995).

Utilization of the sweet potato largely determines the varieties to grow, whether as food either directly or in processed forms as feed component or as sources of industrial starch. For use as food, variety preferences also seem to vary among and even within countries (Carpena, 2009). Orange-fleshed sweet potato varieties can be promoted for their food security, nutritional value and for their income generating potentials. Sweet potato roots are most frequently used after boiling, baking or frying. They are also processed into starch, flour or puree to make secondary food products (Padmaja, 2009).

The poor usually do not have adequate means to gain access to food in the needed quantities. Since access to food is closely related to poverty and economic growth, availability of food for the populace is a crucial issue in the development of a nation. Hence, food security becomes important in any consideration of the sustainability of the wealth of a nation. Sweet potato is one of the food security crops that can contribute to alleviate poverty among rural dwellers through improved processing techniques and food diversification.

Hence, the objectives of this work are: (1) to determine one attribute that can easily be measured on the field that will have a direct, positive and huge impact on general acceptability by the consumers. (2) To determine the proximate composition of some sweet potato genotypes for industrial use.

MATERIALS AND METHODS

Materials sources and collection

All the fifteen (15) sweet potato genotypes used in this work namely NRSP/O5/3D, CIP440293, CIP440163, NRSP/05/022, NRSP/05/10D, CIP199004-2, NRSP/05/3B, Centinnial,199034-1, 87/0087, NRSP/05/5A, Ex-Igbariam, Shaba, NRSP/05/7C and Ex-Oyunga, comprising white, cream-yellow and orange-fleshed sweet potato (OFSP), were obtained from the wweet potato programme experimental field of the National Root Crops Research Institute, Umudike, Nigeria. They were harvested during dry season, after five months of planting.

Laboratory analysis

Representative samples were obtained from each freshly harvested sample, properly labelled, bagged and transported to the laboratory for immediate analyses. Standard methods of the Official Methods of Analytical Chemist (AOAC, 2010) were used for the determination of the Ash Content, Crude Protein Content, Moisture Content/ Dry Matter Content, Crude Fibre and Fat content. The total carbohydrate was determined by difference, thus

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

The colour of the sweet potato roots were equally evaluated with the aid of colour chart.

Sensory evaluation

Randomly selected 20 semi-trained panellists, drawn from National Root Crops Research Institute Staff and Michael Okpara University of Agriculture, Umudike, were used. Panellists who are good and regular consumer of sweet potato assessed the prepared fried and boiled sweet potato chips for colour, mouth feel, flavour and general acceptability, on the degree of their likeness, where 1 = dislike extremely, 5 = neither like nor dislike and 9 = like extremely using a 9-point Hedonic scale (Iwe, 2002).

RESULTS AND DISCUSSION

Table 1 shows the results of the chemical properties of the different sweet potato genotypes. Total fat content ranged from 1.02 (Ex-Igbariam) to 1.72 (CIP440293) g/100 g and crude fiber had a range of 0.67 to 2.00g/100g, ash content ranged from 0.50 to 1.52 g/100 g in genotypes Centinnial and NRSP/05/5A, respectively. They had low to high crude protein content, which ranged from 3.94% (NRSP/05/022) to 6.93% (Centinnial). The total carbohydrate content ranged from 20.28% (CIP440293) to 33.11% (NRSP/05/7C) and they differed with varieties ($P < 0.05$). Moisture content differed quite significantly ($P < 0.05$) and ranged from 59.10 to 71.25% for NRSP/05/3B and CIP440293, respectively. Some of the preparation steps for the analysis are shown in Figure 1.

Over 70% of the genotypes (NRSP/O5/3D, CIP440163, NRSP/05/022, NRSP/05/3B, Centinnial, 87/0087, NRSP/05/7C and Ex-Oyunga), were high in both flour and starch yield, while the dry matter is moderate as shown in Figure 2. The dry matter content ranged from 28.87% for variety CIP440293 to 40.90 for variety NRSP/05/3B; flour yield had the range of 21.15 to 33.57% for genotypes CIP440293 and 87/0087 respectively; starch yield was from 13.16 to 22.90% for CIP440293 and NRSP/05/7C. All these are similar reported values. This is a good indication of industrial potential use of these sweet potato genotypes.

Result of the sensory profile for colour, taste, mouth feel and general acceptability are shown in Tables 3 and 4 shows that the colour of the root matters a lot to the consumers. Genotypes Ex-Igbariam and CIP440293-OFSP in particular had sensory scored more than 7 points as indicated by the sensory panel which is an indication of the consumers' preference and breeding

Table 1. Results of the chemical properties of the different sweet potato genotypes.

Genotypes	Crude fibre (%)	Ash content (%)	Fat content (%)	Crude protein (%)	Moisture content (%)	Carbohydrate (%)
NRSP/05/3D	1.07	0.94	1.10	5.57	60.45	31.94
CIP440293	1.99	1.20	1.72	5.55	71.25	20.28
CIP440163	1.63	1.30	1.62	5.18	63.26	28.64
NRSP/05/022	1.47	1.30	1.20	3.94	60.73	32.83
NRSP/05/10D	1.04	1.50	1.32	5.39	64.82	26.97
CIP199004-2	1.29	1.30	1.36	5.18	64.12	28.04
NRSP/05/3B	1.06	0.94	1.07	3.77	59.10	35.12
Centennial	0.67	0.50	1.61	6.94	60.74	30.21
199034-1	1.92	1.00	1.43	5.20	67.36	25.01
87/0087	0.73	1.10	1.47	6.34	62.70	28.39
NRSP/05/5A	2.00	1.52	1.29	4.27	59.70	33.22
Ex-Igbariam	1.87	0.92	1.02	5.06	61.27	31.73
Shaba	1.32	1.10	1.28	4.82	67.06	25.74
NRSP/05/7C	0.75	1.50	1.11	4.68	59.60	33.11
Ex-Oyunga	1.38	1.14	1.35	3.96	62.50	31.05
FSLSD (0.05)	0.117	0.159	0.172	0.060	0.388	0.769

Figure 1. Sweet potato field (A), Fresh sliced sweet potato (B), Sample preparation (C), Frying of OFSP (D), OFSP fried chips (E) and fried white fleshed sweet potato chips (F).

attribute. Generally, the sweet potato genotypes were more preferred in fried form to the boiled form (Figure 3). The colour of the root matters (genotypes Ex-Igbariam, Shaba and CIP440293 in particular) to the sensory panel, which was an indication of the consumers' preference and breeding attribute.

Table 2 shows the result of the colour characterisation of the fresh sweet potato roots. The colour ranged from white to deep orange in colour.

CONCLUSION

The colour of the root was the main attribute the panellist cherished. Therefore, a good target is root colour, which can be easily measured on the field by cutting open the roots. Many of the sweet potato genotypes may be used for flour production, especially NRSP/05/022, NRSP/05/3B, Centennial, 87/0087, NRSP/05/5A, Ex-Igbariam and Shaba while NRSP/05/3D, NRSP/05/3B, Centennial, 87/0087,

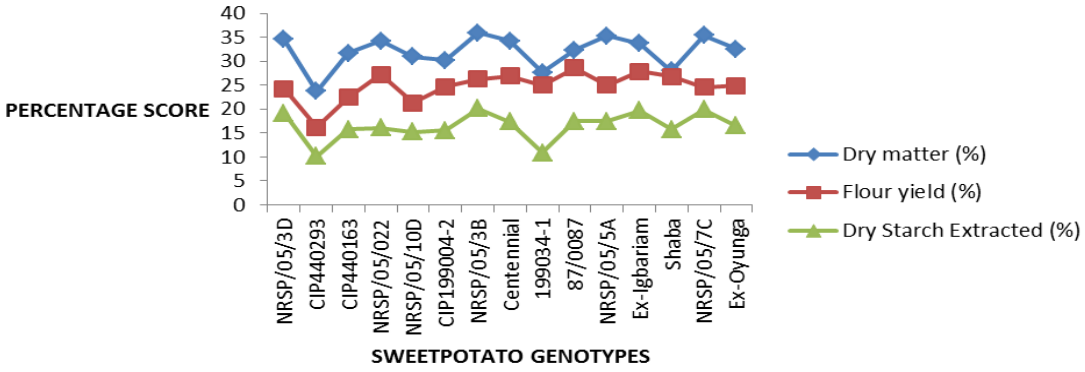

Figure 2. Dry matter, flour and starch percentage yields of the experimental sweet potato genotypes.

Table 2. Root colour characteristics of the experimental sweet potato.

Genotypes	Root back colour	Root flesh colour
NRSP/05/3D	Purple	White
CIP440293	Orange	Deep orange
CIP440163	Yellow	Cream yellow
NRSP/05/022	Purple	Light orange
NRSP/05/10D	Light purple	White
CIP199004-2	Purple	Yellow
NRSP/05/3B	Light yellow	Yellow
Centennial	Orange	Deep orange
199034-1	Light brown	Yellow
87/0087	Light purple	White
NRSP/05/5A	Light yellow	Cream
Ex-Igbariam	Light yellow	Yellow
Shaba	Purplish orange	Orange
NRSP/05/7C	Purple	Cream yellow
Ex-Oyunga	Orange	Deep orange

Table 3. Mean values of Sensory profile of boiled sweet potato genotypes.

Sweet potato	Colour	Taste	Mouth feel	G/Accept
NRSP/05/3D	5.60	6.47	6.60	6.07
CIP440293	6.73	4.80	4.80	4.47
CIP440163	4.80	5.13	5.60	5.27
NRSP/05/022	4.13	4.07	4.07	4.33
NRSP/05/10D	5.53	5.27	5.33	5.60
CIP199004-2	5.60	5.87	6.00	5.47
NRSP/05/3B	4.93	5.13	5.00	5.07
Centennial	5.40	6.13	5.80	5.67
199034-1	6.07	4.60	5.20	5.20
87/0087	5.93	5.40	5.67	5.80
NRSP/05/5A	5.20	5.67	5.27	5.33
Ex-Igbariam	6.47	5.67	5.33	5.73
Shaba	6.27	4.93	5.33	5.40
NRSP/05/7C	5.53	5.73	6.07	5.47
Ex-Oyunga	6.87	6.33	6.47	6.00
FSLSD (0.05)	0.69	0.65	0.68	0.67

Table 4. Mean values of sensory profile of fried sweet potato genotypes.

Sweet potato	Colour	Taste	Mouth feel	G/Accept
NRSP/05/3D	6.53	6.93	7.13	6.93
CIP440293	7.07	5.27	5.80	5.87
CIP440163	5.13	5.73	5.47	5.60
NRSP/05/022	6.13	5.53	5.47	5.60
NRSP/05/10D	5.60	5.87	5.87	6.20
CIP199004-2	6.80	6.53	6.93	6.80
NRSP/05/3B	4.80	6.40	5.33	5.47
Centennial	6.80	6.33	6.20	6.93
199034-1	6.80	6.40	6.27	6.47
87/0087	6.53	6.33	6.20	6.80
NRSP/05/5A	6.20	6.60	6.33	6.13
Ex-Igbariam	7.47	7.13	7.13	7.20
Shaba	7.13	5.67	6.27	5.60
NRSP/05/7C	7.33	7.07	7.20	6.47
Ex-Oyunga	6.87	6.60	6.80	6.67
FSLSD (0.05)	0.578	0.614	0.610	0.528

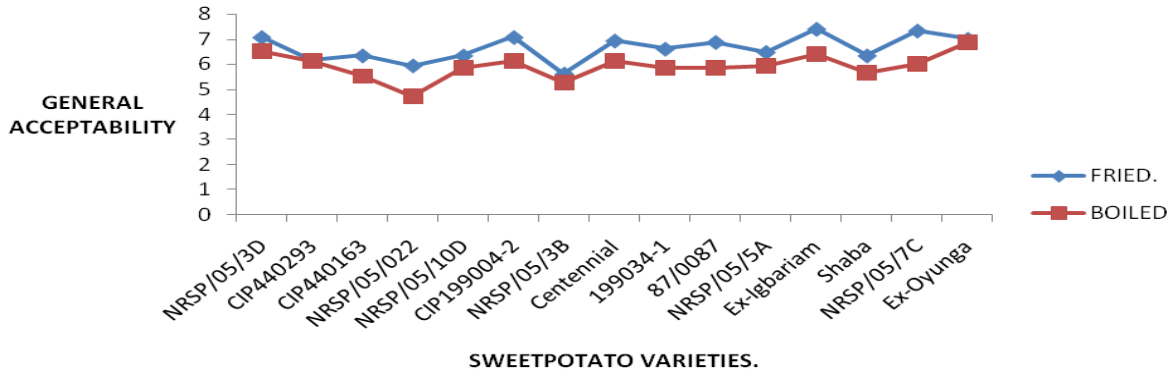

Figure 3. Summary of sensory evaluation of fried and boiled sweet potato chips.

NRSP/05/5A, Ex-Igbariam and NRSP/05/7C may be used to produce starch for pharmaceutical purpose (sugar syrup production). This may translate to food security and income generation for poverty alleviation.

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