

PROMOTION OF SWEETPOTATO FOR THE FOOD INDUSTRY IN NIGERIA

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Abstract

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This paper seeks to promote sweetpotato (*Ipomoea batatas* L. (Lam)) through the diversification of its use in the Nigerian food industry. Sweetpotato was cultivated in few areas by farmers in Nigeria before the recent increase and spread in the last decade, and its use is limited to boiling, roasting and frying. The processing of sweetpotato, as highlighted in this paper, has the potential of making a significant impact on the economy. This is because processing offers the possibility of better storage, added value, lower transportation cost and new markets in the food, feed, and industrial sectors. It will facilitate the marketing of this crop, increase productivity and improve the standard of living by providing income for farmers. The use of sweetpotato in livestock feed will help to improve livestock nutrition and lead to cheaper meat production. Sweetpotato therefore, can play a major role as a food reserve for many rural and urban households, due to diversified usage. Recommendations include identifying and breeding the varieties that will be suitable for different end products so as to enhance its production. There is also the need to determine how the different varieties can be made available all year round by establishing multiplication sites. Industries or entrepreneurs who will be ready to buy must also be identified, for promotion of commercial production. Technical advice must also be provided so as to improve yields.

Key words: promotion; sweetpotato; food industry; Nigeria

Introduction

Sweetpotato is widely grown as a staple food in many parts of the tropic and subtropics, which includes many developing countries where it accounts for about 107 million/tons in production per year (Table 1). It is extensively grown in the tropical zone, ac-

counting for about 81% of total world production (Chandra, 1974). Jones (1966) stated that sweetpotato has the following advantages over other root and tuber crops.

- I. Low demand on soil nutrient.
- II. Tolerance of drought
- III. Capability of providing reasonable yields in

Table 1
Production and value of major crops in developing countries (1982/1983)

Commodity	Value, US \$ millions	Total production, million tons/Yr	Dry matter, million/tons	Edible Energy, million feed	Edible protein, million/tons
Wheat	26.6	108	157	454	18.1
Maize	18.5	156	134	476	12.2
Potato	11.7	82	17	51	1.4
Sweetpotato	9.5	107	32	99	1.5
Cassava	8.9	127	51	109	0.5
Soya bean	6.5	30	28	127	10.8
Sorghum	5.8	47	42	149	4.9
Groundnut on shell	5.3	80	17	74	3.4
Banana	4.2	40	13	34	0.3
Tomato	4.2	22	1	4	0.2
Yam	3.9	24	6	21	0.4
Millet	3.9	27	24	34	2.5
Beans, dry	3.4	12	10	40	2.6
Barley	3.1	21	19	52	2.1
Cabbage	2.3	13	1	2	0.1
Chickpea	1.3	6	5	22	1.2
Broad Bean dry	0.9	4	3	12	0.9
Cocoyam	0.6	5	1	4	0.1
Lentils	0.4	1	1	4	0.3

Source: FAO, 1984; Production Yearbook 1983; FAO estimates of farm gate price (unpublished)

agro-ecological zones where other crops would fail.

IV. Low requirements for external inputs such as fertilizer

V. Flexibility in planting and harvesting period.

Nearly all sweetpotato is grown in developing countries, with Asia and Africa accounting for 80 and 15 percent of the world production, respectively. Its ease of cultivation and ability to thrive even under harsh conditions promote its spread in Africa. It is an attractive cash crop because of its low input requirement. The main input is labour for clearing and making mounds, which is usually supplied by family members. This makes it a good security crop due to its high calorie return per unit land area. In Nigeria, the National Root Crops Research Institute (NRCRI) has demonstrated the agronomic potentials of sweetpotato in the humid zone of the country (Ojeniyi, 2001). The

International Institute of Tropical Agriculture (IITA) also did some work on the utilization of sweetpotato for Man and livestock.

Sweetpotato and Its Potentials

Sweetpotato is an important staple food crop in Africa in general and Nigeria, in particular. It contains Vitamin A with sufficient quantities of a precursor known as beta-carotene. Vitamin A deficiency is a particular problem for children under five and for pregnant and lactating women. Serious Vitamin A deficiency can lead to blindness; chronic deficiency reduces a child's capacity to fight other diseases with sufficient negative long-term effect on the health of human. It is therefore important to know the potentials of sweetpotato so as to improve its utilization in Nigeria.

Beta-carotene is produced in plants and Vitamin

A is produced only in animals (including humans). The absorption of beta-carotene and its conversion to vitamin A in the body is controlled naturally, and because vitamin A does not exist in plants, there is little danger that over-ingestion of vitamin beta-carotene from sources such as sweetpotato could lead to vitamin A toxicity. However, if excessive amounts of beta-carotene are ingested (which is very unlikely) simply reducing this intake will correct the situation with no lasting toxic effects. Kapinga (2001) opined that 100g of sweetpotato can provide enough beta-carotene to produce from 0 to 100% of the suggested daily vitamin A requirement (350ug) per day for infants and young children). Not all beta-carotene can be converted by the body, so this translates to about 2400ug of beta-carotene, an amount easily supplied by about 100g of orange-fleshed sweetpotato. The amount of fresh weight required to yield the daily requirement of beta-carotene is even less (Carey et al., 1999). Infants, young children and adults are usually encouraged to eat more of orange-fleshed sweetpotato to protect them against blindness. It contains adequate amount of calories in form of Vitamins B and C as well as useful amount of other micronutrients, such as iron. Various varieties of sweetpotato have been identified by CIP and partners, tested and accepted in Kenya, Tanzania, Uganda and Mozambique.

Currently, sweetpotato is being utilized in various forms in other parts of the world. These uses can be adapted in the country to boost production and consumption of the crop. A summary of sweetpotato utilization potentials for the Nigerian food industry, adapted from Egeonu (2004), is given below.

Sparri: Sweetpotato has been successfully made into sparri (coined from 'sweetpotato garri'). This is grated sweetpotato that is subsequently fermented for 1-2 days and then roasted in the same way as garri is produced from cassava. The product is as tasty as cassava garri and keeps well.

Confectionaries: Sweetpotato can be made into various confectionaries including buns, cakes, rolls and puff-puff by utilizing dough made from the parboiled and grated tubers. Extensive work on this has been done in Ghana.

Flour: Sweetpotato flour could be used for baking on its own or as a supplement to cereal flour, as well as a stabilizer in the ice-cream industry (FAO, 1990).

Crisps: Sweetpotato could be processed into crisps in much the same way as potato.

Canned Sweetpotato: This is common in the USA where the yellow-fleshed varieties are preferred, and the tubers are cut into large chunks, filled into cans, heated at 85°C and immediately sealed.

Animal feed: Both roots and tops apart from being used fresh, could be made into a dried meal and fermented silage and fed to livestock, including pigs, cattle and poultry. This use is quite significant in China, the USA, Taiwan and India (Scott, 1992; Woolfe, 1992).

Starch: Starch can be produced from sweetpotato in the same way as from the other starchy roots except that the solution is kept alkaline (pH 8) by using lime, which helps to flocculate impurities and dissolve the pigments. Sweetpotato starch is used in the manufacture of starch syrup, glucose and isomerized glucose syrup, lactic acid beverages, bread and other confectionaries, as well as distilled spirits called shochu in Japan. Noodles and isomerized saccharides as a sweetener for soft drinks are also made from sweetpotato starch in China, Japan and Vietnam (Prain et al., 1997).

Sweetpotato Beer: The Koedo Brewery Kawagoe, of Kawagoe in Japan has been producing sweetpotato beer from roast local sweetpotatoes since 1996. It contains 7% alcohol and tastes like something between beer and wine, with a faint sweetness (JRT, 2000).

Sweetpotato Beverage: Marketing of sweet-potato beverages and yoghurt started in 1997 in Japan and these products are now quite popular (JRT, 2000). Technology transfer and adaptation from this country into Nigeria for sweetpotato beverage production in commercial quantities is an important initiative to be taken.

Table 2 shows the mineral and vitamin content of sweetpotato tuber performed in IITA, Ibadan laboratory. The caloric value of roots and tubers is given

Table 2
Approximate composition of fresh potato tubers

Nutrients	Percentage, % composition
Water	0.5 – 7
Starch	8 – 29
Protein	0.95 – 2.4
Ether extract	1.8-64
Reducing sugar	0.5-2.5
Non-starch (carbohydrate)	80-81
Mineral matter	0.88-1.38
Fat	Nil

Source: FAO, 1994

Table 3
Caloric value of roots and tubers, 100 g

Common names	Scientific name	Calories per 100g
Yam (trifoliolate)	<i>Dioscorea dumentorum</i>	391.25
Sweetpotato tuber	<i>Ipomoea batatas</i>	391.06
Cassava (Manioc)	<i>Manihot utilissima</i>	390.94
Yam (Yellow) tuber	<i>Dioscorea cayenesis</i>	385.69
Cocoyam (Tania) tuber	<i>Xanthosoma sagittifolium</i>	382.63
Yam (White) tuber	<i>Dioscorea rotundata</i>	381.18
Cocoyam (Taro) tuber	<i>Colocasia esuleuta</i>	376.37
Yam (Water)	<i>Dioscorea alata</i>	373.1

Source: Oyenuga 1978; Nigerian Food and Feeding Stuffs. University Press Ltd

in Table 3, while Table 4 shows the energy and proximate composition of sweetpotato (Table 5).

Table 6 shows the ecological zones and sweetpotato growing states in Nigeria. Products such as starch, syrup, alcoholic drinks, beverages, carotene, protein enriched pulp, feed yeast, silage and flour are also produced from sweetpotato soup or stew. It is

Table 4
Energy and proximate composition of sweetpotato

Component	Tuber	Peels	Young leaves
Dry matter	28.72	11.73	12.45
Crude Protein (0%)	5.24	6.33	24.65
True Protein (0%)	3.81	5.73	22.58
Ether Extract (0%)	0.46	1.34	3.58
Crude Fibre (0%)	0.41	0.34	9.1
Nitrogen free Extracts (0%)	91.49	87.44	51.2
TOTAL	2.6	4.18	9.48

Source: Adapted from Oyenuga (1968)

Table 5
Mineral and Vitamin Content of Sweetpotato Tuber (mg/100g food)

Nutrients	Value mg/100g
Thiamine	16.51
Phosphorus	31.201
Riboflavin	0.025
Carotene or Vitamin A	0.0078
Niacin	0.561
Ascorbic Acid	26.25
Calcium	16.571

Source: Odebode (2004)

boiled and pounded with cassava (fermented). Sweetpotato is dried and milled for sweetening 'ogi' (pap). It is eaten sliced and fried in oil in some localities, or dried before frying in oil. Other potential uses of sweetpotato include the following:

Production of 'Sparri' (Toasted Granules)

Sweetpotato 'sparri' processing stages are similar to 'garri' (cassava toasted granules) processing stages. The tubers are peeled, washed, grated, pressed and roasted as cassava 'garri'. Selected tubers are washed and left in water with a teaspoonful of squeezed lemon

in water for about 35 minutes. These tubers are grounded in a mill and put in polythene bags for de-watering and placed on the screw jack (press) for about twenty-two hours. The use of sodium meta bi-sulphate is to aid the processing of fermentation, which lasts for about seventy-two hours giving a sour taste to the tubers. Sifting and nesting follow this. (Figure 1)

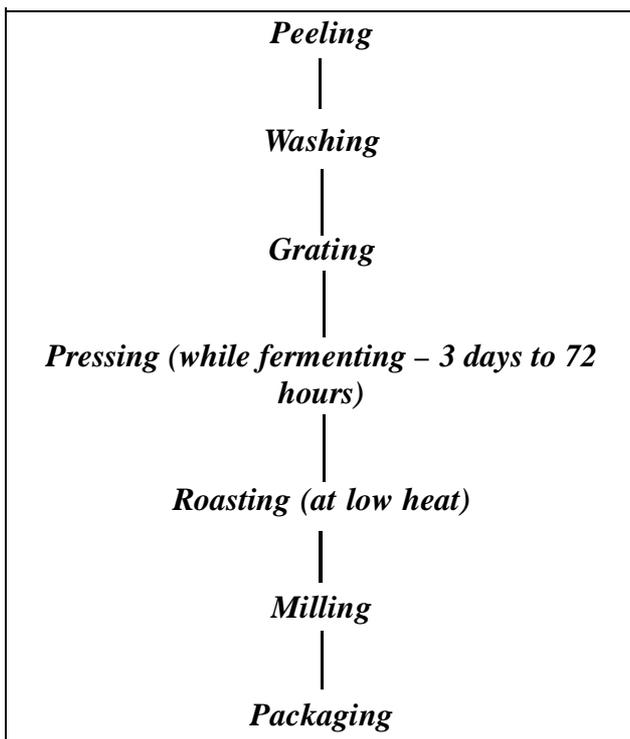


Fig. 1. Processing stages of Sweetpotato 'sparri'

In Nigeria, there is little sweetpotato processing. More than half of the sweetpotato produced is boiled or fried. Other sweetpotato products such as chips, starch, puff-puff, chin-chin, buns, bread, jam, crisps when introduced into the Nigerian food industry, will enhance the demand for new sweetpotato varieties. Sweetpotato has a high nutrient value per hectare, per day, and is highly dependable due to its drought tolerance and ability to withstand typhoon conditions. It is acceptable to consumers due to its palatability and inexpensiveness (Table 7).

Challenges of Sweetpotato Production in Nigeria

Sweetpotato is an important food security crop in Nigeria (Odebode, 2004). It is a short-term crop consumed boiled and mashed. It is mono-cropped or intercropped or intercropped in complex cropping systems with some staple crops such as yam and maize. It has also been identified as the least expensive, year round source of dietary, vitamin A, especially the orange-fleshed type (Low et al, 1997). The crop is cheap, can be purchased in affordable units and is easily cultivated, yet it is facing a lot of production and post harvest challenges.

Sweetpotato products have good profit margin and suitable for income generation. The prices of sweetpotato product may not be very impressive or attractive especially for bakery products. Flour from sweetpotato can be made when prices are low early in the season and may be stored for the future. Identifying and breeding the varieties that will be suitable for different end products will enhance the production of sweetpotato.

There is also the need to determine how the different varieties can be made available all year round. Multiplication sites must be established and industries or entrepreneurs who will be ready to buy must also be identified. It will be promoted on the commercial basis. A sustainable farmer-based and managed seed multiplication must be enforced. Technical advice, which will be backstop on agronomic prospects of production, must be provided so as to improve the yield. The supply of sweetpotato tubers must be consistent so that the demand will be met all year round. Collaboration with other partners interested in sweetpotato production processing and with utilization must be done to ensure good quality tubers. Sweetpotato pests (field/store) should be estimated. This is because the processing of this crop is prolonged if tubers are affected.

There is also need to make available small-scale processing equipment, appropriate technologies, to enhance local production and processing of this crop. However, retailers, wholesalers, and small-scale en-

Table 6
Distribution of sweetpotato production in different ecological zones of Nigeria

Ecological zone	States	Form of utilization
South-West Zone	Oyo*, Osun*, Lagos*, Ekiti, Ondo, Ogun	Snacks, Sweet Potato Flour "Spafun" Vines and leaves given to Livestock Boiled and Eaten Fried into Chips and Eaten Pounded or Mixed with Yam and Eaten with Vegetable Soup
South-East Zone	Anambra*, Enugu*, Imo*, Abia*, Ebonyi	Boiled and Eaten Fried and Eaten as chips Roasted Pounded
South-South	Edo, Delta*, Bayelsa*, Rivers*, Akwa Ibom, Cross Rivers*	Fufu Made into Porridge Snacks Starch Small tubers are used for animal feed Roasted or fried in cooking oil before being eaten.
North-Central	Benue*, Kogi*, Kwara*, Niger*, Kaduna*, Nassarawa*, Plateau*	Boiled, Roasted and eaten Fried and Eaten as Chips Used in preparing "Kunnu" drink Fufu with Vegetable Soup "Usinsin Dankali" Snacks Sweetpotato flour mixed with Cassava flour to make Amala
North-East	Yobe, Borno*, Adamawa, Gombe, Taraba, Bauchi*	Boiled and Eaten Used as Sweetener Dried and Fed to Livestock "Kunnu" Drink
North-West	Kano*, Jagawa, Kebbi, Sokoto*, Zamfara, Katsina*	Eaten Boiled with Rice Processed into Kunuzaki Sweetening Agent Oiled and Eaten with Groundnut Cake

Source: Odebode (2004)

* = Sweetpotato Growing States

preneurs should be encouraged to participate in the production and processing actively. Agricultural Credit Bank should also help so that small-scale farmers can have access to facilities in banks to improve or solve the problem of finance.

Conclusion and Recommendations

Sweetpotato production will be very profitable in Nigeria if processing and further utilization are promoted. The potentials of the crop will also be very real if the products are sold, thus enhancing income-

Table 7
Production, processing steps and utilization of sweetpotato

Product type	Product name	Processing steps	Description	Utilization
Sun-dried Chips (milled into flour)	a) Cake	Fresh roots Peeling Chipping Sun-drying (2 days) Milling	Sun-dried chips Milled is usually white in colour Can store for 3-6 months	Serves as snacks or main dish to entertain visitors
	b) Other products Puff-puff Buns Bread Chin-chin			Served as snacks to entertain visitors of for income generation
Sweetpotato leaves		1. Fresh leaves 2. Wither in the sun to get soft 3. Boil (20-30 min) 4. Squeeze to drain water	For making soup Narrow leaf is preferred to bread leaves	Vegetable soup served with Pounded yam, "Eba" or "Amala"
Sweetpotato "Sparri" (toasted granules)	"Sparri"	1. Peeling 2. Grating 3. Dewatering 4. Sieving 5. Toasting 6. Sieving	Can store for more than six months Vulnerable to storage pests Put in refrigerator	Soak in water and eaten with groundnut as a snack Put in boiled water and served with soup
Boiled sweetpotato Tuber	Ketchup	Boiled Sweetpotato Chopped Mixed with tomato Sugar, Onions, Vinegar, salt, water	Jam, put in Refrigerator	Serves with bread for breakfast
Sun-dried Chips	Sweet-potato Chips	1. Peeling 2. Trimming 3. Chipping 4. Deep frying	Shed and deep frying is better, to avoid breakage	Serves as a Snack
Sweetpotato Tuber	Sweetpotato Jam	1. Peeling (450g) 2. Simmering (20 mins) 3. Lemon (3) + Oranges (3) and boiled in 750ml water + 6g citric acid 4. Cooking (25 mins at 970C till mixture is thickened)	Put in Refrigerator	Served with Bread for Breakfast

Source: Odebode, 2004

generating capabilities of the farmers/producers in Nigeria. Sweet potato will therefore, begin to play an important role in the reduction of food shortages, particularly in economically and ecologically marginal areas of Nigeria. This is because when producers succeed in accessing growth markets whether domestic or exports, sweetpotato will contribute to income and employment generation. Moreover, access to markets will be instrumental for achieving the desired goals.

It is therefore imperative to make all possible efforts to strengthen the links between farming systems and markets. To achieving this, sweetpotato requires a demand driven, integrated approach to research, development and investment in the crop. Emphasis should therefore be put on market opportunity identification and product development research to meet the crops income generating potential. This will signal the requirements for investments in processing and farm production enterprises with cost-reducing and resource-conserving technologies being critical for maintaining competitiveness.

All stakeholders in the sweetpotato sector (producers, traders, processors, researchers, policy makers and consumers) need to come together to map out a national strategy for the development of the sweetpotato industry in Nigeria.

In summary, sweetpotato is boiled and eaten with stew, sliced into chips or dried and milled for sweetening of pap porridge, boiled and pounded yam. However, the processing of sweetpotato in Nigeria is being faced with a lot of problems. These problems, according to Ojeniyi et al. (2001), include lack of processing equipment for sweetpotato, proper packaging of sweetpotato products to enhance good quality, consumer education on the utilization of sweet potato and its products; manual peeling of sweetpotato, presence of the enzyme polyphenol oxidase in sweetpotato, storage of fresh sweetpotato tubers, and inadequate data on production statistics and demand for raw sweetpotato or its products.

There is the need to enlighten sweetpotato consumers on various forms of utilization and uses of sweetpotato. Furthermore, there is the need to improve or increase research and development activi-

ties to improve the storage, processing, preservation and quality of sweetpotato products. Current statistics should also be acquired to enhance production.

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