

# Socio-economic contributions of sweetpotato cultivation, processing and utilization: implications for the development of appropriate technology in Nigeria

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## Abstract

Sweetpotato is an important root crop that has been neglected in Nigeria for quite some time. Sweetpotato has the capacity of playing a role as famine reserve for many Nigerians and a source of income generation. The study examined the socio-economic contributions of sweetpotato cultivation, processing and utilization in Nigeria and the implication for developing appropriate technologies for sustainable cultivation and processing. The study reveals its economic role, nutrient content, sweetpotato supplies in Nigeria, poor cultivation condition, constraints to harvesting and tuber storage and the potentials for processing. Therefore, increasing sweetpotato's contribution to food security, economic development and raising the incomes of especially the poor farmers in Nigeria is likely to require changes on several aspects, cultivation practices, farm management systems, processing techniques, marketing and infrastructure facilities development. Most importantly there is the need to commercialize sweetpotato production and processing industries.

Keywords: Sweetpotato, socio-economic, contribution characteristics, processing, and technology.

## Introduction

Sweetpotato is becoming the most widely distributed root crop in most developing countries. It is grown in most parts of the tropics, sub tropics and warm temperate regions (Cobley, 1977). Asia produces over 90 percent of the world's sweetpotato, with China alone accounting for over 85 percent of the production. The Portuguese and Spanish explorers, traders and Missionaries in the 16th Century brought it into Philippines, Indonesia, India, Japan and Malaysia (FAO, 1994). The crop now ranks fourth most important after rice, wheat and corn in China (Lu *et al.*, 1989). Africa produces only about five percent of the world's production (Onwueme and Sinha, 1991). Sweetpotato, *Ipomoea batatas* (L.) Lam., originated in Tropical America (Mexico, Central America and Caribbean) and the North Western part of South America (FAO, 1990). The crop spread very early from the New World to the Pacific Islands, Asia and more recently to Africa. The crop is now grown throughout the tropics (Cobley, 1977). The purpose of this paper is to:

Expose the potentials of sweetpotato;

- Suggest ways of increasing production; and
- Identify the processing and utilization potential aspects of the crop; and
- Recommend appropriate technology for processing the crop.

## Socio-economic contributions of sweetpotato

Sweetpotato is a potential food security crop if economic policy objectives on national development are fully implemented in Nigeria. These policies include increasing low-cost staple food supplies to urban consumers, guaranteeing a regular source of income as well as cheap carbohydrates to rural households in areas where the crop is already cultivated and increasing food production and food security in semi-arid zones that are vulnerable to draught (Berry, 1993). Sweetpotato is yet to become a staple food in Nigeria due to the fact that it has been produced and consumed as a secondary crop. Sweetpotato is one of the major root crops widely consumed in the world. Increase production of sweetpotato will have significant effects on food security and economic development at the family, community and national levels. Sweetpotato is becoming an important root crop in West Africa, and could play a major role as a famine reserve for many rural and urban households. It can be grown on soil with limited fertility with little weed control (Bashaasha *et al.* 1995). Subsistence farmers in the tropics take interest in sweetpotato production because it is drought tolerant. It is cultivated for its carbohydrate rich tubers, and is

utilized primarily as human foodstuff. Sweetpotato tuber can be boiled, fried, roasted, baked and fermented as drink for human consumption (Onwueme and Sinha, 1991). In some areas the tuber peeled, peels are sliced and dried in the sun to produce chips, which are often ground into flour for partial substitute for wheat flour in bread and pastry making. In Malawi, they are sometimes boiled or roasted and pounded with groundnuts to produce *futali* (Kay, 1973). In USA, sweetpotato is often used as human food and they are eaten boiled, fried, canned, frozen or dehydrated into flakes. It is also used in a variety of products such as pie fillings, purees, candied pieces, soufflés, and baby foods.

Consumption of fresh sweetpotato is limited by the increasing perishability of the roots which begins to deteriorate within 35 to 36 hours after harvesting. With little or no facility for storage and transport, it is difficult to market sweetpotato any distance from the where it is grown. Hence there is the need to provide awareness on processing of sweetpotato into different forms that is less bulky to transport. Despite consumer lack of awareness to processed sweetpotato, marketing is also a constrain to the expansion of the use of the crop as a low-cost food in urban areas. This could be associated with the problem of infrastructure. The mode of packaging sweetpotato in most areas of the country is in baskets or sacks. Most farmers sell at the farm gate or sell the roots in the farms. There is the need to mechanize and commercialize production and marketing of sweetpotato in Nigeria. More information is needed on the marketing for potential improvement of the crop to effectively compete with other root crops.

In the arrears where sweetpotato is cultivated, it is very important as a source of income as well as providing household food security and welfare to a large number of people who are involved in the growing, processing and marketing it. The potential for increasing farmers' return from these activities or enhancing the relative importance of sweetpotato as a source of increased rural income depends on the possibility of increasing output and productivity as well as on commercialization, enhancing processing and decreasing the cost of marketing

### Nutritional value of sweetpotato

Sweetpotato is a rich source of Vitamin A and little amount of other Vitamins such as Vitamins B and C (Ndolo *et al.* 2001). It produces more edible energy, protein and dry matter basis than any other crop (Horton *et al.*, 1989). It is often a source of starch used in industries to manufacture adhesives, dextrin, paper and also cosmetics. It is also a source of Mg, K and other mineral (Lu *et al.*, 1989). Sweetpotato is also used industrially to produce glucose, syrup noodles and alcohol. Its flour often acts as dough conditioner in bread manufacture and functions also as a stabilizer in ice cream. It can also be used as animal feed or infant food (Ambe, 1997). Large quantities of sweetpotato, mainly culls are used in some countries as a high carbohydrate feeding stuff for cattle, pigs and poultry (Otoo *et al.*, 2001). They are occasionally used as food for Tilapia in fish-ponds (Kay, 1973).

The foliage has the potential for use as vegetable and are eaten in parts of Africa and the Philippines (Alvarez, 1987). Bacterial and fungicidal substances have been isolated from both the tubers and the vines of sweetpotato and used in a number of countries for various medicinal purposes (Kay, 1973)

### Sweetpotato supplies in Nigeria

Sweetpotato is a crop that is recently being promoted in Nigeria. It was introduced almost 100 years after cassava to serve as a supplement or an alternative to cassava gari toasted granules often consumed through drinking gari after being soaked in cold water. The improvement of sweetpotato in Nigeria is under the supervision of the National Root Crops Research Institute at Umudike in Abia State. According to Akoroda *et al.* (2000) this institute has done a lot of crossing and generation of superior types along line selection of characteristics. Unfortunately much research has not been done on the status of sweetpotato in Nigeria. However, both the cream and purple skin coloured types of sweetpotato are grown in selected areas in Nigeria. The orange flesh type is yet to be cultivated in Nigeria except for the ones done for research purposes. Sweetpotato is an herbaceous, perennial vine cultivated as an annual (Kay, 1973). It is a dicotyledonous plant of a large family containing 45 genera and 1000 species. *Ipomoea batatas* (L.) Lam. is phylogenetically related to 15 wild

species of *Ipomoea*, section *Batatas* (McDonald and Austin, 1990). A large number of cultivars exist and great variation is found in the forms and growth habits. These are in forms of colour of tuber skin, the flesh, shapes of the tuber and of the leaves, depth of rooting, time of maturity, resistance to diseases and pests and several other vegetative characteristics (Onwueme, 1978). On the basis of tuber texture after cooking, sweet potato flesh can be firm, dry and mealy; soft, moist and gelatinous or very coarse, suitable only for animal feeds or for industrial uses (Onwueme, 1978; FAO, 1994).

### Cultivation condition

Sweetpotato is essentially a warm climate crop, grown throughout the world from 40°N and 40°S and up to 2300 m above sea level (FAO, 1990). Kay (1973) reported that sweetpotato is grown under highly contrasting systems of agriculture, ranging from intensive horticultural practice to subsistence family and cultivars differ very considerably in their adaptability to soils and environmental conditions. For optimum growth, a temperature of 23°C with abundant sunshine and warmth is required. Its growth is restricted by cool weather and affected by temperatures below 10°C (FAO, 1994). The crop requires a day length of 11 h or less to promote flowering. It does not flower in days longer than 13 h (Cobley, 1977), but the tuber yield do not appear to be affected by day length (Kay 1973). A well-distributed rainfall of 750 – 1,000 mm per annum is best for the crop (Kay 1973; Cobley, 1977). Drought is harmful to sweetpotato during the first six Weeks After Planting and at the time of tuber initiation (Onwueme, 1978; FAO, 1994). Chukwu (1995) found mean irrigation water need of sweetpotato per dry season (November – February) is about 505 mm. The volume of water per season is equivalent to water application rate of 5300 cm<sup>3</sup>/ha. Minimum amount of water is required during sprouting and at crop development stage, when about 70 percent soil cover is expected (Chukwu, 1995). Sweetpotato can be grown in variety of soils but sandy or sandy loam high in organic matter with permeable sub-soil is ideal (Onwueme and Sinha, 1991). Kay (1973) also reported that sweet-potatoes are sensitive to alkaline and saline conditions and good drainage is

essential. Yields are best on soil with a pH range of 5.6 – 6.6. Sweetpotatoes are grown on ridges, mounds and flat. Planting on ridges or mounds produces higher yield than when planted on flat. Cultivation on mounds (20 – 30 cm high and 80 – 100 cm wide) is extensively practiced throughout the tropics. However, planting on ridges is the most common method of growing sweetpotato, in both the tropics and the temperate. It has been shown that the higher the ridge, the greater the yield (Onwueme, 1978; FAO, 1990; 1994). The percent increment in root yield was higher in plant on ridges than on flat at the wet season over dry season planting because ridges still conserve water than ordinary flat soil even in the dry season planting (Ambe, 1997). The yield increased with increased spacing. They also reported different requirements for different varieties in spacing for the development of optimum leaf area and maximum number of tuber and yield. Sweetpotato is propagated by the means of vine cuttings obtained from previous season crop, seeds, sprouts or transplant raised from tubers (Kay, 1973; FAO, 1990; 1994; Onwueme and Sinha, 1991). Cultivation with tuber results in low yields, therefore use of vine cuttings is recommended for commercial propagation of sweetpotato (Kay, 1973; Onwueme and Sinha, 1991). Apical cuttings are used as they grow and yield better than basal or middle cuttings. Vine cuttings are relatively cheaper and the plants are free from soil-borne diseases. Also the tubers produced from the vines are of more uniform size and shape. About 20 – 45 cm cuttings with at least seven nodes normally give higher yields than cuttings with only few nodes (Onwueme and Sinha, 1991).

*Planting* involves the insertion of the basal portion of the vine at about 45° into the soil. About 50 – 75 percent of the cutting is inserted into the soil. Often time the cuttings are left to wilt for 24 – 48 hours before planting (Cobley, 1977; Onwueme, 1978). Planting operation is performed manually in most of African countries and mechanical transplanters are used in many developing countries (Onwueme and Sinha, 1991). It is recommended that sweetpotato is planted at 25 – 30 cm within rows on ridges that are 60 – 75 cm apart. Usually one vine is planted on each spot, but two or three vines may be

planted on various portions of the same mound (Kay, 1973). It is best to plant sweetpotato early in the rainy season so that the crop can grow and mature before the onset of the dry season (Onwueme and Sinha, 1991). Sweetpotato vines grow rapidly and compete effectively with weeds. For this reason, weed control measures are only necessary for the first three months of growth (Onwueme and Sinha, 1991). Sweetpotato gives reasonable yields on relatively poor soils, yet it responds well to fertilizer application. Fertilizer requirements of sweetpotato may vary with soil type, the environment, and the cultivar grown. Nevertheless, a 6: 9: 15 NPK fertilizer applied at 560 – 1120kg/ha is recommended. Excessive nitrogen fertilizer should be avoided, since it delays tuber formation and it promotes shoot growth at the expense of tuber growth, (Onwueme, 1978; Onwueme and Sinha, 1991).

### Harvesting of sweetpotato and tuber storage

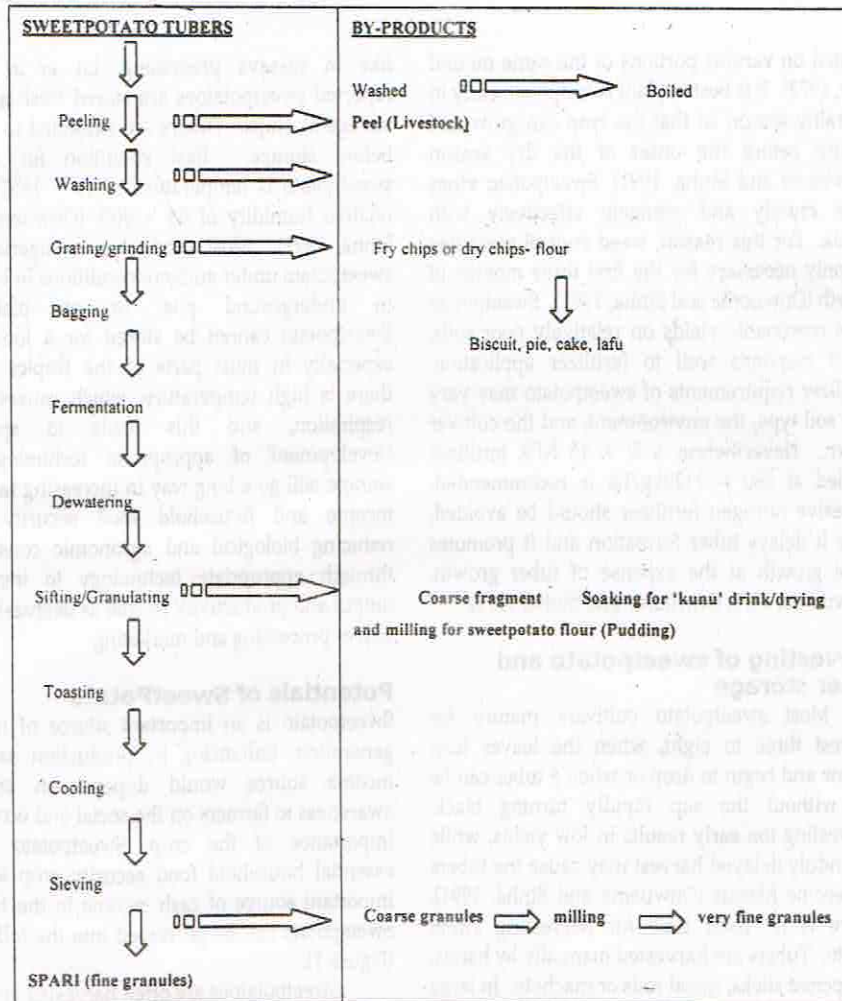
Most sweetpotato cultivars mature for harvest three to eight, when the leaves turn yellow and begin to drop or when a tuber can be cut without the sap rapidly turning black. Harvesting too early results in low yields, while an unduly delayed harvest may cause the tubers to become fibrous (Onwueme and Sinha, 1991). There is no fixed time for harvesting sweet potato. Tubers are harvested manually by hands, sharpened sticks, metal rods or machete. In large scale production, tubers are harvested by ploughing or by combine harvesters (Cobley, 1977; Onwueme, 1978; Onwueme and Sinha, 1991). Yields vary greatly according to cultivar, local climatic conditions and cultural techniques. Yield about 17.5 – 20.0 t/ha are realizable in the tropics (Kay, 1973). Average yield per hectare in Africa is 8 t/ha. In Nigeria, the average yield is 14t/ha (Horton, 1988). Precise data input and yield of sweetpotato is not available but the cultivation of sweetpotato is thought to require less labour per unit of output than most other major Nigerian staples. Sweetpotato is processed before eaten, in any case, processing into toasted granules and flour are laborious and time consuming, some times requiring up to five days

like in cassava processing. Lu *et al* (1989) reported sweetpotatoes are stored fresh and dry storage as chips. Tubers are subjected to curing before storage. Best condition for storing sweetpotato is temperature of 13 – 16°C and a relative humidity of 85 – 90% (Onwueme and Sinha, 1991). Most producers in Nigeria store sweetpotato under ambient conditions in baskets, in underground pits, or on platforms. Sweetpotato cannot be stored for a long time especially in most parts of the tropics where there is high temperature, which causes tuber respiration, and this leads to spoilage. Development of appropriate technology for storage will go a long way in increasing farmers' income and household food security. Also reducing biological and agronomic constraints through appropriate technology to increased output and productivity as well as decreasing the cost of processing and marketing

### Potentials of SweetPotato

Sweetpotato is an important source of income generation. Enhancing its production as rural income source would depend on creating awareness to farmers on the social and economic importance of the crop. Sweetpotato is an essential household food security crop and an important source of cash income to the farmer. Sweetpotato can be processed into the following (Figure 1).

Sweetpotatoes are often harvested and sold in small amount of frequent intervals and in short period of time. Sweetpotato can be planted two to three times in a year, the characteristic that serves to raise farmers' income for sustainable household cash flow. The harvesting of sweetpotato as its complements with other crops in the field can be combined with other activities. This crop can give farmers and producers a flexible condition to adjust to changing market situations, which may facilitate income stabilization and mitigate the effect of risk for specialization of commercial producers, as well as for low-income farmers who consume a large share of their output.



**Figure 1: Processing potential of sweetpotato**  
Adapted from Meludu, et al. (2003)

**Conclusion**

This suggests in turn that the flexibility of income management derived from sweetpotato production may be important for issues of urban food supply as well as for rural incomes. However, the main constraint to the production of sweetpotato is labor. This means that there is the need for technical labour improvement during cultivation and processing. As there is increase in the innovation on processing, farmers being aware of this will want to produce more as their crop will not just be marketed only as fresh.

Increasing sweetpotato's contribution to food security, economic development and raising

the incomes of especially the rural poor people of Nigeria is likely to require changes on several aspects, cultivation practices, farm management systems, processing techniques, marketing and infrastructure facilities development. Research has shown that cassava processing technology has been used for the processing of sweetpotato. The only problem identified was that the cassava graters holes are too big for sweetpotato. Research should therefore focus on developing appropriate processing technology for small-scale farmers. Most importantly there is the need to commercialize sweetpotato production industries.

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