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Cassava and the future of starch

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The nutritive reserves of cassava is made up of starch, which is one of the most important products synthesized by plants that is consumed as food and used in industrial processes. The currently increasing cassava production will lead to higher amount of starch available making it cheaper for industrial processes, and opening up new markets. There is also abundant capacity in many tropical countries such as Nigeria to increase cassava production.

Cassava (*Manihot esculenta*), also called manioc, tapioca or yuca, is one of the most important food crops in the humid tropics, being particularly suited to conditions of low nutrient availability and able to survive drought (Burrell, 2003). The plant grows to a height of 1 to 3 m and several roots may be found on each plant. Although cassava leaves are sometimes consumed, the major harvested organ is the tuber, which is actually a swollen root. The plant is propagated mostly from stem cuttings. A major limitation of cassava production is the rapid post harvest deterioration of its roots which usually prevents their storage in the fresh state for more than a few days (Okezie and Kosikowski, 1982).

Cassava ranks very high among crops that convert the greatest amount of solar energy into soluble carbohydrates per unit of area. Among the starchy staples, cassava gives a carbohydrate production which is about 40% higher than rice and 25% more than maize, with the result that cassava is the cheapest source of calories for both human nutrition and animal feeding. A typical composition of the cassava root is moisture (70%), starch (24%), fiber (2%), protein (1%) and other substances including minerals (3%).

Compared to other crops, cassava excels under suboptimal conditions, offering the possibility of using marginal land to increase total agricultural production (Cock, 1982). Plant breeders, agronomists and recently molecular biologists have made substantial improvements in cassava yields during the last two decades. While, genetic characterization and mapping has revealed some insights into the molecular nature of cassava (Tonukari et al. 1997; Fregene et al. 2003)

An important food source

More than two-thirds of the total production of cassava is used as food for humans, with lesser amounts being used for animal feed (Nwokoro et al. 2002) and industrial purposes. The future demand for fresh cassava may depend on improved storage methods, but the markets for cassava as a substitute for cereal flours in bakery products and as energy source in animal feed rations are likely to expand.

Starch is one of the most important plant products to man. It is an essential component of food providing a large proportion of the daily calorific intake. In West Africa, cassava flour and gari (a processed cassava product) are consumed in large quantities. Cassava starch is recommended for use in extruded snacks for improved expansion. It is also used as a thickener in foods that are not subject to rigorous processing conditions. Cassava starch, which is very bland in flavor, is used in processed baby foods as a filler material and bonding agent in confectionary and biscuit industries.

Cassava as an industrial base

Cassava is also used to produce starch for industrial use and other products used in processed food. Starch is a multibillion dollar business worldwide and it is finding application in several industries. Cassava starch can perform most of the functions where maize, rice and wheat starch are currently used. Starch is utilized in sizing and dyeing in the textiles industries to increase brightness and

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weight of the cloth. In the pharmaceutical industries, starch serves as a filler material and bonding agent for making tablets.

Cassava starch also have several other numerous uses such as an additive in cement to improve the setting time, and it is used to improve the viscosity of drilling muds in oil wells. It is also used to seal the walls of bore holes and prevent fluid loss. Starch is also the main raw material in glue and adhesive industries. In paper production, cassava starch is currently used as glue to achieve brightness and strength. Starch is also an important raw material for powder in the cosmetics industries. In detergent soap manufacture, starch is used to get better recovery and to improve the shelf life of detergents. While in the rubber and foam industries, starch is employed for getting better foaming and color.

Cassava starch can be converted to maltotriose, maltose, and glucose as well as to other modified sugars and organic acids (Tan et al. 1984). Starch from cassava can be used to make fructose syrups (Vuilleumier, 1993) and formulate gelatin capsules (Nduele et al. 1993). The use of cassava as a source of ethanol for fuel is already being exploited and very promising. Recently, Roble et al. 2003 demonstrated the production L-Lactic acid from raw cassava starch in a bioreactor using *Aspergillus awamori* (fungus) and *Lactococcus lactis* spp. *lactis* (bacteria). Furthermore, cassava dregs could be employed for phytase production after the addition of a nitrogen source and mineral salts (Hong et al. 2001), while activated carbons prepared from waste cassava peel (Rajeshwarisivaraj et al. 2001) are efficient as adsorbents for dyes and metal ions.

The future of cassava production

Sub-Saharan Africa is expected to experience the most rapid growth in food demand in root and tubers averaging 2.6 percent per year through 2020 (Scott et al. 2000). This growth will account for nearly 122 million metric tons with most of the increase coming largely from cassava, 80 million metric tons (66% of the total). Cassava demand is estimated to grow at 2.0% annually for food and 1.6% per year for feed in developing countries, while total cassava production is projected to reach 168 million tons by 2020 based on the current production rate (Table 1). However, this amount can be far surpassed in developing countries with the right policies and incentives. Moreover, with the increasing establishment of starch-utilizing industries in developing countries, the production of starch will simply have to increase beyond the projected figures in Table 1.

Table 1. Cassava[a] production and use in 1993, and projected to 2020 (Scott et al. 2000).

Country/region	Area (million ha)		Yield (mt/ha)		Production (million mt)		Total use (million mt)	
	1993	2020	1993	2020	1993	2020	1993	2020
Sub-Saharan Africa	11.9	15.9	7.4	10.6	87.8	168.6	87.7	168.1
Latin America	2.7	2.7	11.3	15.6	30.3	41.7	30.3	42.9
Southeast Asia	3.5	3.5	12.1	13.7	42.0	48.2	18.9	24.4
India	0.2	0.2	23.6	28.4	5.8	7.0	5.7	7.3
Other South Asia	0.1	0.1	9.4	13.5	0.8	1.3	0.9	1.4
China	0.3	0.3	15.1	20.2	4.8	6.5	5.1	6.4
Other East Asia	na	na	na	na	na	na	1.8	1.9
Developing	18.8	22.9	9.2	12.0	172.4	274.7	152.0	254.6
Developed	...	...	12.1	14.7	0.4	0.4	20.7	20.5
World	18.8	22.9	9.2	12.0	172.7	275.1	172.7	275.1

[a] Figures for cassava and similar roots such as taro. Cassava alone accounts for over 97 percent of the total in developing countries. na: no recorded production; ha: hectares; mt: metric tons.

Cassava is a staple food consumed in both rural and urban areas of Nigeria, a country with a population of about 120 million people. In recent years, it has also been transformed from being a subsistent crop to industrial cash crop. Cassava is one of the most actively marketed food products and is the most promising in terms of growth and new market opportunities. There is also a regular surplus of cassava in most producing countries. Even so, several governments in Africa have taken positive steps to promote cassava production for industrial processing since many of these countries have large capacities for cassava production.

The major beneficiaries of a more diversified world market for cassava will be Sub-Saharan Africa. In Nigeria, the bulk of current cassava production is mostly processed into food products (Adeniji et al. 1997), indicating an excellent opportunity for raising the production level with the expansion of industrial starch processing. There is a great deal of extra land available in Nigeria and much of this unused land is quite suitable for growing crops. Certainly an increased cassava production, in order to convert it into an industrial base, is very possible by increasing the area of land farmed without any need for irrigation.

Perspectives

Continuing strong growth in food demand for cassava reflects the important role that cassava plays in the diets. The growth rate in food demand also stipulates that cassava will maintain its importance in regional diets as Sub-Saharan Africa continues to urbanize and increase its share of processed food products for consumers in the countryside and in the cities. Increased cassava production can be exploited in the establishment of starch-based industries. In countries with high labor availability and unused land, increase in cassava production and processing can lead to better income for farmers, as industry demand increases. However, policies should encourage the establishment of starch-based industries such that produced cassava is destined for local market and not for export. This will stimulate job creation and real economic growth.

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