CASSAVA: TOWARDS THE YEAR 2000

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INTRODUCTION

Cassava's socioeconomic importance and characteristics

In the tropics, cassava is the most important root crop and ranks fourth after rice, sugarcane and maize as a source of calories for human consumption. It is a major carbohydrate food for 500 million people, and in tropical Africa it is the single most important source of calories in the diet. Total world production has increased from 70 million t in 1960 to an estimated 150 million t in 1990. Of this total, 43% is produced in Africa, 35% in Asia and 22% in Latin America and the Caribbean (Table 1). The crop is principally used as a human food, either fresh or in a processed form; however it is of growing importance both as an animal feed and as a raw material for producing starch and starch-based derivatives.

Cassava has a number of attributes that have contributed to its reaching this level of worldwide importance and that have made it an attractive crop for small-scale farmers with limited resources in marginal areas:

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Table 1. World cassava production (million t).

	1985	1986	1987	1988	1989	1990
World	136.6	133.6	136.8	141.3	148.6	150.3
Africa	58.2	58.6	58.4	59.6	62.9	69.1
Ghana	3.1	2.9	2.7	2.8	3.3	3.6
Madagascar	2.1	2.4	2.2	2.2	2.3	2.3
Mozambique	3.2	3.3	3.4	3.2	3.5	4.1
Nigeria	13.5	14.7	14.0	15.0	16.5	19.0
Tanzania	6.8	6.2	6.0	6.1	6.2	6.9
Uganda	2.7	1.9	2.8	2.5	3.1	3.3
Zaire	15.5	16.2	16.2	16.3	16.4	17.6
Asia	48.5	42.7	47.6	52.3	54.1	50.8
China	3.6	3.5	3.3	3.3	3.2	3.2
India	5.7	4.9	4.8	5.4	4.5	5.7
Indonesia	14.0	13.3	14.3	15.5	17.1	15.8
Philippines	1.7	1.7	1.8	1.8	1.8	1.8
Thailand	19.3	15.2	19.5	22.3	23.5	20.7
Vietnam	2.9	2.8	2.7	2.8	2.9	2.5
Latin America	29.6	32.1	30.6	29.2	31.4	32.2
Brazil	23.1	25.6	23.5	21.7	23.4	24.3
Colombia	1.4	1.3	1.3	1.3	1.5	1.9
Paraguay	2.9	2.9	3.5	3.9	4.0	3.6

Source: FAO Production Yearbooks.

- It is one of the most efficient carbohydrate-producing crops.
- It is tolerant of low soil fertility and drought and has the ability to recover from the damage caused by most pests and diseases.
- The roots can be left in the ground for long periods as a food reserve, providing an excellent insurance against famine.
- The crop is well adapted to multispecies agricultural systems and subsistence cultivation in which farmers seek to minimize the risk of total crop failure.

This paper presents an overview on the present status and prospects for cassava during the decade of the 1990s and describes the socio-economic, political and institutional environment within which cassava research and development activities will be carried out.

Trends in production and utilization

Cassava's contribution to economic development changes as countries undergo structural adjustments typical of the development process, such as industrialization and urbanization. Future prospects for the crop are governed by the rate at which each country experiences these structural adjustments. Macro socio economic and political tendencies can best be examined on a continental basis.

Latin America. Over the past 30 years Latin America has undergone a very rapid process of urbanization, as countries in the region followed a policy of import substitution towards industrial growth. In 1960, 70% of the total population was located in rural areas, whereas by 1990 the situation had been reversed with over 70% of the population living in towns and cities. Many countries at the beginning of this period were obliged to increase their imports of certain basic foodstuffs, especially cereals, as local food and feed production was unable to keep pace with the increased demand of a growing urban population. Governments also often subsidized these imports as a means of maintaining food prices low for a population whose social conditions were precarious. This period also saw a progressive movement of cassava production to less favored environments as prime agricultural land was placed under higher value export crops. Against this scenario, cassava production declined during the 1970s, exhibiting a negative growth rate of -1.5%

(Fig. 1). The crop was unable to compete in price with grain staples which resulted in lower consumption of both fresh and processed cassava in urban Latin America (CIAT, 1987a).

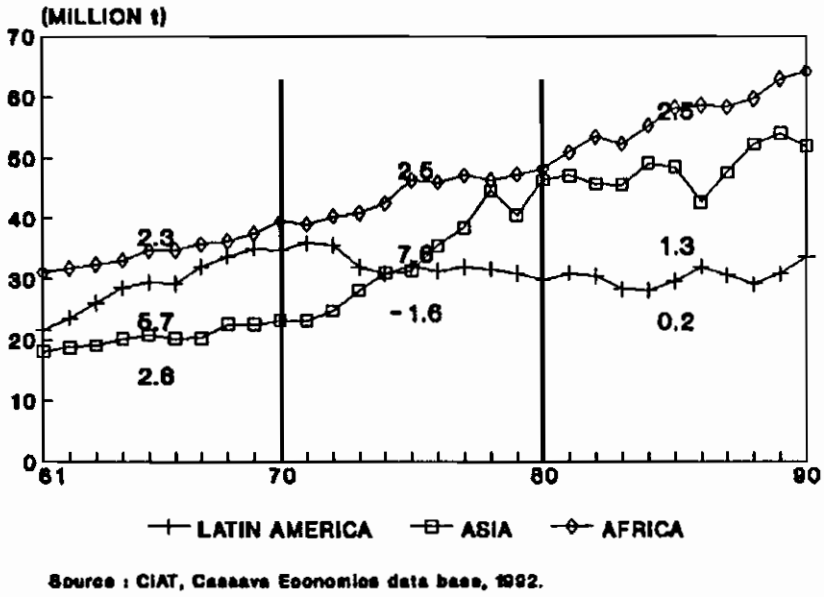

Figure 1. World cassava production and growth rates by continent (1961-90).

The trend of decreasing cassava production during the 1970s and early 1980s has gradually changed into one of slow but accelerating growth in the late 1980s. The debt crisis, in which virtually all Latin American countries were engulfed during 1983, saw the removal of the subsidies on imported cereals as a move was made to reduce the foreign debt and to a greater self reliance in food and feed production. In a number of countries, a process of market diversification has also been initiated with the processing of cassava into dry chips and meal for incorporation into animal feed concentrates and other

industrial uses. This has led to a stabilization in prices and an incentive for farmers to adopt yield increasing technologies.

Government policies that indirectly affect cassava's comparative advantage to substitute food and feed grains are under strong pressure within the import liberation philosophy that many countries are currently following. Transport subsidies, support prices and input price controls for the major grains are being lowered or eliminated in several countries. This will indirectly favor the potential for cassava in alternative markets and as a consequence strengthen traditional demand (Correa and Henry, 1992).

During the coming decade, the animal feed concentrate industry is seen as having the greatest potential for absorbing increases in cassava production as the demand for meat and other animal products is expected to remain strong. Besides the animal feed market, cassava starch will strongly compete with imported starches, principally maize. A potential is also envisaged for high quality cassava flour as a substitute for wheat and other flours in several food products.

Asia. After its introduction into Asia in the 18th century, cassava became an important secondary food staple in upland areas, especially in those regions where there was a deficit of rice. During the 1960s rice production expanded as the "Green Revolution" technologies were adopted, and since that time there has been a gradual diversification of cassava end uses which has maintained a dynamic growth situation. The 1970s witnessed a phenomenal 7.6% increase in production (Fig. 1) principally in Thailand where growth was based on the lucrative export of cassava pellets to the European Economic

Community. However, population increase and strong industrial growth has maintained and fostered demand for traditional and novel starch based products in other countries (CIAT, 1987b).

Overall production growth throughout the 1980s, albeit at a more modest rate (1.3%) than the previous decade, continues to be export led. Thai cassava exports have experienced an annual growth rate of 7% from 1985-1990, Table 2. A significant cost price advantage has enabled Thailand to open new pellet export markets in Asia, Eastern Europe and what was the USSR, despite the imposition of quotas by the EEC in the mid 1980s. Further market diversification is occurring, as greater quantities of cassava are destined for the manufacture of modified starches and other starch derived products for both internal consumption and export. Exports from Indonesia have experienced even higher growth (17.1%) as this country has started to fill its EEC quota, while both China and Vietnam have both exported small quantities of cassava products.

While export may continue to be a major attraction for some cassava producing countries in Asia, population growth and urbanization offers the opportunity of expanding cassava's role as a domestic multipurpose carbohydrate source for food, feed and industry in the coming decade (Bottema and Henry, 1992). To fulfil this role, cassava needs to maintain and improve its price and quality competitiveness against other carbohydrate sources. In this respect, government policies will undoubtedly be an important element in determining cassava's future prospects. Historically, policies have been oriented toward boosting primary commodity production, particularly rice; however, during the last few years, several Asian governments have been lifting such policies. Fertilizer subsidies and

support prices have been decreased in Indonesia and Vietnam, directly affecting production costs and market prices for high input-dependent crops such as rice and maize. Cassava, which is less input-dependent, will therefore become more price competitive resulting in an increased demand to substitute for rice, maize and wheat in processed food products for human consumption and in animal feed.

Table 2. World trade in cassava[1] (000 t).

	1985	1986	1987	1988	1989	1990	Annual growth rates 1985-90 (%)
World exports	8130	7600	7900	10050	11930	10200	7.79
Thailand	7410	6760	6572	8580	10340	8945	7.09
Indonesia	600	425	783	1086	1200	1000	17.13
China	100	280	340	320	200	180	5.34
Vietnam	-	50	40	20	150	30	3.00
Others	20	85	165	44	40	45	1.35
World imports	9000	7840	7900	10440	11950	10200	6.20
EC	6730	6225	6990	7025	6982	6000	-0.60
China (Taiwan)	470	265	192	500	960	900	23.05
Japan	650	370	215	600	650	500	4.00
Korea Rep. of	240	260	138	40	930	900	32.80
USA	70	70	72	75	260	245	29.26
USSR	-	-	-	988	861	750	-13.78
Others	840	650	293	852	1307	905	10.10

Source: FAO

[1] Includes pellets, "native" pellets and dried cassava chips.

Africa. Following its introduction into West Africa in the 16th century, cassava cultivation has extended to Central, Eastern and Southern Africa. The crop is now the most important food staple in many regions of sub-Saharan Africa, providing more than 200 calories per day per capita for over 160 million people. Even in areas where cassava is

not a major staple, it often plays an important role in household food security because of its resistance to drought and pests (Dorosh, 1989). In the 1970s and 1980s, cassava production increased at an annual rate of 2.5% (Fig. 1). This respectable growth in production was, however, below the rate of population growth.

In the 1990s, Africa continues to face a grave food supply situation, particularly in those regions of low soil fertility and prone to drought. It is therefore predicted that cassava production will continue to expand into these areas and maintain its position as a household security crop. In several African countries a rapid process of urbanization is taking place, which is leading to new demands in terms of food and feed. The potential exists to develop market surpluses of cassava to meet these demands. Currently, cassava yields are low, 6.8 t/ha on average across the continent, and considerable increases in production should be possible through the introduction of disease and drought tolerant varieties and improved soil and pest management practices. In these circumstances, the establishment of new or improved processing alternatives and the development of market channels will significantly stimulate the adoption of improved technology, increase production and enhance cassava's income and employment generating capacity. As in the case of Latin America and Asia, government policies will determine the extent to which cassava fulfills its potential. For example in Nigeria, where imports of wheat have been severely restricted, cassava production has increased from 15 million t in 1988 to 19 million t in 1990 (Table 1).

The overall prospects for cassava are that production will continue to grow worldwide. The rate of growth will be determined by the speed with which market diversification takes

place and the extent to which governments pursue liberal agricultural policies that are unbiased towards competing crops. The gradual shift in cassava cultivation from more to less favored environments will also proceed, underlining the crops comparative advantage under marginal edaphoclimatic conditions. This scenario presents a number of challenges for cassava research and development (R and D).

Implications for research and development

The foregoing analysis of the trends and prospects for cassava confirm that the crop does and can in the future contribute significantly to achieving certain development objectives. Specifically, cassava contributes to increased food security, both directly as a starchy staple and indirectly as a feed for livestock. It is becoming increasingly important as a raw material for the production of starch and starch derived products for both food and non-food uses, thereby alleviating the need in many tropical countries to import these raw materials, usually cereals, for this purpose. Finally, foreign exchange can be generated through the export of cassava products. In any one country cassava often plays a combination of the above roles. As importantly, in terms of meeting the welfare objectives of developing countries, cassava production and processing activities provide sources of employment and income in marginal rural areas where there are few alternative economic production alternatives. For these reasons, the development of the crop is often considered an integral part of an overall strategy for furthering socio-economic development (IFPRI, 1989).

In determining a research and development strategy for the crop, the question arises as how to enhance these multiple roles in a rapidly changing political and institutional environment. The global trend towards trade liberalization opens up major opportunities for cassava to enter new markets, as direct and indirect subsidies on competing starchy staples are reduced or eliminated. This requires, on the one hand, that cassava products maintain or improve their price and quality competitiveness through the development and adoption of improved production and processing technologies and, on the other hand, that links between small-scale producers and markets are strengthened through appropriate institutional interventions (Lynam and Janssen, 1992). The greater concern that is now being placed on environmental conservation demands that improvements in crop production and productivity are achieved without degrading the natural resource base. This is a particular challenge given that cassava is often grown in fragile and socio-economically marginal environments.

The institutional environment within which cassava R and D takes place is also changing. At the national level, there is a trend towards a decrease in public sector investment in agricultural research and a gradual greater participation of the private sector in both R and D activities. In many instances, farmers' organizations themselves are taking on a greater responsibility for undertaking applied research of particular interest to their members (CIAT, 1992). For the small farm sector, which includes cassava, where farmers' organizations have yet to develop sufficient human and financial capital on which to base a strong R and D capability, non governmental organizations are assuming an important role. At the international level, a certain dichotomy exists. Over the past five

years there has been a greater recognition of the contribution that root and tuber crops make to economic development. However, with the increased concern for environmental degradation, resources for commodity research in general, and roots and tubers in particular, are being squeezed in preference to resource management research.

Under these circumstances, an R and D strategy for cassava has to be well focused, with an efficient and effective use of the resources available at both the national and international level. Priority setting is an urgent necessity, particularly with respect to the weight afforded to different research areas such as germplasm enhancement, crop management and utilization and marketing research. The effect of technological advancement in any one of these areas may make a relatively greater contribution to achieving the multiple objectives of increasing price and quality competitiveness and ensuring the agro-ecological sustainability of cassava production (Table 3). A decision as to the correct balance between research in the three above mentioned areas can only be achieved through a careful diagnosis of the principal constraints to and potential opportunities for cassava production and utilization in any given situation. In the past, there has been a tendency to overemphasize production related research (germplasm and crop management) to the detriment of process, product and market research, and a failure to integrate the three components either at the research or the development level (CIAT, 1991).

Capacity for undertaking production, processing and marketing R and D is seldom found in the same institution and the effectiveness of technology generation will greatly depend on the working out of interinstitutional collaborative mechanisms that make use of the

expertise present in a number of institutions. This is of even greater importance in larger countries that encompass a number of cassava production and utilization situations under widely differing agroecological conditions. In addition, countries with a relatively strong cassava research capability (e.g. Thailand and Brazil) do and should be encouraged to play a major role in the flow of technology and knowledge to those countries in which the development of a capacity that covers the whole spectrum from basic to adaptive research cannot be justified.

Table 3. Research areas and their relative contribution to achieving the objectives of technology generation activities.

	Objectives		
Research areas	Lower price	Improved quality	Enhanced sustainability
Genetic improvement	+ +	+ +	+ +
Crop management	+ + +	+	+ + +
Utilization/marketing			
Fresh	+ +	+ + +	+ +
Processed	+	+ +	+ +

\+ Low; + + Intermediate; + + + High Contribution

NOTE: The values represent the authors' subjective appreciation and will vary depending on the particular conditions prevailing in each country or region.

A global cassava R and D System

The formation of collaborative mechanisms that bring together a number of institutions that are working towards a common goal and with similar or complementary objectives has proven to be a cost-effective means of enhancing the efficiency of R and D. These interinstitutional arrangements provide a forum for information exchange, priority setting and horizontal collaboration between participants. At the local level, the collaboration between institutions is often best achieved through joint projects that, in a structured manner, define activities, responsibilities and resources for achieving certain agreed upon outputs. At the national, regional and international level, "networking" has become the popular term for bringing together interested parties that seek common goals. For cassava, a wide range of networks already exist (Table 4) or are in the process of formation. Each has its own particular modus operandi, some are formal with clearly stated goals, objectives, activities and outputs, others are more informal, relying on the desires of the respective participants to maintain contact with their peers in other institutions or countries.

Together, the institutions that make up these projects or networks constitute what can be considered as a Global Cassava R and D System whose principal components are:

- The national institutions in developing countries associated with cassava R and D.
- The international and regional institutions with cassava R and D responsibilities.
- Developed country institutions that dedicate resources to basic and applied cassava research and to technical cooperation in developing countries.

Table 4. Cassava and related networks.

Global
Cassava R and D workers
Cassava Biotechnology Network
Cassava Genetic Resources Network
International Society for Tropical Root Crops (ISTRC)
Regional
Asian Cassava Research Network
Panamerican Cassava Breeders' Network
Latinamerican Integrated Projects Network
Collaborators in Root and Tuber Improvement and Systems (CORTIS)[2]
African Francophone cassava network (CORAF)
African Branch of the ISTRC
Subregional
Eastern and Southern African Root Crop Research Network
Southern Cone Cassava Development Network
National
Country Root and Tuber Crop Societies

[2] In French. Collaboration pour les Systèmes et l'Amelloration des Plantes à Racines et Tubercules (COSART).

- The donor community that finances bilateral and multilateral cassava R and D activities.

These different components can only correctly be considered to constitute a system if there are strong links between them, that is, if there is a flow of information, resources and products from one to the other and in reciprocal directions. It is in promoting these flows that the International Agricultural Research Centers (IARCs) with mandates for cassava related activities have a major responsibility. The IARCs, have a self generated interest in ensuring that there exist strong links within and between the other components of the system, as it is through and in collaboration with their partners, especially those in developing countries, that they can fulfil their mission. The relevance and complementarity of the research carried out by the IARCs is governed by a correct appreciation of the constraints to and opportunities for cassava. This has to be carried out in conjunction with partner institutions and be followed by a joint analysis of each collaborator's comparative advantage for carrying out a particular research or development job. Partner institutions should also be similarly motivated by the benefits of a closely integrated global system in which they can readily access or provide information, resources and products that are relevant to their specific needs.

The IARC's role of actively catalyzing R and D networks has become widely recognized. However, from playing a dominant role in the organization of networks in the past, there is a greater désire to participate more as equal partners. While the international nature of the IARCs bestows a certain comparative advantage in terms of convening and supporting the consolidation of networks, decision making should be a responsibility

shared by all participants. Institutional considerations aside, the acknowledgement that, as individuals, we are working towards the common goal of improving the welfare of those that depend on cassava for their livelihood, should in the end be the prime motivating factor in our wanting to contribute actively to a closer integration, that will ultimately increase the efficiency and effectiveness of our work.

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