GLOBAL CASSAVA RESEARCH AND DEVELOPMENT:

The Cassava Demand Studies and Implications for the Strategies for the CIAT Cassava Program

Attached to this document is an executive summary of the Cassava Demand Studies in Asia and Latin America

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GLOBAL CASSAVA RESEARCH AND DEVELOPMENT

ATTACHMENT A

Executive Summary of Cassava
Demand Studies in Asia and Latin America

The Impetus for a Cassava Demand Study

Cassava is something of an enigma in the international center system. Research on cassava was initially funded because of its obvious importance (third after rice and maize) as a starchy staple in the tropics and because of its phenomenonal yield potential, even under significant stresses. However, ignorance about the crop has often unjustifiably resulted in the image of cassava as something of a pariah, being accused of impoverishing soil, causing cretinism among cassava consumers, and stymieing the economic progress of cassava producers. A crop produced by poor farmers on poor lands for poor consumers was perceived to be the antithesis to the modernization process being pursued by developing countries. As growth in funding for the CGIAR system slowed and resource allocation between commodities become a central issue, cassava was affected by this image problem, as doubts were raised--not about the current importance of the crop, but about cassava's future as countries within the tropics developed.

Doubts about the amount of research resources that should be devoted to cassava found their expression (1) in the 1983 decision by CIAT Board and management to reduce the Cassava Program significantly in a period of very tight budgetary constraints; (2) in the 1984 External Program Review of CIAT, which recommended that funding for the Cassava Program be frozen (at the 1983 reduced level) until the future demand for cassava was better characterized; and (3) in the TAC's current "Review of CGIAR Priorities and Future Strategies," which sees future funding on cassava to be held to current levels. These actions must be seen as a vote of no-confidence, not in the CIAT Cassava Program, but in the cassava crop itself.

The concerns about cassava focused on the demand for the commodity. Cassava was seen, if not as an inferior good, then as a commodity with very inelastic demand and therefore with limited growth prospects as the overall economy developed. Such inelastic demand would result in significantly reduced payoffs to research investment. However, the problem is not unique to cassava. At some point in a country's economic development, per capita consumption of basic food staples will decline. Almost by definition, demand for food staples is inelastic, particularly when they bulk large in the diet. However, this fact has not hindered research investment in grain or legume staples, if nothing else because of the benefits to be derived by consumers. One could conclude then that cassava was being unfairly singled out, especially when appropriate processing makes it possible for cassava to enter alternative markets with significant growth potential.

The other dimension of the cassava enigma is that the crop in most respects contradicts the paradigm created by the Green Revolution wheat and rice

varieties. A singular focus on development of improved varieties is not sufficient to achieve impact in cassava. A research strategy for cassava has to focus on the complete commodity system; that is, production, processing, marketing and demand. It is very apparent that a lack of investment in research on postharvest technology can significantly reduce the payoff on investment in production technology and vice versa. The analysis of demand for cassava in different markets at different stages of economic development is an integral part of the research process, helping to define strategy, priorities and outreach activities. Understanding demand is key to understanding the potential impact of research on socioeconomic goals and, in turn, in designing technology introduction strategies that will maximize the achievement of CGIAR objectives. Unlike the rice and wheat model, a cassava research strategy is complex. There is no one-to-one correspondence between release of a new variety and impact on farmer income and food consumption objectives. In cassava research, complexity is necessary to be effective; it also breeds uncertainty and doubts among those who would support it.

The commitment of resources by the CGIAR to cassava indeed should be defined by the future potential of the crop and the contribution cassava can make to the stated objectives of the CGIAR system. As will be shown, cassava is uniquely placed to make a contribution to some of the more intractable of those objectives, especially by maximizing this multifarious demand for the crop.

Problem Structure and Methodology

A world economic study of cassava, focusing on the future potential demand for the crop, is beset from the beginning by the problems of a very weak data base and considerable methodological complexity. The sources of that complexity arise from the following:

-- Cassava is a multiuse commodity, comparable only to maize in the range of its uses. The potential demand for cassava is, therefore, an aggregation of the demand in each individual market. These markets in turn are independent of one another, yet must compete among themselves for the roots. Even within cassava food markets, different cassava products have distinctly different demand characteristics.

-- The postwar period has witnessed a significant increase in the possibilities for commodity substitution, especially in markets for carbohydrate sources. Cassava often competes with different substitutes in different markets. Moreover, although cassava has remained outside the policy arena, policy interventions in the markets for competing substitutes have an obvious impact on the demand for cassava. These policy interventions vary by country. To understand the potential demand for cassava requires an understanding of the complete grain (both food and feed grains)-livestock sector in each country.

-- Under certain conditions cassava is considered a tradable commodity (and thereby directly influenced by trade and exchange rate policies); but under other conditions, cassava is a nontradable (in which case an

assumption of autarky would apply in the analysis of demand). Moreover, because cassava moves in a semiprocessed form, there is no one international market for the commodity; rather there is a starch market, a pellet and chip market, and a flour market. These markets, in turn, have been heavily influenced by trade and tariff policies established by importing countries (there is virtually no market intervention by the exporting countries themselves).

The research problem--the potential world demand for cassava--therefore had to be significantly simplified by comparting the problem into independent components. The first, and absolutely necessary, division was an analysis of cassava production and demand country by country as food consumption patterns, price and trade policies, agroclimatic characteristics, crop production patterns, and overall economic development all vary. As these factors affect cassava demand, the country had to be the unit of analysis. The second level of analytical subdivision was the market. Individual cassava markets were assumed to be independent, and the potential demand in each market was analyzed separately--market size, growth prospects, and the price at which cassava would compete with principal substitutes. A simultaneous evaluation of cassava supply and demand within a multiplicity of markets in each country was beyond the scope of the data base and the manpower available. Two questions then followed from the market analysis: (1) Are production costs for cassava below the market entry price? and (2) what is the potential for bringing the implied root price in the different markets into line; that is, expanding the production base?

The study, in the end, does not give a quantitative projection of the future demand for cassava in the world. Rather the study adopts a positive (rather than normative) approach, asking whether cassava can compete at current production costs and under current prices of substitutes and policy regimes in markets with significant growth prospects. For this study a positive answer implies a basis for demand growth for cassava. The country-by-country analysis, in turn, offers something of a comparative framework for assessing cassava's potential at different stages of development. Cassava already plays a role in all the markets considered in at least a few countries. Understanding what factors have been responsible for cassava's use in these markets gives some basis for understanding whether these same cassava markets will develop in other countries.

Cassava within a Development Framework

Demand is a necessary, but altogether limited, criterion for evaluating the future of cassava in the tropics. Instead, cassava should be evaluated in a broader context, focusing on the crop as a vehicle for development. Ironically, cassava has remained outside the purview of agricultural planners and policymakers; yet it has contributed significantly to meeting policy goals in many developing nations. In other countries this role has been curtailed because policies on grain substitutes have indirectly discriminated against cassava.

The role of cassava in the food and agricultural sector changes as the overall economy develops. In the initial stages when most of the population lives in rural areas, cassava has generally served as a basic

food staple. Cassava's high-yielding ability, adaptation to drought, tolerance to disease and pest attack, and indeterminate harvest period have made it a subsistence crop par excellence, providing a secure food supply even under quite risky conditions. In many areas processed products were developed in order to eliminate the HCN in the roots, as a means of storage, and as a staple for trade. In traditional, rural, cassava-consuming areas per capita consumption levels are usually very high.

In Asia and Latin America today, it is unusual to find farmers who produce cassava purely for subsistence purposes. As urban markets develop and farmers enter into the market economy, cassava shifts increasingly to a cash crop, first supplying food markets. Because processed cassava is relatively inexpensive, it often becomes the staple of the urban poor, such as farinha de mandioca in Northeast Brazil or gari in many parts of West Africa. However, these processed staples usually face a very inelastic demand in urban areas; and it is the growth of other markets such as starch and animal feed that provides the potential for further increases in demand for the crop. Unlike most other carbohydrate staples, cassava is able to maintain a significant elasticity in demand throughout the growth process by shifting into increasingly expansive, alternative markets.

Nevertheless, the transition to a multimarket cassava system has often been inhibited by a number of constraints including grain price policies that discriminate against cassava; capital constraints for investment in processing; insufficient technical information; and inefficient price formation in cassava markets. Knowledge of this unexploited demand, however, opens up cassava's potential as a development tool. Potentially elastic product demand, together with competitive production costs, implies significant income-generation potential for cassava producers.

As these are almost always small-scale farmers operating under some principal agroclimatic constraint, cassava is a rare case where the benefits of new technology can be targeted to that stratum which has normally remained outside the development process. The improved equity in rural income distribution will, in many cases, coincide with a positive benefit for consumers of traditional cassava products, usually the lower income strata. Thus market development, tied to improved cassava-production technology, can set in motion the type of dynamic growth that has occurred in Northeast Thailand over the past 15 years.

Development of cassava markets with elastic demand will depend upon the economy's overall stage of development, as well as on the policy environment for competing substitutes. Two points follow from this. First, the strategy adopted for the development of cassava will vary by continent. No single strategy will apply across tropical Asia, Africa and Latin America. Second, cassava has thus far remained outside the policy-making process, often to its disadvantage. Because of the increasing possibilities for commodity substitution, greater consistency in input, credit and pricing policies is needed across commodities in order to ensure the most efficient utilization of agricultural resources. That cassava production has managed to grow despite these policies is an indication of the existing low production costs for the crop.

The Cassava Economy of Asia

A multiple cassava market system is already well developed in Asia, with cassava uses spanning a range from a basic food source through dried pellets for animal feed to high fructose syrup. Cassava is the second most important starchy staple produced in tropical Asia and is a major cash crop in the upland areas of the region. Cassava has achieved this prominence because of the responsiveness of investment, mostly in small-scale processing capacity, and because of the versatility of cassava as an upland crop (Annex Table 1). Its high-yielding ability makes cassava suitable for the needs of very intensive systems, as reflected in yields reaching as high as 60 t/ha in Tamil Nadu, India. Moreover, cassava is also well adapted to the more extensive systems on the agricultural frontier of tropical Asia and to the spectrum of upland areas with major rainfall or soil constraints.

Rice is the dominant calorie source in the diet of tropical Asia. Like all the other grains, cassava is a secondary staple. As a food source, cassava's main role, particularly in Indonesia and India, has been to augment the calorie consumption of the low-income strata, essentially because of its lower calorie costs. Because of its different forms, cassava has the ability, even as a food commodity, to segment its market, thereby maximizing overall market demand. In Indonesia, for example, the poor consume gaplek, a dried form of cassava. Average income elasticities suggest that gaplek is an inferior good; but because of the positive elasticity in the lower income strata, lower prices and increased supplies of gaplek would target benefits to the very poor. Fresh cassava, on the other hand, has a positive income elasticity and is a more preferred form of consumption; nevertheless, high marketing margins and lack of convenience have limited consumption in urban areas. Finally, a very elastic demand for krupuk, a flavored toasted wafer of cassava starch consumed primarily by the high income strata, has resulted in a positive overall growth in demand for cassava as a food.

Cassava market diversification in Asia over the last two decades has been heavily influenced by the export market. Export prices are set by a preferred (as compared to feed grains) tariff rate for cassava entering the European Economic Community. As a result there is no price integration between world markets for feed grains and for cassava pellets. In general Asian countries have found it more profitable to export cassava and utilize domestic or even imported maize in their animal feed industries. A corollary to this point is that while cassava could have competed in world feed grain markets on a cost basis (Annex Table 2), it could not compete on a price basis; nor did it need to, as the EEC absorbed all that could be produced. The year 1983, however, saw the imposition by the EEC of voluntary export restraints (quotas) on cassava. Thailand was most affected because the quota was below its export capacity. Nevertheless, through effective policy measures, cassava production and exports have continued to grow during the quota period, and farm-level prices were maintained above what could have been achieved by linking the Thai cassava market to the world maize market. Moreover, during this period, when prices of maize and cassava came into line for periods of time, cassava was utilized in the domestic mixed-feed industry in both Thailand and Malaysia. This point is important as it shows that if prices are competitive, cassava

will be used by feed manufacturers in Asia and that cassava prices, for however short a period of time, do sometimes come in line with world feed grain prices.

The world market in most countries in Asia sets a price floor under domestic markets; all major producing countries, except the Philippines, have at some point been exporters. However, in the 1980's, except for Thailand, Asian countries have either reduced export levels or moved to net import positions, especially in cassava starch. Starch demand has been rising rapidly in all these countries, to the extent that countries such as Indonesia and Malaysia have had to import large amounts. Many countries have expanded demand by moving to modified starch production, and Indonesia has begun to produce high-fructose syrups based on cassava starch. Growth markets exist for cassava in Asia, to the point that production is not keeping up with demand.

To date, little improved production technology for cassava has reached the farm level. Declining costs of production could accelerate the diversification of markets in Asia (Table 1), especially into the animal feed market. The market structure already in place has the capacity to

Table 1. Asia: Summary of Market Potential for Cassava by Country.

	Market Potential [1]				
	Food			Animal Feed	
Country	Fresh	Processed	Starch	Domestic	Export
Thailand			++	++	++
Indonesia	+	+	++	*	+
India					
Kerala	+		+		
Tamil Nadu			++		
Semi-Arid		*		*	
Philippines	+		+	*	
China	+		++	++	++
Malaysia			++	++	

[1] Market potential is defined in the following classification:

+ Maintenance of existing consumption levels
++ Growth in existing markets
* Unexploited growth potential due to lack of sufficient production to service all markets

absorb significant increases in production, without drastic declines in prices. This multiple-market structure allows cassava to attain a range of benefits, including simultaneous improvements in the welfare of the low-income consumer (in India and Indonesia) and in the income of the small-scale farmer in the upland areas. Cassava has already been a major source of income growth for farmers in areas such as Northeast Thailand and Lampung, Indonesia. New cassava technology could bring benefits to farmers bypassed by the Green Revolution, especially those that start from a much poorer resource base than those that benefited from the new rice technology.

The Cassava Economy of Latin America

Latin American economies have undergone rapid structural change in the postwar period, accompanied by a number of adjustment problems, as reflected in strains on urban services, high inflation rates, malnutrition among a significant portion of the urban population, a rising external debt, and high rates of unemployment. Many of these problems have been due, directly or indirectly, to the excess rate of rural-urban migration, induced by the very skewed distribution of land resources. The growing number of urban poor has induced an often contradictory agricultural policy, whose two elements have been low urban food prices and income supports to farmers (through intervention in input and output markets). Not surprisingly, policies have often had to resort to subsidies in order to fullfill both objectives.

Cassava has remained outside this policy process; yet it has been strongly affected by policies on grain substitutes. Moreover, cassava has also been affected by the shift in the locus of overall food demand from rural to urban areas. Whereas changing food consumption patterns and restructuring of food markets should have provided an opportunity for growth in market demand for cassava, the fact is that cassava production has stagnated. Unlike Asia, cassava has not been able to make the transition to a multiple market system in Latin America; traditional food markets continue to dominate in the overall demand for cassava.

Prices of substitutes and the "urbanization" of food consumption have been the major influences on overall demand for cassava in Latin America. Only traditional dried cassava products, such as farinha de mandioca in Brazil, are inferior goods (i.e., the income elasticity is negative); and only in Brazil do these products dominate in overall cassava demand. Even here, policy has been the dominant influence on declining consumption, as the very heavy subsidies on wheat flour have completely shifted relative prices and consumption levels for the two commodities (Annex Table 3). For fresh cassava, on the other hand, income elasticities are positive (except in Paraguay), with a very significant elasticity in demand in urban areas. In this case the very high costs of marketing fresh cassava in urban areas have shifted relative prices between rural and urban areas. Per capita consumption levels are much lower in urban than in rural areas although market demand is much more elastic; and with the shift in residence of the population to urban areas, average per capita consumption levels have

declined. However, as the locus of consumption shifts from rural, subsistence consumption to purchased cassava, actual market demand for cassava has been increasing at a significant rate (Annex Table 4). Recent advances in storage technology for fresh cassava promise to lower marketing costs and improve consumer convenience, thereby increasing market demand even further.

Nevertheless, the major potential growth in demand for cassava exists in the market for animal feed components (Table 2). Technical change in

Table 2. Latin America: Summary of Market Potential for Cassava by Country.

	Market Potential[1]				
	Food			Animal Feed	
Country	Fresh	Processed	Starch	On-Farm	Dried
Mexico				*	*
Nicaragua	++				*
Panama	+				*
Cuba	+			*	*
Haiti		++		*	
Dom. Rep.	++	+		*	
Brazil					
Northeast	++	+			*
North		++			
South	++		++	++	
Colombia	++				*
Ecuador	+				*
Peru	++				*
Venezuela	++				*
Paraguay	+	+	++	++	

[1] Market potential is defined in the following classification:
+ Maintenance of existing consumption levels
++ Growth in existing markets
* Unexploited growth potential due to policy or market constraints

animal production and changes in market structure for meats have made this a very expansive market in the last two decades. New breeds and the availability of protein concentrates have made cassava a major on-farm feed source for swine in southern Brazil and eastern Paraguay, and more recently, in southern Mexico. However, the major potential market is for dried cassava in mixed animal feeds. In most tropical Latin American countries, price interventions in the feed grain market have curbed a potential role for cassava. However, with the devaluation of exchange

rates, reduction in subsidies, and rationalization of prices in response to the 1982 debt crisis, cassava is now competitive on a cost basis with domestically produced feed grains in all major producing countries except Venezuela, where a differential exchange rate policy for feed grain imports still makes cassava uncompetitive (Annex Table 5).

Even though economic growth and structural change in Latin America have fostered market diversification in many agricultural commodities, there has been little development of multimarket systems in cassava. This is partly due to policies on substitutes, as well as to lack of efficient price formation within cassava markets. Developing the market for cassava as an animal feed source provides a virtually unique opportunity for developing more well-integrated cassava markets and for raising incomes of small-scale farmers in Latin America, especially those in more marginal agroclimatic areas such as northeastern Brazil, the Atlantic Coast of Colombia, or the coastal plain of Ecuador. Excess capacity exists in these systems because of limited cropping alternatives and inelastic demand for those that are grown. Development of a processing capacity for dried cassava puts a price floor under existing markets, providing the incentive to expand production.

Increased production in turn brings greater price stability to cassava food markets, thereby benefiting consumers. These initial interventions are organized as integrated cassava development projects, which develop the market channels, provide the credit and technical assistance for the processing technology, and extend production technology. Projects are now functioning in Colombia, Ecuador, Panama, Mexico and Brazil. Dried cassava is now being competitively produced for the feed industry in Latin America, and the benefits are being targeted on the small-scale producer.

The Prognosis for Cassava in Africa

Cassava is the most important food crop in sub-Saharan Africa, providing more than 200 calories per day for over 200 million people. Cassava's central role in the African diet takes on special importance as Africa is the only region in the world where per capita food production has been declining. At issue in the short term is the role of cassava in reversing that trend; and in the longer term, the contribution cassava can make to overall development of the agricultural sector in Africa. Yet, analysis and data to address these issues are virtually nonexistent.

Cassava's future in Africa rests upon defining the income and employment generation potential of the crop. Any role here in turn is linked to developing marketable surpluses, on the one hand, and identifying and developing markets, on the other hand. These issues in turn lead to questions about the type of product (there are a wide range of cassava food products in Africa), the demand parameters for the different products, the interventions needed in processing technology and marketing channels, and the effect of pricing policies on substitutes. Cassava has a potential role as a farm income source in current production areas, if marketing channels to growing urban areas can be opened, and as a stabilizing component in farming systems in marginal, food-deficit areas. In order to develop strategies to foster these roles, it is necessary to answer the foregoing questions. To begin to plan for development of cassava in Africa, a joint IITA-CIAT study has been developed to characterize cassava

production, processing, marketing and demand. The three-year project is seen as an integral part of IITA and CIAT's development of a consistent research strategy for cassava on the continent.

ANNEX TABLES

Annex Table 1. Asia: Type of Land Constraint in the Principal Cassava Production Zones

Country	Type of Land Constraint		
	Limited Farm Size	Marginal Agro-Climatic Conditions	Frontier Areas
China	Guangdong	Guangxi	
India	Kerala Tamil Nadu (irrigated)	Tamil Nadu (non-irrigated)	
Indonesia	Java (level sawah)	Java (eroded hillside)	Transmigration schemes
Malaysia		Peat soils	Land development zones
Philippines	Visayas		Mindinao
Thailand	Central Plain	Northeast	Northern region

Annex Table 2. Comparison of Costs of Maize from Major Exporters and Cassava (on a maize equivalent basis) from Thailand, cif Japan.

	Maize			Cassava
	U.S.A. ($/t)	Argentina ($/t)	Brazil ($/t)	Thailand ($/t)
Production Costs				
Variable Costs	60.0	37.9	66.6	52.6
Fixed Costs	59.8	32.9	68.2	7.7
Total Costs	119.8	70.8	134.8	60.3
Marketing and Processing	24.7	25.3	33.9	33.8
F.O.B. Costs	144.5	96.1	168.7	94.1
Freight to Japan	26.0	32.4	34.2	10.0
C.I.F. Costs	170.5	128.5	202.9	104.1
Yield (t/ha)	6.25	3.36	2.22	5.22

Note: All costs are at 1985 prices and exchange rates. Thai cassava costs represent 1981 costs multiplied by the wholesale price index and divided by the 1985 exchange rate. Costs are then put on a maize equivalent basis by dividing by 0.7.

Source: Maize: Ortmann, G., U.J. Stulp, and N. Rask, "International Trade and Economic Development: Examples of Comparative Costs in International Commodities," 1986; and Cassava: CIAT.

Annex Table 3. Brazil: Relationship between farinha de mandioca and wheat flour prices and consumption, 1960-80.

	1960	1970	1980
Farinha Consumption (kg/capita)	26.3	23.5	12.0
Wheat Consumption (kg/capita)	26.2	25.2	45.5
Farinha/Wheat Consumption	1.00	0.93	0.26
Farinha/Wheat Prices	0.61	0.64	2.95

Annex Table 4. Colombia: Disaggregation of Demand Parameters for Fresh Cassava in Rural and Urban Areas, 1983.

Parameters	Rural	Urban
Population Growth	- 0.1	3.7
Income Elasticity	0.28	0.38
Per Capita Income Growth	2.5	1.4
Demand Growth	0.6	4.2
Weighted Average [1]	0.51 (0.6) +	.49 (4.2) = 2.4

[1] Weights are distribution of total consumption between rural and urban areas in 1983.

Annex Table 5. Latin America: Comparison of Production Costs for Dried Cassava and Prices for Cassava and the Principal Feedgrain, 1986

Country	Production Cost [1]	Price [1]		
	Cassava	Cassava	Grain	Cassava/ Grain
Sorghum:				
Colombia	17,044	25,600	32,000	80
Mexico	50,429	64,000	78,000	82
Venezuela	1,279	1,870	2,200	85
Maize:				
Peru	994[2]	2,475	3,300	75
Panama	170	180	230	78
Paraguay	32,406	56,000	70,000[3]	75
Brazil	1,306	1,330	1,705	78

[1] Price and costs in local currency per ton.
[2] Assumes cassava comes under ENCI purchasing system, in which case transport costs are not included.
[3] Maize import price,