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GLOBAL CASSAVA RESEARCH AND DEVELOPMENT

Agroeconomic Study of Cassava
in Sub-Saharan Africa

Presented by

Centro Internacional de Agricultura Tropical (CIAT)
Cali, Colombia

and

International Institute of Tropical Agriculture (IITA)
Ibadan, Nigeria

May 1987



PED. EXTERIOR

AGROECONOMIC STUDY OF CASSAVA IN SUB-SAHARAN AFRICA



A PROPOSAL

PRESENTED BY THE

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BACKGROUND

Cassava Within the Context of the African Food Situation

Cassava, since its introduction into the continent in the 16th century, has spread throughout sub-Saharan Africa to become one of the dominant starchy staples in the diet. Although the crop is grown in every country of the sub-continent, it is especially concentrated in the humid, tropical regions. Africa produces 48 million tons of cassava annually from 7.4 million hectares, and provides more than 200 calories per day for 200 million people on the continent. It is the dominant staple in Central Africa, making up over 50 percent of average staple food consumption in Zaire, People's Republic of the Congo and the Central African Republic. In the coastal West African countries stretching from Ivory Coast to Nigeria (Figure 1), cassava shares an equal place with yams, and further west in coastal West Africa cassava is the second most important staple after rice. In East Africa maize is the dominant staple in most countries, but cassava is of key importance in Mozambique, Tanzania, Uganda, Rwanda and Burundi.

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. Prior to independence, Africa was essentially self-sufficient in basic food staples. Over the succeeding two decades, however, this position has slowly, but steadily deteriorated into one of food import dependence, where cereal imports are filling the gap created by insufficient growth in production of domestic staples. Financing these imports has become increasingly difficult as African countries have watched their balance of trade turn negative and the repayments on their external debt rise. Falling per capita food production and declining international financial liquidity are particularly problematic in the light of estimates that approximately 150 million out of 450 million Africans suffer from some form of malnutrition.

The African food problem is commonly traced to problems on the supply side. Because of stagnant or even falling productivity, area

expansion, which is usually into more marginal agricultural zones, is not sufficient to enable production to keep pace with rapidly expanding population. Moreover, rising population densities in these more marginal rainfall areas have reduced the buffering capacity of subsistence production units against major variation in rainfall, often resulting in substantial shortfalls in food needs in those years when rainfall is especially short. This situation of periodic famines has given particular urgency to the African food problem.

Nevertheless, demand-side factors are also operative in defining food needs. The most salient feature in this regard is the very marked rate of growth in the urban population. Although only approximately 25 percent of the African population resides in urban areas, the growth rate of the urban population has been high, in most countries exceeding 5 percent per annum. Rapid urbanization usually results in a shift to foods that are relatively convenient to store and prepare in the home. If transport and marketing systems are not limiting and farmers are responsive to changes in food demand inherent in the urban diet, urbanization can generate demand-led growth and increased incomes in the agricultural sector. On the other hand, when the domestic agricultural sector is unable to respond to increased urban demand, rising urban food prices have often led to government intervention to regulate prices and to meet shortfalls through imports of cereals. Prices of imported cereals to urban consumers are often kept relatively low through overvalued exchange rates, food aid, concessional sales, and sometimes direct subsidies. Such interventions, in turn, further retard the development of domestic marketable surpluses, not only of cereals but also of cassava and other substitutes for grain, a clear example of the tendency to sacrifice long-term growth and structural adjustment in favor of short-term political needs.

DEVELOPMENT STRATEGIES FOR CASSAVA

At issue then is the role that cassava could play in developing an overall food and agricultural strategy for Africa. In defining such a

role, short-term strategies should not mask the planning for longer term development needs. Defining such a role can only be sketched in broad outline. Of more immediate concern is the role cassava can serve in bridging the food gap. Food production in Africa is fundamentally based on rainfed farming systems. This makes African farming inherently risky, with marked variation in food supplies both annually and seasonally. This highly variable production situation is made even more unstable in areas where land is made scarce by rapid growth in rural population which either reduces farm size or induces migration to more marginal agricultural areas.

Cassava's adaptation to relatively marginal soil and rainfall conditions, its high productivity per unit of land or labor, the certainty of obtaining some yield even under adverse conditions, and the possibility of maintaining continuity of supply throughout the year have made this root crop a basic component of the farming system in large areas of Africa. Famines rarely occur in areas where cassava is widely grown, as it provides a stable base to the food production system.

This indicates that cassava can play a critical role in bridging the food gap. One of the questions arising from this is the part that research can play in strengthening such a role. Basically three roles are possible:

1. Increased productivity in existing cassava systems. In some current production areas higher population densities and shortened fallow period are placing a premium on increased yields. Opportunity for increasing productivity through the use of chemical inputs such as fertilizers and pesticides are limited because shortages of foreign exchange limit the supply of the chemicals and inadequate rural infrastructure hinders their distribution. There is, however, significant scope within cassava cropping systems to achieve yield increases through changes in varieties and basic management practices.

2. Movement into marginal areas. A more radical role for cassava would be to stimulate production in non-traditional growing areas, especially where there is a food deficit. In recent years cassava has been expanding in the densely populated highlands of Central Africa and areas where there are seasonal rainfall constraints. Further expansion of cassava in these regions is a possible means of stabilizing food production. Such a strategy, however, may require broadening the germplasm base presently available in Africa. There is a wide diversity in production conditions in African agriculture and few crops do as well as cassava over such diverse conditions, especially where they are not supported by high input use.

3. Meeting an expanding urban demand. A complementary approach is to increase production and move cassava from surplus-producing areas (or potential surplus areas) to food-deficit areas. Such an approach depends first on a marketing system where transport costs do not become excessive in the eventual retail price, and second on a certain minimal level of purchasing power in the importing region. For the latter reason such trade in cassava will probably best be directed at rapidly expanding urban areas and particularly at the low-income strata in those areas. Processing also will be critical to such a role. Such a strategy can build on the extensive trade in gari (a fermented food product) that already exists in West Africa. In many urban areas of West Africa, gari is already the cheapest source of calories and stores well.

Marketed surpluses, moreover, provide the basis for utilizing cassava in a longer term development strategy for the agricultural economies of Africa because marketable surpluses are an avenue for increased farm incomes and increased employment. Traditionally in Africa this surplus generation has been based principally on non-food cash crops, principally for export. The multiple uses of cassava can provide a basis for developing cassava as a cash crop, with the advantage that an expanded production can stabilize food consumption when national food production of other crops is adversely affected by weather. In Asia cassava has provided such stability to the food

economies of Indonesia and Kerala (India), where a large proportion of the crop is grown because of the demand by commercial processors but where it can move into food channels when rice supplies are limited. Moreover, development of cassava based on small-scale, rural processing can provide significant sources of off-farm employment. Cassava can thus make a significant contribution to both bridging the food gap and laying a base for longer term economic development, but only if the strategy for research and development of the crop focuses on its role as a source of income generation and not purely on its role as a subsistence food crop.

Making this strategy operational depends on more detailed information about cassava growing conditions, production systems, processing methods, marketing, and urban consumption patterns. Not only is there very little information on these issues available but even the production statistics are at best no more than educated guesses. The data base on which to begin to structure cassava research and development activities is so weak as to provide only rough hypotheses. Justifying a larger role for cassava to policy-makers, as well as to outside donor agencies, will require a much more systematic study of the economics of the crop.

PRESENT STATE OF CASSAVA RESEARCH WITHIN THE CGIAR SYSTEM

Unlike most other staple crops, virtually no research on cassava is carried out in developed countries. Cassava research, which has been motivated principally through CGIAR funding, started in the early 1970's. Cassava research in the CGIAR system is carried out by two centers: CIAT, which has the global mandate for the crop and regional responsibility for Latin America and Asia, and IITA, which has regional responsibility for Africa. The primary focus in both programs has been on developing improved production technologies, with genetic improvement of the crop being the central focus.

IITA has developed improved varieties and breeding populations and families for Sub-Saharan Africa that are high yielding, resistant to diseases and insect pests, good in quality for consumer acceptance and low in cyanide content. For example, improved varieties from the IITA breeding program have been adopted by cassava farmers throughout Nigeria. It is estimated that present improved varieties will be planted on three million hectares by 1990. Sierra Leone, Liberia, Cameroon, Gabon, Zaire, Rwanda, Tanzania and the Seychelles are all countries that have released new varieties selected from IITA improved breeding material. Furthermore, the biological control of the cassava mealybug in Sub-Saharan Africa is within reach of complete success. Among the natural enemies imported from South America for control of the cassava mealybug (Phenacoccus manihot), the parasitic wasp Epidinocarsis lopesi has proven to be particularly successful over the past three years. It has now been released and established in 13 countries over 650,000 km² in Africa.

During 1986, IITA conducted an economic analysis of cassava production, marketing and demand in Africa as part of its Strategic Planning Study designed to help the institute identify priority areas for research. The study relied on published literature, visits to several major cassava-producing countries, and discussions with informed national researchers and others for information on cassava. This broad overview served as a background document for meetings of the Strategic Planning Study Group, which named cassava as one of the Institute's priority crops.

CIAT has devoted considerable resources to research on cassava over the past decade and a half. The world's largest germplasm collection held by CIAT has been carefully evaluated and many useful characters from this collection have now been incorporated into the breeding populations that IITA is distributing throughout Africa. Apart from work covering production aspects CIAT has recently emphasized the development of post-harvest technologies and the analysis of market diversification as a means of making cassava more commercially viable in Latin America. These research activities have in turn led to the

setting up of national research programs in the principal producing, developing countries.

For the past two to three years, CIAT has been undertaking an intensive analysis of cassava production, marketing and demand in Asia and Latin America. The studies focus on evaluating the current status of cassava in each major producing country, leading to an evaluation of production constraints, market constraints and potential for developing new markets. These studies have helped to guide the CIAT Cassava Program in the development of its research program in both production and utilization technologies and in the formulation of an international cooperation strategy. Additionally, the studies have provided a direct input into the formulation of national program plans for cassava research and development by local agencies.

IFPRI (The International Food Policy Research Institute) is also currently conducting a study, "Analysis of Trends and Prospects for Cassava in the Third World", funded by IDRC (International Development Research Centre). This project involves analysis mainly of secondary data and includes case studies of two major cassava producing countries in Africa: Zaire and Nigeria, as well as several countries in Asia. The proposed CIAT/IITA study would build on the foundation laid by IFPRI's work in Africa, but would involve significant efforts at primary data collection in production, processing and consumption of cassava.

An in-depth economic study of cassava in Africa would serve several critical functions. First, the African component would complete a global analysis of cassava. The completed study will provide a solid basis for evaluating the potential of this neglected crop, on which so little rigorous socio-economic research has been done. At the level of the CGIAR system, the study will provide the basis for planning longer term research resource needs for the crop. Second, the study will be a central component in the evolution of IITA's research and outreach strategy for cassava in Africa. The types of issues discussed in the previous section--increasing productivity in existing cassava systems, moving of cassava into marginal areas, and meeting an expanding urban

demand with increased cassava production near urban centres--will be fleshed out in detail so as to have both a medium and long-term perspective on the development of the crop. Likewise the study will identify those areas where more cooperative research projects between IITA and CIAT are required to meet research needs in Africa. Finally, the study will aid policy-makers of national programs in setting priorities and developing strategies for cassava.

PROJECT PROPOSAL

Objectives

An economic study of cassava in Africa is a means to an end, that being the elaboration of a solid analytical base for consistent planning of research and development activities of the crop. Needless to say this is not an easy task. There are very few reliable secondary data on cassava production, prices, marketing channels and consumption. National production statistics for cassava are often incomplete and may be questionable under scrutiny. Moreover, very few case studies exist that focus on cassava in any detail. While there is an obvious need for such a study, in itself it is handicapped by the lack of secondary data on which to form hypotheses or plan surveys. Thus a central feature of the project will be the collection of primary data; and, as the study will be continental in scope, selection of survey sites will have to be done in a systematic manner.

The overall objective of the project, therefore, will be to provide an in-depth characterization of cassava production, processing and marketing in Sub-Saharan Africa. The specific objectives are as follows:

1. Describe the structure of cassava-based cropping systems in principal and potential producing areas.
2. Define the technical and economic parameters for traditional cassava processing techniques.

3. Provide estimates of the consumption of cassava products within the diets of the rural population in principal cassava-producing regions.
4. Define the role of cassava as an income source in farming systems and the structure of marketing channels for cassava products.
5. Estimate demand parameters for different cassava products in urban areas.
6. Quantify the impact of price and import policies for grains on the production and consumption of cassava.

Project Structure and Research Methodology

Virtually no reliable secondary data on cassava exist for African countries. Moreover, in contrast to Asia and Latin America, the dominant issues shift from demand constraints to production and marketing constraints. In order to understand these constraints, given the lack of secondary data, there is a need for a project fundamentally based on surveys and primary data collection. Single-visit surveys are usually inappropriate if accurate data on production, yields, resource use and on-farm utilization are desired. Appropriate survey methodology, experienced personnel, and close field supervision are critical to the study.

Topic Coverage

The data collection and analysis can be divided into four relatively independent subject areas, namely: (1) production, processing and consumption at the village level, (2) marketing of cassava products and price formation, (3) urban consumption patterns and urban food demand, and (4) effects of price and trade policies on cassava production and demand. The bulk of the primary data collection will focus on the first component. The second and third components will also require primary data collection but these will be undertaken in more

limited areas to complement existing marketing studies and food budget surveys and will assess global marketing and urban consumption issues by means of well-defined case studies.

There will be a significant technical input into specific areas, particularly production and processing, and possibly nutrition. Technical expertise in defining constraints on cropping systems will be provided by production scientists at IITA and CIAT. With regard to the processing component, there is a special need to evaluate the effectiveness of HCN elimination and to characterize quality factors of the different cassava products. The Tropical Development Research Institute (TDRI) of London, England has completed a substantial body of research in this area. TDRI personnel will be involved in (a) developing the questionnaire that will be used for evaluating processing; (b) field-level technical assessment of processing methods; and (c) laboratory analyses of samples collected in survey sites. A nutritional element will be an additional component, especially in the areas with very high consumption levels of cassava root products and leaves although this expertise lies outside the Centers. Contact has tentatively been established with the International Child Health Unit based in Sweden, to assist with the nutritional aspect. They will carry out nutritional surveys and evaluate the health status of the population in high cassava consumption areas of Zaire, Tanzania and Mozambique. They have shown great interest in collaborating with this project.

Area Coverage

The study will be continental in scope, but will have to be selective in terms of where in-depth surveys will be carried out. Operationally, the project will be divided into three regions, namely, West, Central, and East and Southern Africa (Figure 1). In each of these regions, priority countries will be chosen that reflect both major production zones as well as global issues of interest to the study. A first approximation to these priority countries is as follows: (1) West Africa: Nigeria, Ghana and Ivory Coast; (2) Central Africa: Zaire, Cameroon, and Central African Republic; and (3) East and Southern Africa:

Tanzania, Rwanda, Uganda, and possibly Mozambique. The latter region will be closely tied to the East and Southern Africa Root Crops Research Network (ESARRN) coordinated by IITA and jointly funded by USAID and IDRC.

Survey Methodology

Appropriate sampling will be the key to establishing the variability found in African production and consumption patterns of cassava. Developing a sampling frame when the population is essentially unknown and agricultural census data are scarce requires a series of stages in which information is developed to feed into the sample design. The framework for selecting survey sites will be based on the experience CIAT gained in the Latin American study. This process will involve three stages:

1) An agro-climatic mapping of the distribution of cassava production will be developed. CIAT has developed such a mapping for Latin America and has the meteorological data base, soil maps, and zoning characteristics to do the same for Africa. The difficulty is in getting a first, albeit gross, estimate of the spatial distribution of cassava production. IDRC has financed a project to collect basic existing information on cassava in all principal producing countries. These data will be the basis for the mapping of cassava distribution.

2) The mapping will be used to subdivide and sample relatively large geographical areas. Drawing on CIAT's experience in this area, cassava production and consumption will be characterized on a regional basis through key informant surveys; i.e., extension agents, cassava researchers and farmer-leaders. The focus of the survey is not on the farm, but on the region and on eliciting the spatial distribution of characteristics of interest. This stage will provide the sampling frame for selection of areas, stratified by characteristics that influence variability in cassava production and consumption, and weighted by production.

3) Once geographical areas have been sampled, then a more conventional sampling strategy will be used to select villages and farmers within villages. At this stage detailed questionnaires will be developed on production, processing and consumption. A balance will be sought between generating comparable data across survey sites and understanding the particular influences on cassava systems at each site. Some of the variability will be apparent in the second stage, which will allow focus on particular issues in given areas in the farmer survey stage.

Project Structure and Administration

The project organization will have a full-time project leader, to be based at IITA, and who will administer and coordinate the project. He will report to the Director of the Resource and Crop Management Program (RCMP) of IITA where the position which will be located. A steering committee, consisting of the CIAT cassava economist, the Director of the RCMP at IITA, and the project leader will be responsible for the overall supervision of the project. Each of the three regions (i.e. West, Central, and East and Southern Africa) will have one agricultural economist or economic anthropologist who will act as regional coordinator and will be responsible for leading the research in each region. In priority countries a national coordinator will be contracted part-time from one of the universities or research institutes and will be in charge of (a) identifying graduate students for day-to-day survey management in the survey sites; (b) establishing the research agenda for the country; and (c) overseeing data management and doing some of the analyses. Such a structure will assure a well-supervised field survey capacity, but with research objectives defined at a continental scale.

In the priority countries the following national research institutes and universities are potential collaborators in the project. They will be formally contacted when the project funding is secured. At that time a mechanism for ensuring their effective collaboration will be worked out. This will include a formal consultation mechanism.

1. Cameroon
 - a) Institute of Agronomic Research, Cameroon
 - b) Department of Agricultural Economics, University of Dschang
2. Central African Republic
 - a) Station Principale Agricole, Grimari
3. Cote d'Ivoire
 - a) Centre Ivoirien de Recherches Economiques et Sociales (CIRES), Abidjan
 - b) Institut de Recherches Agronomiques Tropicales et des Cultures Vivrieres (IDESSA), Bouake
 - c) University of Abidjan
4. Ghana
 - a) Crop Research Institute, Kumasi
 - b) Faculty of Agriculture, University of Ghana, Legon, Accra
 - c) Cape Coast University, Cape Coast
5. Mozambique
 - a) Instituto Nacional de Investigaçao Agronómica (INIA), Maputo
6. Nigeria
 - a) Root Crops Research Institute, Umudike, Umuahia
 - b) Department of Agricultural Economics, University of Nigeria, Nsukka
 - c) Department of Agricultural Economics, University of Ibadan, Ibadan
7. Rwanda
 - a) Institut des Sciences Agronomiques du Rwanda, Butare
 - b) Université National du Rwanda, Butare
8. Tanzania
 - a) National Root and Tuber Improvement Programme, Agriculture Research Institute, Ukiriguru, Mwanza
 - b) Sokoine University of Agriculture, Morogoro
 - c) University of Dar es Salaam, Dar es Salaam
9. Zaire
 - a) Program National Manioc (PRONAM), Kinshasa
 - b) Université du Zaire, Kinshasa

Time Frame

The project is expected to require three years to complete. Given timely funding, the project head will be appointed in early 1988 and the regional coordinators shortly thereafter. The information search will be completed by this time, and the agro-climatic mapping should be under way. Prior to the initial planning meeting, an in-depth background study on cassava in Africa will be written by Paul Dorosh of IITA. The second stage of the project involving the key informant surveys will begin in 1989. The village level surveys will continue for one year. Data collection in the marketing, urban consumption and policy areas will occur simultaneously and will also overlap with the analysis and write-up period in the third year which will extend to the middle of 1991.

FINANCIAL REQUIREMENTS

The budget consists of the leader's office and the three regional offices. The needs for each region are virtually the same. The major items are personnel costs, fixed capital items for field work (e.g. vehicles and microcomputers) and travel expenses for consultants. The budget breakdown is shown in the attached table.

Budget Notes

The Overseas Development Administration (ODA) of Great Britain have expressed an interest in funding through TDRI an economist for a complete year on the project in the evaluation of processing techniques. The following budgetary notes assume that the Regional Coordinators of West, Central, and East and Southern Africa will be located at Cote d'Ivoire (Abidjan), Kinshasa (Zaire), and Dar-es-Saalam, (Tanzania), respectively. These locations could be changed following further consultation with the national programs. The Project Leader will be based at IITA with the RCMP.

National coordinators may be obtained through secondment from the national university or research systems which will be refunded at cost or they may be recruited as direct hires at the local going rate. The full-time persons will be needed in each of the three regions at an estimated cost of \$5,000/p.y.

The secretaries and other local staff will be hired locally at the current national rate inclusive of social benefits. The cost will vary from one country to another.

Ph.D. Fellowships - Five agricultural graduates from each of the three Regions of Africa will be given the opportunity to work for the Project. They will be awarded a fellowship for the entire period (or it could be for the second and third year only) of their Ph.D. studies. The cost of the fellowship for a student registering at one of the leading African universities and for each of the three years has been evaluated and used as the basis of this budget. Two visits to IITA are included in this budget estimation.

The national coordinators will be required to travel regularly (100 days/year) within their countries to the survey sites. In certain countries, e.g. Zaire, this entails travel by air to the sub-regions and by public transport within the sub-region.

AGRO-ECONOMIC CASSAVA

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>
Project Leader			
Salary, benefits	110,000	110,000	110,000
Secretary	4,000	4,000	4,000
Admin. Assistant	4,000	4,000	4,000
Accounting Assist.	4,000	4,000	4,000
Research Assoc. I	10,000	10,000	10,000
Research Assoc. II		10,000	10,000
Travel	15,000	15,000	15,000
Vehicle Maint., Gas	6,000	6,000	6,000
Supplies	5,000	5,000	5,000
Services	5,000	5,000	5,000
Western Region			
Regional Coord.	75,000	75,000	75,000
National Coord. (2)		10,000	10,000
Enumerators		7,500	
Secretary	4,000	4,000	4,000
Grad. Students (5)	37,600	28,600	37,600
Travel	10,000	10,000	10,000
Survey Travel		7,000	7,000
Supplies	5,000	5,000	5,000
Services	5,000	5,000	5,000
Vehicle Maint. Gas	6,000	6,000	6,000
Central Region			
Regional Coord.	75,000	75,000	75,000
National Coord. (2)		10,000	10,000
Enumerators		7,500	
Secretary	4,000	4,000	4,000
Grad. Students (5)	37,600	28,600	37,600
Travel	10,000	10,000	10,000
Survey Travel		10,000	10,000
Supplies	5,000	5,000	5,000
Services	5,000	5,000	5,000
Vehicle Main. Gas	6,000	6,000	6,000
Eastern Region			
Regional Coord.	75,000	75,000	75,000
National Coord. (2)		10,000	10,000
Enumerators		7,500	
Secretary	4,000	4,000	4,000
Grad. Students (5)	37,600	28,600	37,600

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Total 3 Years</u>
Travel	10,000	10,000	10,000	
Survey Travel		7,000	7,000	
Supplies	5,000	5,000	5,000	
Services	5,000	5,000	5,000	
Vehicle Maint,Gas	6,000	6,000	6,000	
Other				
Planning Workshops		15,000		
CIAT Travel	20,000	20,000	20,000	
Subtotal	640,800	715,300	704,800	2,060,900
Capital				
Vehicles(8)	120,000			
Computers(4)	24,000			
Office equipment	10,000			
Motorbikes(12)	18,000			
Capital Costs	172,000	0	0	172,000
Grand total	812,800	715,300	704,800	2,232,900

