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**PRODUCTION, MARKETS, PRICES, AND FOOD  
SECURITY RELATIONSHIPS AMONG SELECTED  
STORABLE COMMODITIES IN RWANDA:  
A RESEARCH PROGRAM OVERVIEW**

by

**SESA/MSU Research Team**

**Working Paper No. (DRAFT)**

**MINISTERE DE L'AGRICULTURE,  
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REPUBLIQUE RWANDAISE**

## SESA WORKING PAPERS

The SESA working paper publication series is designed to provide users with timely research results while refinements and longer-term synthesis are completed and final reports are produced. The preparation of working papers and their discussion with those who design and influence programs and policies in Rwanda is an important step in SESA's overall survey and analysis mission. Comments and discussions on working papers helps identify additional questions for consideration in further research and in refinements of major reports to be written by SESA researchers. Users of these working papers are encouraged to submit comments and inform us of on-going information and analysis needs.

Serge Rwamasirabo  
Director of SESA



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**1986**

## **ACKNOWLEDGEMENTS**

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## **I. INTRODUCTION AND OVERVIEW**

This paper briefly describes an applied research project being undertaken by the Agricultural Survey and Statistical Service (SESA) of the Ministry of Agriculture in collaboration with the Department of Agricultural Economics at Michigan State University, USA.

## **II. AFRICA-WIDE FOCUS OF RESEARCH**

The project for Rwanda will also contribute to the objectives of a USAID/Michigan State University Cooperative Research Agreement entitled "Food Security in Africa." The overall goal of this broader research project is to assist African governments and policy makers in devising ways of achieving improved food security. For purposes of this research, food security is defined as "the ability of a country or region to assure, on a continuous long-term basis, that its food system provides the total population access to a timely, reliable, and nutritionally adequate supply of food." This definition has both transitory and chronic dimensions.

### **2.1 Dimensions of Food Security**

Transitory food insecurity refers to a short term inability by some part of the population to gain access to adequate food. This may happen when there are: 1) transitory fluctuations in farmers own production of food; 2) transitory higher real prices of food (due to shortfalls in national production) which may price the poor out of the market; 3) disruption of the marketing system due to natural disasters or civil disorder; or 4) temporary declines in real income from either farm or non-farm sources which prevent the country (or particular individuals in it) from buying adequate food from the domestic or international market. Many international research and assistance organizations are focusing major attention on identifying, forecasting and relieving transitory food security problems. See for example work by FAO, The World Bank, IFPRI, and the IMF.

Chronic failure to provide food security results when some part of the population has a chronic or long-term inability to gain access to an adequate supply of food. The chronic dimension of food security has two related subdimensions: 1) a substantial portion of the population in many poor countries permanently lack adequate real income to gain access to sufficient food, either from their own production or by purchasing it in

the market; 2) food systems in many countries have a limited ability to increase the supply of food at low cost.

The "Food Security in Africa" Cooperative Agreement research project at Michigan State University relates to both transitory and chronic food security problems, but gives primary focus to identifying and better understanding the barriers to increased long-term production and productivity in national food systems. The primary research agenda relates to understanding the interaction of technological change, institutional reforms, and macro-level policy in overcoming food production and marketing constraints. In undertaking this primary focus on longer-term supply expansion, the research will treat key relationships and linkages to transitory food security problems and inadequate short and long-term real income problems.

### **III. RESEARCH FOCUS IN RWANDA**

#### **3.1 Commodity and Policy Focus**

Beans, sorghum, bananas, cassava, and sweet potatoes are the five most important sources of calories in the Rwandan diet. Beans are also the most important source of protein, especially for the rural population. Sorghum is mostly used in the production of beer, although more sorghum can be consumed directly during stress periods. Bananas and sweet potatoes have considerable storage flexibility as long as they are left on the tree or in the ground, but do not store well once harvested. Cassava is likewise an important crop that can be considered a food reserve to deal with transitory food security problems.

One important food security related question in Rwanda is: what are the strategies that different types of rural households have for shifting consumption among these and other crops during periods of shortage and how do these short term coping strategies affect longer-term crop mix, technology use and overall production? Another important question is: how to overcome constraints to expanding the production of these products, especially the storable commodities like beans and sorghum?

The Government of Rwanda has developed a national food strategy aimed at expanding overall production and consumption. Technology, institutional and price policy are important instruments the Government is using to help achieve their food strategy goals of increasing by the year 2000, among other things, nationwide average yields of beans to 1100kg/ha (from a current base of about 700 kg/ha) and of sorghum to 1800

kg/ha (from approximate current average yields of 1100 kg/ha). One of the critical challenges facing food strategy policy makers in Rwanda is to discover and implement effective technology, institutional and price policies to expand overall food system production and productivity. This research is designed to support the Governments' ongoing efforts to better understand the type and mix of policies that could be most effective and affordable.

The Government's technology policy involves strengthening the research capabilities of its national agricultural research organization (ISAR) in cooperation with donors and international research centers such as CIAT (for beans) and ICRISAT (for sorghum). There is an especially important relationship between beans, sorghum, and maize because of the nitrogen fixing capabilities of beans, and because climbing beans are thought to be more productive per unit of land. The search for more productive and appropriate varieties of sorghum and maize that can be intercropped each season with improved beans constitutes one important technology research theme.

A pluralistic institutional policy has been followed toward input and output marketing firms in Rwanda. Private marketing firms are allowed and major road improvement investments over the past 10-15 years have significantly improved transportation infrastructure. Many private merchants have acquired small and medium volume trucks, and are thought to play an important role in input and output arbitrage across the various regions of the country. Cooperatives are also promoted, and a number of foreign donor projects are assisting the Government in cooperative development efforts. Since 1974, the Rwandan Government (with various foreign donor assistance) has also developed a national grain storage and price stabilization agency (GREMARWA, now integrated into OPROVIA).

In matters of grain price policy, Rwanda has for the most part pursued a pragmatic program of "indicative pricing." This means that the Government establishes a target price, but for the most part does not require private merchants to adhere to these prices.<sup>1</sup> Yet if market prices do deviate significantly from target levels, OPROVIA/GREMARWA has the mandate to release (acquire) stocks to depress (increase) prices. OPROVIA also regularly tries to purchase beans in rural areas shortly after harvest in order to put upward pressure on market prices.

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<sup>1</sup> 1986 is a unique year in that the Government has established a target price of 35 RFR/kilo which is significantly above the market price at the farm level, and has assured OPROVIA that it can sell a specified maximum quantity of beans purchased at this price to public institutions at 45 RFR/kilo.

Government officials in Rwanda have also expressed a desire to improve their food and agricultural price (and quantity) information system. First, improved knowledge of how the market works and behaves under different stress conditions can provide valuable inputs into OPROVIA and cooperative market stabilization activities. Second, there is a concern that private merchants may be privy to market information, not available to farmers and consumers; thus they may be able to extract unfair advantage over producers and/or consumers. The working hypothesis of the Government is that better knowledge of prices may lead to more equitable distribution of economic benefits and a more responsive food system.

### **3.2 Project Objectives and Research Questions**

The two major objectives of this research project are:

1) To develop information and analytical procedures which will contribute to understanding of important policy questions related to production, marketing, prices and food security for selected storable commodities in Rwanda.

2) To contribute to the development of a framework and analytical capacity for future food security analysis in Rwanda and the specification of anticipated data requirements.

These objectives are approached through four sets of interrelated research questions, each designed to provide improved knowledge and test more specific hypotheses at critical micro and macro levels for components of the the storable commodity food system in Rwanda. The research components, subcomponents, and related general research questions are outlined in Table 3.1. As shown, there is both a macro and micro focus. At the macro level, aggregate market behavior and performance analysis is to be undertaken. At the micro level, both farmers and merchants behavior will be studied. By understanding key participants and interrelationships at these different food system levels, a more comprehensive and dynamic assessment of food system development constraints and opportunities is possible.

### **3.3 Scope of the Research**

#### **3.3.1 Criteria for Selection of Prefectures Emphasized in the Study**

SESA has recently completed the first comprehensive national agricultural survey which represent a rich source of information. SESA's large comprehensive sample

**Table 3.1 General Research Questions By Component and Subcomponent of the Storable Commodity Food System in Rwanda**

Component	Subcomponent	General Research Question
I. Aggregate (National) Market Level	1. Prices	1. What historical price information is available and what can these show about price level and changes over time, space, and product form?
	2. Quantities	1. What historical quantity produced and marketed information is available and what can these show about production and related trends?
II. Farmer Behavior Level	3. Farmer Food Security Coping Strategies and Market Interactions	1. What are the effects of farmer coping and market interaction strategies and standard operating procedures on individual household and national food availability conditions?
	4. Farmer Crop and technology decisions, and market interactions?	1. What is the effect of input and product markets on farmers crop choices, production technology choices, and innovation/experimentation/adoption decisions?
III. Merchant Behavior	5. Merchant characteristics	1. What is the nature of the firms in the marketing system serving farmers?
	6. Merchant practices and constraints	1. How do marketing firm practices affect farmers and what constraints/problems face the marketing system?
IV. Food System Programs, Policies and Overall Performance	7. Selected Public Program activities	1. What is the effect of key public programs on the market, farmers', merchants', and consumers' behavior?
	8. Food System Performance	1. What is the overall effect on system and production, productivity, and consumption of critical public and private sector actions?

frame, necessary for compilation of national statistics, is to experience for more focused surveys with greater in-depth analysis objectives. Whenever possible, however, it is important to relate these focused studies back to the national survey.

The SESA/MSU team has chosen to emphasize only five of the ten prefectures in Rwanda. Table 3.2 gives a breakdown of the factors taken into consideration in making the selection. SESA's national production estimates for 1984 were useful in the selection of the five prefectures for inclusion in a series of more focused studies. Since these studies focus on food security and food distribution system development issues, it is important to consider regional differences in production per capita. Among other things this helps establish hypotheses about the magnitude and direction of the flow of basic foodstuffs between regions. For example, Table 3.2 shows per capita production of four basic, but highly commercialized, commodities varies considerably among the five prefectures. For dry beans, rural per capita production in Kigali, Kibungo, and Butare exceeds the national average, indicating that these rural areas may, on average, produce a marketed surplus. Conversely, Ruhengeri and Kibuye are below that national average in rural per capita production of beans, indicating that they most likely need to make up a shortfall in beans either through trade or substitution in consumption. For corn, the pattern is exactly reversed, with Ruhengeri and Kibuye producing more than the national average per capita, while Kigali, Kibungo, and Butare produce considerably less than the national. Kigali and Butare are high sorghum producers, while the other three prefectures produce less than the national per capita average. In potatoes, Ruhengeri's production per capita far surpasses any of the other prefectures in Rwanda. These data show that the prefectures under consideration represent a diverse range of ecological zones, and most likely different farmer survival strategies.

Table 3.2 also shows that calories produced per capita in the rural areas in starchy foods (tubers and bananas) are roughly equal among the five prefectures. This lends credence to the belief that there is very little regional specialization and inter-regional trade in starchy foods. Exceptions to this generalization are Kibungo for bananas and Ruhengeri for potatoes. Nonetheless, regional self-sufficiency appears to be farmers' basic production strategy in the starchy crops. This is probably due in part to the fact that the starchy crops require a relatively more sophisticated marketing system due to the somewhat short amount of time which they can be stored without losses. Because all prefectures are basically self-sufficient in starches, per capita production of these foods did not play a decisive role in selection of prefectures for more detailed studies.

Other factors which played roles in determining regions of interest were: 1) distance from Kigali, and 2) presence of complementary research units in the area.

**Table 3.2 Factors Used in Selecting Prefectures to be Included in the Study**

Factors	Prefecture					
	Kigali	Kibungo	Butare	Ruhengeri	Kibuye	National
Rural Pop. (1984)	710,109	446,628	665,376	607,881	455,936	5,552,309
1984 Production per capita for rural population (kg)						
Dry beans	51	47	45	24	28	40
Dry corn	3	2	2	25	44	13
Sorghum	52	29	47	22	9	31
Potatoes	7	9	12	201	34	45
1984 Production in 1000's kcal per capita (rural)						
Potatoes	3	5	7	115	20	26
Other tubers	234	153	265	130	226	202
Bananas	158	432	100	83	94	136
Total	395	590	372	328	340	364
Total All Foods	691	839	757	676	697	714
Distance to Kigali (km)	-	108	135	116	139	-
Farming Systems Research	Yes	Yes	Yes	Yes	Yes	Yes

Distance from Kigali was a criterion because it is necessary to include samples from various points in the distribution network, and yet minimize the administrative and travel costs required by the research. Note that areas in the East, North, South, West, and Center of the country are included in the five prefecture sample.

The presence of complementary research efforts in the selected prefectures is important because this enables the research to link the broader macro-oriented issues in the study with the micro-level information available through local research units.

### **3.3.2 Taxonomy of Surveys Envisioned**

Table 3.3 shows the various surveys envisioned. These are named according to the four major study components identified earlier in Table 3.1. For each component a series of systematic surveys will obtain either existing secondary information or new primary data from selected food system participants. At the national market level, systematic collection or assembly of price information already collected by the Ministry of Planning of Rwanda will be undertaken. The objective is to obtain data on a timely basis in order to use it in analysis. Selected price surveys will also be conducted in each of the five prefectures included in the study in order to monitor, during the life of the study, both retail and wholesale prices, and to complete a consistency check on the retail price data obtained for the same period from the Ministry of Planning.

Surveys at the farmer, merchant and overall food system performance level are all designed to provide information to help answer the research questions identified in Table 3.3. A majority of the surveys are focused on relatively limited samples and maximize the involvement of the analysts in understanding how the selected food system components operate and relate to each other. Only two surveys are designed to be added to SESA's total on-going national sample survey.

### **3.4 Research Design and Management Methods**

Two important research implementation tools are being used to help systematically organize and collect necessary data, and to efficiently specify and manage the numerous research tasks involved in the project.

The first tool is a research planning matrix as specified in Table 3.4. Information on the cells of this matrix will be iterated several times as the research design proceeds. Since the matrix is maintained on a microcomputer with spread sheet software, it is easy to modify and expand as needed.

**Table 3.3 Taxonomy of Surveys Envisioned**

Survey Name	Topics Covered	Type of Surveyor	Sample Size and Characteristics	Freq./year
National Market I	Retail Price (Miniplan)	Supervisor	National - assembly of Miniplan data collected	12
National Market II	Retail/Wholesale	Supervisor	Focused - 25 interviews (5 Prefectures, 5 interviews each)	12
Farmer I	Beans and Sorghum Transactions	Enumerator	National - 1092	48
Farmer II	Strategies and Constraints to Marketing	Supervisor	Focused - 100 interviews (5 Prefectures, 20 farms each)	1
Farmer III	Strategic and Tactical Production Decisions	Analysts	Focused - 15 interviews (3 farm types; 1 type per Prefecture)	1
Farmer IV	Strategies and Constraints to Production	Supervisor	National - 1092	1
Merchant I	Descriptive Characteristics	Analysts	Focused - 50 interviews (5 Prefectures, 10 each)	1
Merchant II	Standard Operating Procedures	Analysts	Focused - 50 interviews (5 Prefectures, 10 each)	1
Program and Policy Reconnaissance I	Research Results on Production Alternatives	Analysts	Focused - 15 interviews with on-farm and on-station researchers	4
Program and Policy Reconnaissance II	Production Constraints and Possibilities	Analysts	Focused - 15 interviews with extension agents	1
Program and Policy Reconnaissance III	Market and Policy Situation	Analysts	Focused - 00 interviews with agency managers and analysts: 3/mo. - donor agencies 3/mo. - parastatals 3/mo. - other government and private	

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**Table 3.4 Research Planning Matrix**

Components	Subcom- ponent	General Question	Specific Question	Reason For This Question	Data Needs		Data Source	
					Item	Sub-Item	Secondary	SESA Survey #
I. Aggregate Market								
II. Farmer								
III. Merchant								
IV. Food System Program, Policy, and Performance								

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In the planning phase of the project, general and specific research questions are specified for each component and subcomponent of the research plan. Reasons for these questions are identified so as to limit the research to those questions needed to accomplish project objectives. Next, the data needed to answer specific questions is identified as are the sources of this data. If a primary survey or special activity on the part of SESA/MSU researchers is required, this will be planned, and the specific question number on the surveys will eventually be listed so as to avoid designing surveys that ask many interesting but non-essential questions.

The second tool is a research task and activity calendar to be organized around the design, implementation, and analysis of surveys, and the writing of reports and working papers on the analysis. The project began in June 1985 and is scheduled to be completed in August 1987. The Michigan State University resident researcher began work in Kigali in Sept. 1985 and is scheduled to remain until March 1987. On-going presentation and discussion of research outputs with Rwandan user groups is programmed over the life of the project.

#### IV. EXPECTED OUTPUTS

In addition to conducting the research described herein, the objective is to build existing and complementary data sets which will be valuable for future analysis. The emphasis is on organizing and utilizing to the maximum existing information before designing new data collection activities. Another of the objectives of the project is to provide additional practical research experience for Rwandan researchers as fully participating team members and thereby to increase SESA's long-term capacity to conduct food security and policy oriented research.

Working papers will be prepared throughout the life of the project. Reports will be developed based upon refinement and synthesis of working papers and further analysis. The preparation of working papers and their discussion with those who influence policy is an important step in the applied research process; it is a means of timely research result dissemination and provides an opportunity for comments and helps identify additional questions for consideration in further research and presentation of results. The following is a list of anticipated topics for working papers and reports. It is intended to be suggestive of the anticipated subject matter of papers and reports- not definitive. Applied research, like farming and marketing, involves a good deal of uncertainty.

#### **4.1 Tentative List of Anticipated Topics For Working Papers and Reports**

1. **Production, Markets, Prices and Food Security Relationships for Selected Storable Commodities in Rwanda - A Research Plan**
2. **Analysis of Production, Population, and Price Trends for Beans and Sorghum in Rwanda**
3. **Compilation of Historical Agricultural Price Data from Various Sources, Including a Detailed Description of Price Collection Methodologies**
4. **A Study of Agricultural Commodity Merchants with Fixed Place Operations in Five Prefectures of Rwanda**
5. **Quantities of Beans and Sorghum Purchased and Sold by Farmers in Rwanda, Including Breakdowns by Farm Production Class, and Characteristics of Transactions**
6. **Survival and Risk Management Strategies, and Standard Operating Procedures of Rwandan Farm Families**
7. **The Role of Rwandan Extension Agents In Collecting and Extending Information About Crop Prospects, Prices, Markets, and Farm Commodity Policies**
8. **Information From Rwandan Farmers About Potential Supply Responses to Economic Incentives**
9. **Characteristics of Rwandan Household with Low Food Consumption and Those with the Largest Marketed Surplus with Implications For Food Security**
10. **Food Aid, Prices and Food System Incentives in Rwanda**
11. **Assessment of Potential for Storable Commodity Supply Response in Rwanda: A Summary of Conclusions from Interviews with Farming Systems and Agricultural Production Researchers**

12. Observations on Market Performance in the Food Grain Sub-Sector and Implications for Programs of Public Stocks Management and Price Stabilization in Rwanda
13. The Potential for Using Reported Farm Commodity Prices As An Indicator of the Next Season Crop Size and Prices
14. Production, Markets, Prices and Food Security in Rwanda: A Summary Report

## V. RESEARCH TEAM MEMBERS

The research described in this document is being conducted by a diverse group of Rwandan and expatriot analysts:

1. RWAMASIRABO, Serge, Director of SESA.
2. MUKEZANGANGO, Jean Chrysostome, SESA Researcher.
3. NGIRUMWAMI, Jean Leonard, SESA Researcher.
4. LOVERIDGE, Scott, MSU in-country Researcher.
5. DEJAEGHER, Yvan, Long-term Consultant to SESA.
6. SHAFFER, James D., Professor, MSU, short term in-country participation.
7. WEBER, Micheal T., Professor, MSU, short term in-country participation.
8. MEHEN, Tom and Curt REINTSMA, USAID Washington Food Security in Africa Project Managers.
9. FUCHS-CARSCH, Micheal, Agricultural Development Officer, USAID/Kigali.

## SESA WORKING PAPERS IN PROGRESS, APRIL 1986

1. "Production, Markets, Prices, and Food Security Relationships Among Selected Storable Commodities in Rwanda: A Research Program Overview" by SESA/MSU Research Team, 1986, (20 pp.)
2. "Production, Marketing, and Price Trends for Beans and Sorghum in Rwanda" by Scott Loveridge, 1986 (forthcoming)
3. "Characteristics of Agricultural Commodity Merchants with Fixed Place Operation in Five Rwandan Prefectures" by Scott Loveridge and Jean Leonard Ngirumwami, 1986 (forthcoming)
4. "Compilation of Historical Agricultural Price Data for Selected Commodities from Various Sources, Including a Description of Price Collection Methodologies", by Jean Chrysostome Mukezangango and Scott Loveridge, 1986 (forthcoming)
5. "Quantities of Beans and Sorghum Purchased and Sold by Farmers Over the Period Nov. 1985 to March 1986 in the Prefecture of Kigali, Including Breakdowns by Farm Size and Characteristics of Transactions.", by Scott Loveridge and Jean Chrysostome Mukezangango, 1986 (in preliminary draft phase)
6. "Behavior of Agricultural Commodity Merchants with Fixed Place Operations in Five Rwandan Prefectures", by Jean Leonard Ngirumwami and Scott Loveridge (in preliminary draft phase)
7. "Results of Surveys with Farmers in Five Prefectures of Rwanda about Food Security and Crop Production Strategies", by Jean Chrysostome Mukezangango and Scott Loveridge, 1986 (in preliminary draft phase)
8. "Compilation of Historical Agricultural Production Data from the Ministry of Agriculture, Including a Description of the Data Collection Methodology", by Serge Rwamasirabo, Jean Chrysostome Mukezangango, and Sharon Bylenga. 1986 (in planning phase)
9. "Seasonal Price Indices for Corn, Sweet Potatoes, Manioc, Peas, and Bananas in Rwanda". 1986 (in planning phase)