TRANSFER AND COMMERCIALIZATION OF AGRICULTURAL TECHNOLOGIES: EXPERIENCES IN WEST AFRICA

West African Small Grants Program (1998-2000)

Final Report

Funded by USAID Africa Bureau for Sustainable Development

November 2000

SAFGRAD

Semi-Arid Food Grain Research and Development (SAFGRAD)

OAU/STRC-SAFGRAD
Coordination Office
01 BP 1783
Ouagadougou 01
Burkina Faso

Tél (226) 30 60 71
(226) 31 15 98

Fax (226) 31 15 86
e-mail: oua.safgrad@cenatrin.bf

Scientific, Technical and Research Commission of the Organization of African Unity (OAU/STRC)

OAU/STRC Secretariat
26/28 Marina
N.P.A. Building
P.M.B. 2359
Lagos
Nigeria

Tel (234) 263 34 30
(234) 263 32 89
Telex 28786 TECOAU NG
Cable TECNAFRICA
Fax (234) 126 36093
e-mail: oaustrcl@rcl.nig.com

Organization of African Unity (OAU)
General Secretariat
P.O. Box 3243
Addis Ababa
Ethiopia

Tel (251-1) 51 77 00
Telex 21046 OUA ET
Cable OAU Addis Ababa
Fax (251-1) 51 78 44

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Contents

PREFACE..... vii
ACKNOWLEDGEMENTS..... ix
LIST OF ACRONYMS..... xi
EXECUTIVE SUMMARY..... xiii

1. BACKGROUND..... 1

1.1. Issues and Constraints
1.2. Goal and Objectives
1.3. Strategies
1.4. Design of the Program
1.5. Screening and Approval of Proposals

2. TECHNOLOGY TRANSFER AND UTILIZATION OF RESEARCH RESULTS..... 5

2.1. Model for Techonology Transfer and Commercialization
2.2 . Availability and Choice of Technologies
2.3 . Towards the Development of Seed Production Microenterprises
2.3.1. Seed Increase of Improved Potato and Onion cultivars in the sudano Sahelian Zone of Burkina Faso
2.3.2.Seed Increase and Distribution of Improved Millet and Maize Cultivars in Senegal
2.4 . Crop Production and Farm Enterprise Development
Case one: Commercialization and Utilization of Cowpea
Case two: Increasing Vegetable Oil Seed Production and Processing in Northern Ghana
Case three: The Medina Sabakh Millet Production and Commercialization Project

3. DECREASING POST HARVEST LOSSES AND IMPROVING THE NUTRITIONAL QUALITY OF BASIC DIETS..... 17

3.1. Post Harvest Technologies to Empower Women's Groups
3.2. Improving the Nutritional Quality of Basic Diets :
3.2.1. Utilization and Commercialization of Soybean Products
3.2.2. Utilization of Forest Ditax Fruit as Source of Vitamin C

4. CAPACITY BUILDING..... 23

4.1. Strengthening National Institutions
4.2. Improving Technical Skills
4.3. Institutional Framework for the Implementation of WASGP
4.3.1. Strengthening Collaboration with NARS
4.3.2. Establishment of the Regional Technical Committee (RTC)
4.3.3. Establishment of Focal Units (FU) at National Level
4.3.4. Coordination and Management

5. LESSONS LEARNED..... 29

6. SUGGESTIONS OF PROGRAMS FOR FOLLOW-UP PHASE OF WASGP..... 31

6.1. Implication for Market and Cost of Technology Research
6.2. Stimulating the Economic Growth of Rural Sector
6.2.1. Revitalizing NARS Technology Verification and Transfer Systems
6.2.2. Adding Value to Crop Commodities
6.2.3. Promotion of Seed Production Enterprises
6.2.4. Contracting Technical Services
6.2.5. Microfinance Program
6.2.6. Intervention for Improving the Nutritional Level of Households
6.2.7. Capacity Building

Preface

The West African Small Grants Program (WASGP) is an USAID/AFR/SD and OAU/STRC-SAFGRAD initiative for promoting transfer and commercialization of agricultural technologies. The present report highlights activities undertaken from 1998 to 2000.

The first section of this report outlines the main issues, constraints and objectives identified in consultation with key stakeholders (i.e. farmers, food processors, agribusiness, research, extension, NGOS, etc.) in Senegal, Ghana, Burkina Faso and Mali.

Section two of the report discusses a number of productive and income generating technologies that have been identified and commercialized through the implementation of 18 projects. In several countries of sub-Saharan Africa, the public sector has dominated in the production and distribution of improved seeds and has failed to provide effective agricultural production support services. Some of the technologies delivered led towards the development of private seed production enterprises.

In section three, evidence from reviewed projects showed that the use of post harvest technologies not only reduced the 10 to 25% loss of fruits (mango, etc.), soybean, vegetables (tomato, onion, etc.) spices and condiments, but also enabled the transformation of commodities into value added products.

Improving technical skills, strengthening of institutional capacities and mechanisms for facilitating the implementation of the program are discussed in section four of the report.

Furthermore, lessons learned and suggestions (future programs) for sustaining the momentum gained to enable the private sector play key role in the development of agribusiness and in the provision of agricultural support services are discussed in section five and six of the report respectively.

Taye Bezuneh
International Coordinator
OAU/STRC-SAFGRAD

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The publication of this report would not have been possible without the persistent effort and dedication of the staff of SAFGRAD Coordination Office. We are deeply indebted to dedicate this report to the late Drs. Robert Mshana and Mbaye Ndoye respectively former Acting Executive Secretary and Assistant Executive Secretary of OAU/STRC, Lagos, Nigeria, who facilitated the implementation of the Program. Their contribution will always be remembered.

List of Acronyms

ACCT : Agence de Coopération Culturelle et Technique
APSY : Association des Producteurs Semenciers du Yatenga, Burkina
ARI : Animal Research Institute
ASK : Association Song Koaadba, (producer group), Burkina
CIRAD : Centre de Coopération Internationale en Recherche Agronomique pour le Développement
CNCAS : Caisse Nationale de Crédit Agricole du Sénégal
CNCR : Comité National de Concertation des Ruraux, Sénégal
CNRST : Centre National de Recherche Scientifique et Technologique
CRI : Crop Research Institute
CRS : Catholic Relief Services
CSIR : Council for Scientific and Industrial Research
DRA : Direction Régionale de l'Agriculture
DRPF : Direction de Recherches sur les Productions Forestières, Sénégal
ENCR : Ecole Nationale des Cadres Ruraux, Sénégal
ENEA : Ecole Nationale d'Economie Appliquée, Sénégal
FRI : Food Research Institute
FU : Focal Unit
IARC : International Agricultural Research Center
ICRISAT : International Crop Research Institute for Semi-Arid Tropics
IITA : International Institute of Tropical Agriculture
INERA : Institut de l'Environnement et de Recherche Agricole, Burkina
ISRA : Institut Sénégalais de Recherches Agricoles
ITA : Institut de Technologie Alimentaire, Sénégal
MoFA : Ministry of Food and Agriculture, Ghana
NARS : National Agricultural Research Systems
NGO : Non Governmental Organization
NWC : National Working Committee
OAU : Organization of African Untiy
PSAFS : Production Support and Financial Services
RTC : Regional Technical Commission
SAFGRAD : Semi Arid Food Grain Research and Development
SARI : Savannah Agricultural Research Institute
STRC : Scientific, Technical and Research Committee
UNDP : United Nations Development Programme
UNIDO : United Nations Organization for Industrial Development
UNIS : Union Nationale Interprofessionnelle des Semences, Sénégal
UPSE : Unité de Production de Semences, ISRA, Sénégal
USAID : United States Agency for International Development
WASGP : West African Small Grant Program
WINROCK : International NGO

Executive Summary

The goal of the program has been to improve the livelihood of resource poor farmers by enhancing the efficient transfer and commercialization of agricultural technologies with particular emphasis on attaining food security, generating income and employment.

The underlying assumption of the program has been that technology options that could substantially increase agricultural production and productivity do exist. But farmers and other end-users have yet to benefit from research results largely because of inefficient technology delivery systems. An equally important assumption has been that market liberalization and economic policy reforms will create an enabling environment for the private sector to play a key role in the provision of agricultural production support services.

Based on established criteria and the deliberations of the Regional Technical Committee, 18 small grant projects were selected on a competitive basis from among 92 submitted proposals. The grantees included farmers' associations, women groups, food processors, seed growers, and the National Agricultural Research Systems.

About 80 more productive, income-generating technologies have been identified. Forty-five of these technologies have promoted the transformation of agricultural produce into value-added products. To advance seed increase and distribution, sixteen technologies were delivered. In addition, seventeen productive technologies improved agricultural production and productivity to enhance food security and increase the supply of raw materials to industry.

The commercialization of grain legumes, such as, cowpea, groundnut, and soybean led to an improvement of the nutrition of basic diets. The small ruminants enterprises not only generated income, but also contributed to the restoration of soil fertility. Thus, diversifying on-farm enterprises enhances complementarity in the use and recycling of resources, as well as in generating revenues and employment.

The innovative model employed by the West African Small Grants Program (WASGP) first, forged partnerships among key stakeholders engaged in technology generation; second, strengthened linkages between agencies involved in transfer and utilization; and third, identified market outlets and opportunities. Facilitating linkages between suppliers and users of technology resulted in a successful transfer, minimizing the hurdles for moving research results to clients.

National consultations took place in order to determine areas of interest and capacities in technology transfer and commercialization. Among the main issues and constraints documented through the implementation of on-farm and food processing enterprises were: low managerial capacity of producer organizations; lack of rules and regulations to promote agribusiness by the private sector, lack of microfinance services to promote microenterprises, such as seed production and fertilizer distribution; narrow base of agricultural raw material production to supply industry; poor linkages to market outlets; inadequate entrepreneurial ability to invest and averse risk; and weak negotiating position of farmers associations with agro industries on prices of raw materials since most contracts are not articulated in a manner to be legally binding and thereby to protect farmers against defaulting cocontractants.

Post harvest losses of tropical fruits such as mangoes range from 10 to 25% in the Sahel. The reduction of these post-harvest losses makes it possible not only to increase food security, but also to help farmers and processing enterprises benefit from local and export markets. Such project supports did generate income and employment in Burkina Faso and Senegal.

In Ghana, soybean utilization in two villages improved the nutritional content of 16 basic diets with protein, iron, vitamins and calcium. A number of household members interviewed expressed their satisfaction that using soybean in their basic diet has resulted in changes in the health and growth of their children. A follow-up study is proposed to determine the nutritional health impact and for the commercialization of improved products.

In Ghana, under the village level soybean utilization project carried out by the Food Research Institute, in collaboration with the Home Economics Department of the University of Ghana and the Women's Development Unit of the Ministry of Food and Agriculture, 147 people were trained (71 women, 29 men, and 47 children) in the utilization of soybean for improving local diets and commercializing products developed.

In Burkina, 60 women were trained in post-harvest technology, processing and marketing of mango fruits vegetables and condiments. Furthermore, 93 men and 2 women received training in commercial cowpea production, storage, and conservation. Twenty-five farmers undertook animal fattening as an enterprise and received training in improved livestock husbandry. Fifteen representatives of producer groups received training in potato and onion seed production, treatment, and storage.

In Senegal, the Food Technology Institute (ITA) trained 15 women trainers in mango, fruit, and vegetable processing. Thirteen producers were also trained by ITA in exploitation of the Ditax fruit, a rich source of vitamin C. The Seed Production Unit of ISRA provided training to 49 people (30 farmers as outgrowers, 15 from collaborating partners and 4 students from Agricultural Engineering School) in millet and maize seed production, treatment and storage.

Farmers have acquired technical capacities to assume the services of certified seed production and distribution. The WASGP-supported seed increase projects showed that small farmers and/or their associations can meet the demand of certified seed at the community level. An important task that requires future support is to assist private seed producers to develop into seed production microenterprises. This requires: sustained linkages to research and extension; training in seed business management; easier access to financial resources and physical facilities for seed cleaning and processing; and organization of producers. Meeting these conditions requires further technical and financial assistance through WASGP.

One of the important thrusts of the WASGP activities has been to improve technical skills. Target groups are technology users (mainly producers, but also processors) of both gender. Several men and women were trained in product development, agricultural production and processing skills during special sessions, workshops, etc.

Institutionalization of WASGP activities at the national and regional levels (through Focal Units and Regional Technical Committees) not only linked research to development, but also improved commitment, ownership, and the desire to monitor the implementation of country-level projects.

Through USAID/AFR/SD support, the technology transfer and commercialization program has been operational for about three years. As a result of implementing several on-farm and food processing microenterprises, a number of success stories, best practices, and constraints have been documented. To sustain the momentum gained to enable the private sector to play key role in agribusiness and in the provision of agricultural support services, a follow-up phase of WASGP is recommended.

1.0. BACKGROUND

1.1. Issues and Constraints

The perception that the generation of agricultural technology is a separate activity from that of its transfer has contributed to the inefficient delivery of research results and to the continuous decline in agricultural productivity and income. These two issues present formidable challenges for agricultural research and rural development.

The decline in food production in several West African countries has been partially due to the poor performance of the public sector in delivering agricultural inputs and technological services necessary to stimulate agricultural growth.

Institutional orientation and demand driven research are crucial factors for enhancing technology transfer and commercialization. Successful commercialization of technologies developed by on-farm research is a necessary condition for the quantum leap needed for agriculture to assume its role as food provider and engine for economic growth in sub-Saharan Africa. Such scale commercialization can be best achieved by the private sector, but there are prerequisites to its success.

The first prerequisite is an adequate institutional framework. Agricultural services are currently dominated by public agencies. Any attempt to quickly privatize these services runs the risk of moving agriculture backward. In fact, the transition must be smooth, and care must be taken to ensure that the private sector has the technical know-how to commercialize and service key technologies. Another key factor is the legal framework allowing for control and monitoring of the whole process.

The second prerequisite is economic. Sustained adoption of a technology will only occur if it is profitable for all actors involved, including sellers and users. Profitability and stability of the market for the end product are key elements for sustained technology adoption.

Other constraints that contributed to the slow growth of the agricultural sector include:

- Agricultural policy has not encouraged farmers to invest in more productive technologies.
- Information on product markets to influence farmers' decision to invest in more productive technologies has been lacking.
- Poor linkages have existed between agriculture and agro industry including food processing units to enhance the transformation of agricultural produce into value-added products still exist.

1.2. Goal and Objectives

The primary goal of the West African Small Grants program has been to improve the livelihood of resource poor farmers and small-scale food processors by increasing the efficiency of technology transfer to attain food security, create employment, and generate income. To achieve this goal, it is necessary to create an enabling environment to effectively provide relevant incentives to farmers and other key actors.

The main objectives of the program are to:

- Identify viable, more productive, and profitable technologies that could effectively be delivered to end users.

- Foster linkages and partnerships between "stakeholders" including public and private research institutions, farmers, development and marketing agencies, private sector NGOs, and traders.

- Stimulate demand-driven research to enhance the transformation of agricultural technologies into value-added products.

- Improve the national capacity for assessing socio-economic and technical constraints, as well as opportunities for the development of agribusiness, food processing, etc.

- Put in place institutional mechanisms, to follow-up the progress of project implementation.

- Facilitate women's participation in agribusiness, technology transfer, and commercialization for food security and nutrition enhancement.

- Facilitate exchange of experiences among countries and micro-entrepreneurs.

- Provide technical backstopping to pilot micro-enterprise projects in participating countries in collaboration with IARCs, NARS, extension systems, and NGOs.

- Document experiences and lessons learned in technology transfer and commercialization.

1.3. Strategies

The common strategies for implementing the WASGP include:

i) Innovative Partnership formation

Strengthening partnership by involving key actors and major stakeholders engaged in technology development, transfer and utilization, as well as in the provision of production support and financial services.

ii) Capacity Building

One of the major thrusts of WASGP program has been to improve technical skills in agricultural production, as well as the delivery of technologies to clients.

iii) Promoting on-farm linkages through the development of microenterprise. Non farm (for example agribusiness) enterprises that will minimize the drudgery of work for women to attain food security of the household.

iv) Survey and inventory - To characterize available technological options and markets, as well as to determine the type of production support and financial services required.

v) Networking - For testing, dissemination and sharing innovative options including market information

1.4. Design of the Program

The underlying assumptions of the program include:

i) Technological options that could substantially increase agricultural production and productivity do exist. However, farmers have not yet fully benefited from research results to improve their livelihood.

ii) Market liberalization and economic policy reforms will create the conducive and enabling environment for the private sector to play a key role in the provision of agricultural production support services and the development of agribusinesses.

The program components were defined based on initial consultation and participation of key stakeholders (i.e. research, extension, Networks, NGOs, food processing industries, women's groups, farmers associations, etc.) engaged in technology generation, transfer, and utilization. National consultants were fielded in Burkina Faso, Ghana, Senegal and Mali to:

i. Take stock of the institutional set-up and orientation of national systems to enhance transfer and commercialization of agricultural technologies, highlighting the different key actors and the type of partnerships and institutional linkages that exist among them.

ii. Analyze on-going initiatives in technology transfer and micro-enterprise development and identify those that merit support; and inventory of the available technologies.

iii. Propose methods for program development including the identification of institutional mechanisms and linkages for program implementation.

1.5 Screening and Approval of Proposals

Based on findings of the consultants' study and objectives of the program, guidelines for developing proposals were sent not only to research organizations, but also to farmers' associations, NGOs, and to women groups and micro-entrepreneurs in Burkina Faso, Ghana, Senegal, and Mali.

The Regional Technical Committee (RTC) was established. It comprised of the NARS Scientific Directors, NGOs, the IARCs (through the Maize and Sorghum Networks) and private sector representatives. The RTC screened and approved proposals.

The West African Small Grants Program (WASGP) support was provided on a competitive basis. The RTC, using established criteria, screened and approved 18 out of 92 submitted proposals. The first meeting of the RTC was held in Ouagadougou, Burkina Faso, 30-31 May 1998; the second in Dakar, Senegal, in April 1999, and the third in Ouagadougou, Burkina Faso, 1-3 August, 2000.

To streamline the process for selecting projects, the following criteria were used:

- Is the firm or association applying for grant legally registered?

- Purpose and objectives of the proposal - Are the objectives of the proposal achievable and also linked to rural economy development?

- What is the Potential of the proposal to generate income and employment?

- Is there an active market demand for the technology/or commodity chosen for transfer and commercialization?

- To what extent does the project improve the nutritional quality of basic diets?

- Does the chosen technology/or commodity have any potential to contribute to food security and to sustainable agricultural development?

- Does the proposal/or project have matching fund component?

- Is the chosen technology simple to transfer and affordable for farmers?

- Does the proposal facilitate partnership development among key stakeholders - including evidence of commitment to accomplish specific roles?

- Does the Project promote private sector activities, such as the development of agribusiness?

- How is the project organized and managed (including budget allocations) to achieve objectives?

2.0 TECHNOLOGY TRANSFER AND UTILIZATION OF RESEARCH RESULTS

2.1 Model for technology Transfer and Commercialization

The model for promoting technology transfer, and commercialization is depicted in Fig. 1. Technology transfer and commercialization is a continuous process that requires an enabling environment to stimulate growth of the agricultural sector. Creating that enabling environment requires adequate and appropriate government policies, investment and institutional responsiveness.

The model for the technology transfer continuum (Fig. 1) shows the key stages of the processes and the partnerships required for enhancing the transfer, and commercialization of agricultural technologies. Furthermore, market research identifying demand by end-users of technologies and linkages to agro-industries and to local and export markets are important components of the model. The model is comprised of the following three important but interlinked stages:

i) The Technology Supply phase

The first step in the development of proposals has been to identify and package workable technology options. Demand driven research by NARS, IARCs, Networks, Universities, etc. is crucial to enrich technology options for clients, such as farmers, food processors, agro industries, private and public sector organizations, women's groups, farm associations, etc. At the outset of this stage, technologies must have gone through verification schemes to determine their profitability to end users.

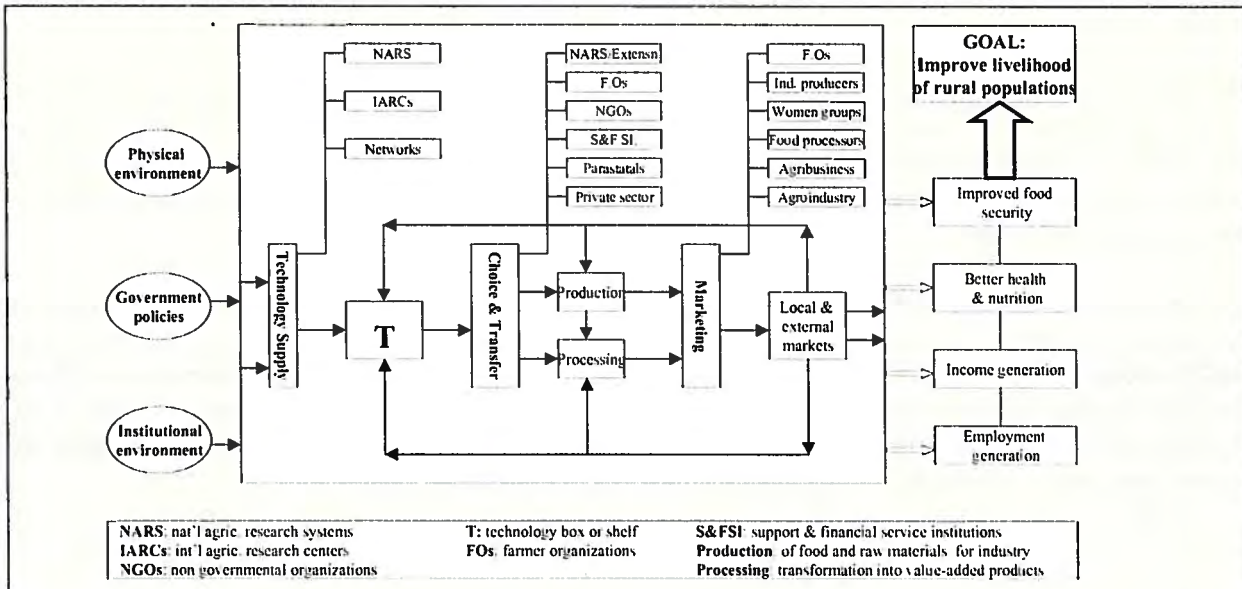


Fig. 1: Model for the Technology Transfer and Commercialization Continuum

ii) The Technology Transfer Phase

The main thrust of the program has been to test new approaches and to promote the transfer of technology. The key strategy of the program has been to recognize that beneficiaries of research results, (for example, farmers and their organizations, food processors, agroindustries, women's groups, and the private sector), are key players that ought to work together with research and extension in the technology transfer and utilization. The provision of support services, i.e. by research, extension, NGOs, informal and formal microfinance, has been crucial for:

a) Improving agricultural production and productivity to meet food security demands and supply raw materials to industry; and

b) Processing to transform agricultural produce into value-added products.

iii) Technology Commercialization Phase

Local and external market outlets were determined to enhance the commercialization of processed and agricultural produce. Key stakeholders include agribusiness micro enterprises, agro industry as buyers of raw materials and sellers of value-added products, farm organizations and women's groups as micro- entrepreneurs, etc.

2.2 Availability and Choice of Technologies

The potential for increasing agricultural productivity and profitability that influence farmers in their choice of technologies. Several technological options are available at research centers. Many of them, however, are not widely adopted by farmers for a variety of reasons including their affordability. Furthermore, the verification scheme for determining the affordability and market opportunity of technologies has been very weak in several countries.

In reality, agricultural research and transfer systems in several countries put little emphasis on assessing the profitability of technologies. Thus, the potential of a technology to generate income and its market demand are usually not determined before recommendations are made to farmers and other end-users.

To address the issue of the technology choice and to ensure the success of its commercialization, WASGP undertook an initial assessment and analysis in countries where projects became operational. The study assessed the extent of market demand for technologies, the technical and institutional constraints in transfer and commercialization, the impact of technology on agribusiness development, and availability of microfinancing to access inputs and credits.

As summarized in Table 1, eighty (80) technologies were transferred and commercialized through 18 pilot project activities. Forty-five of these technologies were delivered in the transformation of agricultural produce into value-added products. To advance seed increase and distribution 16 technologies were introduced. Furthermore, 17 most productive technologies were employed, which led to an increase in agricultural productivity and the supply of raw materials to industry. In addition, the fattening of small ruminants was promoted as a farm enterprise to diversify income and concurrently improve soil fertility by using crop residue and manure.

Lessons:

Lessons learned in implementing the 18 projects showed a lot of agricultural technologies at NARS & IARCs are not widely adopted by farmers and other end-users. At the NARS level, there is a crucial need to strengthen the technology verification and repackaging scheme for determining the profitability and market potential of technologies.

The interplay of stakeholders operating as partners in an enabling environment allowed the various projects to generate income employment and to improve food security, health and nutrition, thereby contributing to better and more sustainable livelihoods for ressource poor farmers and small-scale food processors, etc.

Table 1. Choice of Technologies under the West African Small Grants Program

Projects	Number of technologies transferred to users			Packages of Technologies	Market Outlets
	Burkina	Ghana	Senegal		
1. Cowpea production and Commercialization	6			4 cowpea varieties and 2 agronomic practices	Local, regional and NESTLE
2. Potato and onion seed production and Marketing	3			2 onion and 1 potato varieties	Local
3. Fruit and vegetable drying and Marketing	>4			Mango, tomato and other fruits and vegetables, drying techniques	Exports to Europe
4. Integration of small ruminants and Production (animal fattening)	4			Improved feed ration, shed, pest and disease control, crop residues	Traders, final consumers
5. Community seed production of cowpea Varieties	7			4 improved varieties of cowpea, 2 agronomic practices and one storage technique	Local
6. Vegetable oil seed production and processing		>2		Improved soybean varieties increased and available to over 300 farmers	Individual farmers, Bosbel oil mill industry
7. Soybean utilization technologies		19		2 soy products and 17 recipes (staple foods, stews, sauce, beverages) developed	Final consumers
8. Community canning/bottling system for Training small scale food processors		>3		Food processing and preservation techniques	Local/Export
9. Processing and marketing of Micronutrient enriched soybean Products		8		4 soy products by Darkruby and 4 by Delabac underwent quality evaluation	Final consumers
10. Small ruminants (ARI and women Groups)		4		Improved feed ration, shed, pest and disease control, crop residues	Final consumers, traders
11. Seed production of improved millet and Maize cultivars			6	3 millet and 3 maize cultivars	Individual and organized producers, NGOs, private sector, projects,
12. Valorization of the forest ditax fruit			5	Harvesting technique and 4 products	Producer groups, women groups, industrial processors
13. Mango and fruit drying and marketing			>6	>4 products and 2 drying techniques	Grocery stores, Senegalese Army, hotels
14. Production and commercialization of Improved millet cultivars			3	2 millet cultivars and one threshing method	Individual producers, local traders, Industrial processors

Note: Not included in this table is a project in Togo funded through WASGP to support women organization for processing cassava into gari

2.3 Towards the Development of Private Seed Production Enterprises

For the past three decades, the public sector has dominated the production and distribution of improved seeds whose prices have not been affordable for farmers. In most countries of West Africa, the seed industry is the least developed. Improved seed production and distribution by the private sector is virtually nonexistant. Even though regulatory policies pertaining to seed production and distribution do exist in several countries, seed laws usually do not favour the development of a private seed industry. The few improved cultivars that are produced reach farmers directly from research stations and through the public sector community seed production schemes (farm communities) promoted by crop commodity networks and SAFGRAD.

The sluggish growth in food crop production has been attributed to a number of constraints including the limited use of improved seed and fertilizer. To increase food production, involves the timely access of inputs, such as improved seedand fertilizer to producers. NARS have accumulated years of research results on foundation seed production. However, the production of certified seed is effected in a haphazard manner by various development organizations. The development of the seed industry in several countries remains stagnant and disorganized.

Four seed increase and distribution projects were supported in Senegal and Burkina Faso. The objectives of these projects have been to:

i. Meet farmer and development agency seed demand;

ii. Disseminate proven seed production technologies by training individual farmers and farmer groups;

iii. Document lessons learned on the development of viable private seed production enterprises; and

iv. Establish functional linkages of various processes of seed increase, distribution and sales, i.e., release of varieties, production of foundation seed, and increase of certified seed, by involving farmers.

2.3.1 Seed Increase of Improved Potato and Onion Cultivars in the Sudano Sahelian Zone of Burkina Faso

The Yatenga Seed Producers Association (APSY) based in Ouahigouya, some 170 km north of Ouagadougou has been supported through WASGP to increase the seed of improved cultivars of potato (Sahel variety) and two onion varieties (violet de Galmi and Garango). Potato and onion are important crops in Burkina Faso. The purpose of the grant has been first, to provide technical assistance in seed production and propagation of horticultural crop plant material, for example, potato; second, to minimize importation of the seed of these and other crops; and third, to improve production of potato and onions by more than 85 farmer groups, who cultivated several vegetable crops both for consumption and the local market.

Fig. 2: Potato seed grown by Seed Producers in Ouahigouya, Burkina Faso

In 1998/99 APSY produced 10 tons of potato seed tuber (Fig. 2) meeting 66 percent of the local demand. Fifteen producer associations purchased all of the potato tuber seed which was distributed to several locations in Yatenga province. The gross income generated from potato and onion seed sales amounted to twelve thousand ($12,000) and seven thousand ($7,000) per hectare, respectively.

APSY has also provided training to producer groups in potato, tomato and onion production since it has fields for demonstration and production. So far, several partners have been involved in this project along with ASPY. These include extension services, 85 village groups and also individual producers.

ASPY has improved the capacity of its enterprise by reinvesting income generated in 1998. This financial investment provided for the purchase of farm implements, an improved storage facility and its repair, and land preparation.

2.3.2 Seed Increase and Distribution of Improved Millet and Maize Cultivars in Senegal

The seed project in Senegal promoted the increase of improved millet and maize foundation seed by the Seed Production Unit (UPSE) of ISRA (at the

Bambey Research Center). As summarized in Table 2, about 17 and 12 tons of certified seed of millet and maize were produced respectively by contracting farmers as out growers. This amount of seed is estimated to plant an area of 2,797 ha of millet and 624 ha of maize.

Table 2: Production of millet and maize certified seed in Senegal **(Bambey Research Center, ISRA): 1998 and 1999.**

Variety	Production (kg)		Number contractual farmers		Estimated Area that can be planted (ha)**	
	1998	1999	1998	1999	1999	2000
MILLET						
Souna-3	4 587	3 398	3	3	764	566
IBV-8001	1 637	-	1	-	273	-
IBV-8004	3 298	3 861	4	4	550	644
Total/year (kg)	9 522	7 259	8	7	1 587	1 210
Total seed produced (kg)	16 781				2 797	
Value of seed (CFA)*	8 390 500					
MAIZE:						
JDB	5 022	2 500	2	3	251	125
Synthetic C	2 842	1 500	3	1	142	75
Early Thai	313	300	1	1	16	15
Total/year (Kg)	8 177	4 300	4***	4***	409	215
Total seed produced (kg)	12 477				624	
Value of seed (CFA)*	6 238 500					

*: seed valued at 500 CFA/kg
**: Assumes all of the produced seed is used for the cultivation of the respective crops during the following cropping season; estimates are based on recommended seed rates (millet: 6 kg/ha; maize: 20 kg/ha).
***: Total is different from sum of above numbers because some farmers cultivate several varieties at the same time.

Partnerships among stakeholders was established. These included input providers, facilitators, trainers, trainees, buyers, disseminators, finance suppliers and producers, (Annex 1).

The seed produced has been widely distributed. Buyers of certified seed (not including individuals) were from all ten administrative regions, except Saint Louis and Ziguinchor for millet and Fatick and Louga for maize and also from the neighbouring country of Guinea-Bissau. The bulk of the seed was purchased by farmer organizations, the private sector, NGOs, research extension and development agencies, the poverty alleviation program of UNDP, World Vision, and the Rodale Institute.

Another important output of the project in Senegal has been the improvement of technical skills in seed production. For example, 45 farmers and four students received training in seed production treatment and conservation.

Lessons learned

In Senegal, smallscale farmers or their association, can fill the gap of certified seed production at the community level. Contracting farmers as out growers of certified seed production of millet and maize cultivars improved both their skills in seed technology and their income.

The crucial factors for evolving small farmer associations into seed enterprise services are sustained linkages to research, and extension and the availability of credit to collectively use facilities for seed cleaning and processing.

An encouraging innovation of the seed production enterprise in Burkina Faso has been the reinvestment of its first year's income to improve both production capacity and management. This dynamic internal recycling mechanism of project funds has been critical for the sustainability of the enterprise.

2.4 Crop Production and Farm Enterprise Development

Over the last two decades, research, extension and development agencies concentrated their efforts on the provision of agricultural support services to increase production. Over the same period, farmers lacked the incentives to produce beyond their family needs. More importantly, research and the technology transfer systems in most countries have poor linkages to their clients, such as agro industries.

One of the thrusts of WASGP has been to improve the efficiency of technology and delivery linkages to market outlets, like agro industries. This section of the report discusses some cases of successful commercialization of agricultural technologies.

Case one: Commercialization and Utilization of Cowpea

Cowpea is an important source of protein improving the nutrition of over 150 million people in West and Central Africa. Cowpea is also a cash crop for farm households. The involvement of the private and public sectors in enhancing the transfer, industrial utilization, and production technologies for cowpea has been explored.

Through the West African Small Grants Program support, key partners were brought together to develop the program as follows. First, OAU/STRC-SAFGRAD and the Research and Development Unit of NESTLE established a cooperative agreement to promote cowpea improvement and production for industrial use. Second, partnership of key stakeholders was established among the farmers' Association Song-Kooadba (ASK) with more than 2100 members based in the Donsin district 35 km, northeast of Ouagadougou, SAFGRAD, the Burkina NARS, and the University of Ouagadougou. Third, the program facilitated contractual agreements between NESTLE and farmers' Associations for the production of raw materials (cowpea) for industrial processing. NESLTE, through SAFGRAD, provided inputs and technical services to farmers to increase cowpea production. The agreement also included negotiated prices that farmers agreed to at the beginning of the season. The partnerships of interested groups established a reliable system for commercial production of cowpea. Ninety-five farmers, members of ASK, were involved in the commercial production and participated in the technology transfer and cost of production studies.

Two studies were undertaken:

i. Technology transfer - to quantify the effect of extension services and availability of inputs. This study structured farmers into three groups of 25 members each. The first group of farmers received extension services and

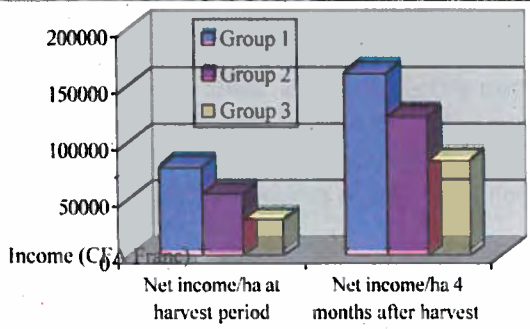


Fig 3. Effect of extension services, inputs, and time of market disposal on cowpea income in Tabtenga (1998/1999), Burkina Faso

Legend
Group 1 : Received extension services and inputs
Group 2 : Received only inputs without extension services
Group 3 : Outside the project support

Fig. 4: Commercial production of cowpea at Donsin, Burkina Faso

Fig. 5: Storage of crop residue and cowpea fodder for small ruminant feeding at Donsin, Burkina Faso

Fig. 6: Small ruminant fattening in Burkina

input support ; the second group received only input support; and the third group includes farmers who operated outside the project but in the same village and proximity.

As shown in Fig. 3, the first group of farmers who received both extension and input services improved their cowpea yield by 200 per cent compared to the national average. Interestingly, those farmers who operated outside the project obtained yields only 30 per cent lower than those within the project. This study showed that there was an exchange of technology information (spill over) among and between farmers. Statistical analysis showed that the yield difference between groups was significant.

Revenues from cowpea sales represented an important share of farm income. Furthermore, income generated from cowpea also depends on the period of its market disposal. For the group of farmers receiving inputs and extension services, the net income from cowpea when sold at harvest time was about one hundred and forty-two dollars ($142) per ha compared to two hundred and ninety-three dollars ($293) per ha when disposed three to four months after harvest. Some farmers, therefore, stored their produce to obtain better prices.

ii. Raising of small ruminants to diversify farm income

The commercial production of cowpea (Fig. 4) gave the impetus to raise small ruminants not only to diversify income, but also to improve the fertility of the soil. Around 25 farmers took up sheep fattening and most of them also cultivated cowpea. Improved feed rations determined through a contractual agreement between ASK and regional extension and NARS included concentrates, cotton oil cakes, cowpea, fodder, groundnuts and crop residues (Fig. 5). The fattening of sheep was undertaken twice per year, targeting holiday seasons (Fig. 6).

Table 3 summarizes the net income gains by the group of ASK farmers who chose to engage in both cowpea and sheep fattening activities under the

project. Annual income gains per participating farmer averaged 171 857 F CFA ($286 US) for the two groups operating under the project. These earnings helped diversify income. Furthermore, the long term gains for cultivating cowpea and raising small ruminants has been the improvement of soil fertility from the application of crop residues and animal manure.

Table 3: Average annual income grains from integrated crop-livestock farming- ASK (Taptenga, Burkina Faso) Project in 1998/99

Farmer Group	Cowpea production (FCFA/ha)*	Sheep fattening: 1st operation (FCFA)	Sheep fattening: 2nd operation (FCFA)	Total income (FCFA)	Amount in US dollars**
Group 1: received inputs and extension services	78 310	63 196	42 023	185 529	306
Group 2: received input only	54 967	63 196	42 023	160 186	267
Group 3: received neither (outside project)	31 792	63 196	42 023	137 011	228
Mean groups 1 and 2	66 638	63 196	42 023	171 857	286

* Figures are calculated on a hectare basis even though, under the project, each farmer cropped 0.5 ha of cowpea.
** $1 US valued at CFA 600.

Case two: Increasing Vegetable Oil Seed Production and Processing in Northern Ghana

Fig. 7: Nucleus farmers discussing soybean production and marketing strategies with some farmers in Karaga district, Ghana

Fig. 8: Soybean seed multiplication outside Karaga, Ghana

Soybean is a relatively new crop in Ghana. The cultivation of the crop has been promoted in northern Ghana for its nutritional value and income generation potential. The partnership of Savanna Agricultural Research Institute (SARI) in cooperation with the Extension Department of the Ministry of Food and Agriculture and farmers of Karaga District, northern Ghana, led to the development of the project proposal on "Increasing Vegetable Oil Seed Production and Processing". One of the largest cooking and industrial oil mills companies (Bosbel) showed interest and entered contractual agreement to purchase the soybean produced.

WASGP supported the above soybean project, first, to enhance the dissemination of improved soybean cultivars and the extension unit of the sub-region; second, to evaluate an alternative approach of technology transfer based on the Nuclear (lead) farmers approach; third, to introduce cultivation of the crop; and fourth, to enable farmers, particularly women to generate income.

The Nucleus Farmer Scheme is a private investor driven approach. The lead farmer has invested on his farm and also serves as a key agent for seed multiplication, and transfer of technology to members (Fig. 7).

SARI provided foundation seed of improved soybean cultivars to the nucleus farmer for the production of certified seed (Fig 8). He served

around 300 farmers by providing them with seed, land preparation services (tractor), and other inputs. These services and inputs were reimbursed in kind or cash at harvest. The lead farmer also helped other farmers organize the marketing of their produce.

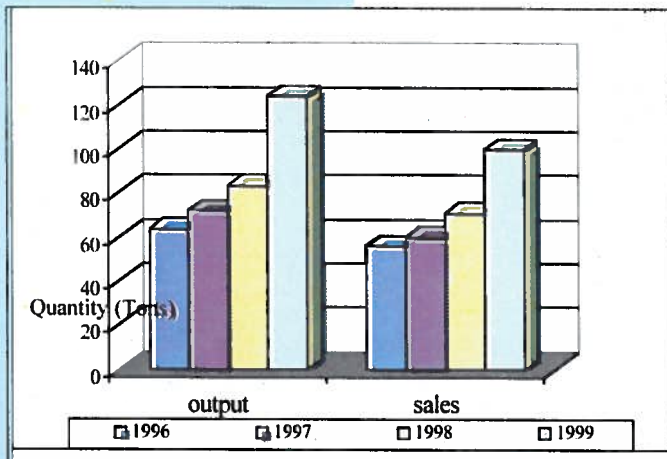


Fig. 9: Trends in Soybean Production and Sales in Northern Ghana

The release of improved varieties of soybean and the promotion on utilization contributed immensely to the development of the crop in northern Ghana. Farmers increased their production of soybean from 65 to 124 tons (Fig. 9) between 1997 to 1999. Among all interviewed farmers, 62% began to cultivate soybean over the last six years and most due to their participation in the project. In terms of cultivated land area in the project region, soybean ranks just after maize.

Soybean is consumed in 88% of the households in the study area. Major forms include 'tubani' (consumed by 83% of the respondents) and 'dawadawa (consumed by 72% of the farmers for its high nutritional value). Household consumption of soybean nearly doubled from 3.6 tons in 1996 to 6.7 tons in 1999. This has important nutrition and food security implications, since the crop is a relatively rich source of protein.

Soybean provided the largest share of household income for the majority of the respondents (62%). The mean share of soybean in household income was 51% i.e., farmers earned more than half of their farm income from soybean, and this share varied between 40 and 80% of farm income. Gender analysis revealed that more women (86%) than men (62%) ranked soybean first as the most important cash crop.

Table 4 shows the proportion of households that acquired Material Life Style (MLS) and Human Capital Investment (HCI) items with soybean income. Household members were able to improve their material well-being and standard of living through the acquisition of items such as bicycles (25%) - a major means of transport in the study area - and corrugated iron sheets for roofing houses (24%). On HCI items, most women spent their income on social obligations such as funerals, weddings and child naming ceremonies, etc. (71%), then 38% on school fees and 57% on clothing. In contrast, only 40% of the men spent their soybean income on social obligations and 62% on school fees.

Public effort to promote the utilization and incorporation of soybean into local diets ('dawadawa') and soybean purchases by NGOs for relief services and food aid have expanded the market for the crop. Industrial use

of soybean as vegetable oil and soybean cake in the poultry industry has been increasing in Ghana. BOSBEL, the largest vegetable oil mill in northern Ghana, RAKTIA HOLDINGS Ltd, and other medium and smallscale firms such as GAFCO, FAMINDUS, FATECO, TRINTO and multi-national companies like Lever Brothers and Nestle in southern Ghana constitute major industrial markets for soybean in Ghana.

Table 4: Uses of soybean income to acquire welfare items in Northern Ghana (percent of farmers)

	Men (n=66)	Women (n=23)	Total (N=89)
Material style of life items			
Bicycle	27.9	14.3	24.7
Furniture	13.2	14.3	13.5
Mattresses	7.4	14.3	9.0
Cooking pot	1.5	14.3	4.5
Radio	16.2	4.8	13.5
Corrugated iron sheet	25.0	19.0	23.6
Tractor	2.9	0	3.3
Human Capital Investment items			
School fees	61.8	38.1	56.2
Medical expenses	17.6	0	16.9
Clothes	38.2	57.1	42.7
Marriage	17.6	16.9	0
Purchased food	5.9	4.8	5.6
Social obligations	39.7	71.4	47.2

Source: SARI field data, 2000

In spite of the growing industrial demand for the crop, marketing is constrained by the poor organization of farmers and the lack of effective linkages to industrial users of the crop. Also, liquidity problems have limited purchases of raw materials by the BOSBEL Company, therefore putting much pressure on farmers to resort to different marketing strategies. The proportion of farmers who sold in the open market (to wholesalers/retailers in local and urban markets) fell from 65% in 1996 to just about 9% in 1999. On the other hand, those who sold directly or through associations to oil mills increased from 2% in 1996 to about 52% in 1999. The involvement of the Nucleus Farmer in marketing arrangements improved from 4.5% representation in 1996 to 20% in 1999.

The utilization and marketing of soybean increased during the project period in northern Ghana. The observed expansion in soybean production gives credence to the fact that resource-poor farmers are constantly in search of new opportunities to diversify their income sources and to improve their well-being. Evidence was found that soybean production has had positive impact on the income of farmers, accounting for over 50% of household income, particularly during the project period. Major constraints to soybean production range from lack of improved seeds and labor to ready markets. Oil Mill industries, for example, BOSBEL, drastically improved soybean marketing in northern Ghana, manifested in higher industrial purchasing of the grain. However, these linkages still remain weak, causing some concern about the sustainability of the market.

The project established functional vertical and horizontal linkages and partnerships between research, extension, farmers, and industry (Annex 2). The partnership between SARI and MoFA has facilitated transfer of technologies to farmers. Informal relationships between SARI and farmers exist mainly through farmer training programs (e.g., IPM field schools) and participation in on-farm trials. Linkages between farmers, industry, and NGOs were identified by the study.

Case three: The Medina Sabakh Millet Production and Commercialization Project

In the Senegalese Peanut Basin, the production of millet has been plagued by various constraints ranging from low use of improved inputs, insect damage to manual threshing, unstable prices compared to cash crops (peanut and cotton), etc. As a result of limited supplies of good quality grains, industrial processors operate below capacity.

Under the WASGP, a millet production and marketing project has been supported with a formally organized producer group in Medina Sabakh, Senegal. Under this project, group members used certified seed produced by research (ISRA/UPSE).

Under the project, the farmer's Association cultivated 50 ha using certified seed (Souna 3), fertilizer, urea, and extension services. A total of 23 tons of millet was introduced into the market. Farmers attributed this poor production performance to adverse climatic condition during flowering.

Unfortunately, the industrial processor did not fulfil its promise to buy the millet produced. The producer group then turned to the open market to sell the millet produce to local traders and food processors at a negotiated price of 92.5 FCFA/kg, generating more than 2 million FCFA in sales receipts. Pricing was the main reason the sale arrangement did not go through with the industrial grain miller (SENTENAC). The industrial processor offered low prices prevailing on flooded cereal markets and stalled negotiations to force the producer group to resort to distress sales. This instance raised important questions about the capacity of producer groups to negotiate and draw legally binding and enforceable contracts with industrial partners. Training in management and access to market information, credit, and storage facilities are enabling factors that will help farmers to get a better negotiating position in the future.

The mechanized threshing introduced through the project reduced post-harvest losses, and alleviated labour burden, especially for women (who were doing manual threshing).

3.0 DECREASING POST HARVEST LOSSES AND IMPROVING THE NUTRITIONAL QUALITY OF BASIC DIETS

3.1 Post Harvest Technologies to Empower Women's Groups

Throughout the Sahel, mango is an important tropical fruit both for the domestic and export market. During peak season, post harvest losses from 10 to 25 percent are common. Minimizing post harvest losses of various fruits and vegetables by promoting community based food processing and storage contributes to food security and enables food processors to take advantage of existing markets.

Fig. 10: Basnere Women Association of the Groupement Naam processing mango in Ouahigouya, Burkina Faso

Fig. 11: Transportation of mango to the processing unit in Burkina Faso

In Burkina Faso, the main project's beneficiaries included the women's group (Women's Association) of Basnere, based in Ouahigouya about 170 km north of Ouagadougou. Assistance to this group of women involved capacity building and the introduction of technology for drying mango, potato, banana, papaya, tomato, onions, etc. both for export and local market (Fig. 10). This activity has generated employment for 20 women on a permanent basis. Furthermore, the women's group raised their business gross income to the level of 12513000 FCFA (US$20,855). This, in turn, raised the gross income of permanent members of the association to the level of 1808000 FCFA (US$3,000). Other beneficiaries of the project included farmers who sold mango to the women's association for a total of 3.209.980 FCFA (US$5,350); transports (trucks and donkey cart, etc Fig. 11), that generated income of 899.275 FCFA (US$1,500). Processed and dried mango is exported to a number of countries like Germany, England, Belgium, France, Italy, and Switzerland.

Fig. 12: Women discussing mango processing and commercialization with USAID/SAFGRAD Review and Evaluation Team in Senegal

In Senegal, the Ndame Lo Women's Association (with about 125 members) was supported in post harvest processing of mango, other fruits, and spices (Fig 12). Local fruits and vegetables are highly perishable. Distribution and utilization of fruits and vegetables are limited because post-harvest processing technologies and conservation are not used. To partially alleviate the constraints of post harvest losses, the Ndame Lo Women's Association received technical services from the Senegalese Food Technology Institute (ITA).

The overall objective of this project has been to enable rural women from Ndame Lo to improve their living conditions through increased employment and income from processed fruit and vegetables using research proven techniques. WASGP enabled ITA in Senegal in training members of the women's group in fruit drying techniques and in installing of two gas dryers in the village of N'Dame Lo.

ITA trained 15 members of the group in carrying out several operations of the drying unit (dryer operation, burning flames and temperature setting and control, hygiene and security measures, etc), drying techniques (osmotic dehydration, leaf herbs and vegetable drying, etc.). These 15 women were able to follow the routine technical operation of post harvest drying of mango and also provided training to the other members of the association.

Fig. 13: Gaz dryers purchased with project support for the N'Dame Lo women association in Senegal

Fig. 14: Inauguration of the new fruits, vegetables and condiments processing facility in Senegal

The acquisition of the two drying units (Fig. 13) has more than doubled the fresh fruit processing capacity plan from 150 to 375 kg per day. The dryers have enabled the group to diversify production. This includes new plant and leaf-based products appreciated for their nutritional value or their aromatic perfume. Of course, classic products such as fruits and vegetable still constitute the bulk of their production. Mango drying accounts for at least 2/3 of their activity. Fig. 14 shows inauguration of the new fruits, vegetables, and condiments processing facility.

Sales receipts are used in various ways as cash flow funds, payments to members, savings and contributions to village-level investments. Expected annual net income from sales in 2000 is around 6000000 FCFA (US$10,000). Despite these production performances, finding market outlets is the main constraint for the women's group. Group members attribute this to poor advertisement efforts. So far, their main clients have been small stores and industries in Dakar such as "La Dakaroise des Fruits" and "Free Work Service." They buy dried

products from the group and package them for sale to consumers, mostly hotels, grocery stores, and tourists. A potential buyer could be the Senegalese Army, which has selected the N'Dame Lo dried mango as part of its new "soldiers food ration" which includes processed products of local industries. The quality of their product and the fame of the N'Dame Lo women's group (winner of the 1994 edition of the Head of State Grand Prize for women's promotion) may explain their selection.

However, marketing difficulties may be related to other factors besides information. Other problems include pricing clientele targeting, substitutes fresh vs. dried mango, taste, and preferences.

The women's group has developed an important partnership. Partners range from research and donors/facilitators to clients. It should be mentioned that this women's group has had long-standing relations with national and international partners such as UNIDO, Government of Japan, AFRICARE, ACCT, ENDA and a Dutch NGO, CNCAS, Germany-Senegal Solar Energy Project, etc. (Annex 3).

3.2 Improving the Nutritional Quality of Basic Diets

3.2.1 Utilization and Commercialization of Soybean Products

The study of soybean utilization at the household and small-scale enterprise levels was undertaken in two farming villages in Ghana.

In Ghana, traditional staple foods for adults and pre-school children are made mainly with cereals and starchy root and tuber crops, while weaning foods are prepared from maize with no protein supplementation. Nutritional data obtained from the study indicated that pre-school children in the project area were "at risk" nutritionally and were malnourished. The need for a nutritional intervention was established in the study area.

The baseline studies undertaken in the two villages (Samsam-Odumase and Mimpemihoasem) of the Greater Accra Region showed that basic traditional diets (prepared from maize, cassava, yam, plantain, etc.) are low in protein and in some other nutrients. Soybean is a relatively new crop in Ghana. With cooperation from the extension services and Women in the Development Department of the Ministry of Food and Agriculture, the production of soybean has been well established in the above mentioned villages. In collaboration with small-scale weaning food entrepreneurs in Ghana, technologies have been developed for the industrial scale production of soybean-based high protein foods. As a result, appropriate technologies for several products such as full-fat soy flour and soy grits are now available for use in the preparation of weaning foods and other blends. Appropriate processing techniques have also been developed for small-scale enterprise level production of specific high-protein, shelf-stable foods.

Village level techniques in the utilization of soybean were developed. The two soybean-based products developed were high quality full-fat soy flour and soybean paste with good nutritional and microbiological characteristics. Interested groups promoted the techniques developed in two villages for small-scale commercial ventures. A total of 17 recipes with desirable nutritional quality (energy, protein, vitamin B and B2, calcium and iron) and sensory characteristics were developed. The recipes adequately cover a range of traditional dishes for effective impact on their nutritional status. The recipes are categorized into whole soy products (including pastes, flour

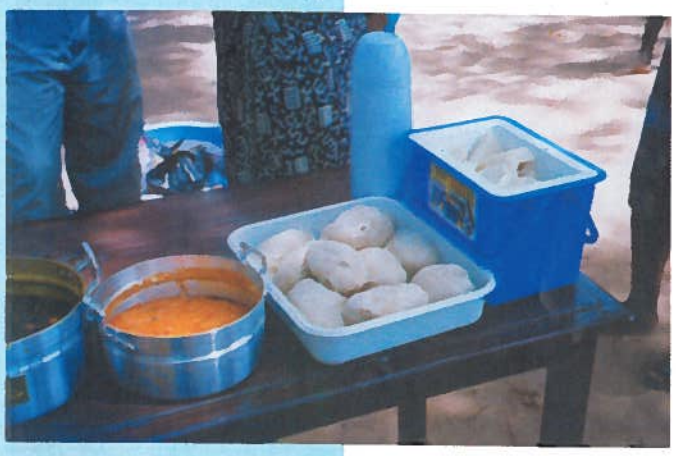


Fig. 15: Soybean fortified food prepared at a training session at Samsam Odumase, Ghana

Fig. 16: Children enjoying soybean fortified drinks for improved nutrition and better health in Ghana

and drinks); soybean wheat stews and soups; soybean incorporated into basic staple foods and soybean in cassava flour (Fig. 15).

The technologies developed are being used by small-scale enterprises for the production of high-protein weaning foods. These products are on sale in the supermarkets and health shops in the urban areas. Some hospitals in the greater Accra Region have been making regular orders for the supply of soy flour from entrepreneurs for sale to expectant women and mothers.

One recent major processing activity in some villages is the production of soy-gari, which was introduced to the gari processors through programs, aimed at promoting soybean utilization for improved nutrition in rural farming communities. This has become a major commercial activity. Although customers pay a little more for the soy-gari than the normal unfortified gari, the demand is increasing and more processors have expressed interest in the training. The beneficial effects on the nutritional status and the socio-economic benefits for the people in the above mentioned two villages was highly appreciated (Fig. 16).

3.2.2 Utilization of Forest Ditax Fruit as Source of Vitamin C.

Ditax is widely adapted in the Sahelo-sudanian and Sudano-Guinean ecologies that extend over 13 countries in West Central and even East Africa. In Senegal, the main producing regions are in the south (coastal and middle Casamance) and the center (Saloum Islands). The tree can reach 15 to 20 meters in height. Flowering occurs between March and June and fruits mature between October and December.

In Senegal, the West African Small Grants Program provided support for the exploitation of Ditax fruits (*Detarium senegalense*) as a source of Vitamin C. The main focus of the research study has been to: determine the optimal harvesting period to obtain good quality fruit; develop methods of processing and conserving the Ditax fruit with diversified and nutritionally-rich derived products; train rural producers and processors in post harvest processing techniques and set up fruit processing microenterprises; and develop horticultural practices for domesticating the tree to ensure proper propagation, establishment and management of the tree.

Production from the narrow supply base is highly variable for various reasons: weather variability, salt water on the islands, traditional harvesting techniques of cutting branches that regenerate slowly. At the same time, demand in rural and urban areas is increasing as the fruit is being consumed in both fresh and processed forms. Various parts of the tree and the fruit are used for medical purpose and in cottage industries. Because of its high demand, the natural populations of Ditax trees are decreasing rapidly. To domesticate the tree, the sustainable management of this natural resource becomes a serious concern.

Product analyses by the Institut de Technologie Alimentaire (ITA) showed that the Ditax fruit is very rich in vitamin C (1200 mg/100 gr), iron, and calcium (table 5). Different products have been obtained from processing the fresh fruit. These include sweet pulp, nectar, marmalade and dried pulp, whose their nutrient content vary considerably. The sweet pulp is substituted for fermented milk and is used with boiled granulated millet flour in a meal and frequently served during social ceremonies (baptisms, religious gatherings, etc.) and at the industrial level (soft drinks and ice cream).

Table 5: Chemical composition of Ditax based products

Parameter	Pulp	Pulp ITA	Nectar	Compote
Humidity (%)	66.7	84.84	83.93	28.33
Acidity (%)	-	o.14	0.08	0.14
pH	-	3.70	3.47	3.46
Sugar	29.7 g	9.96%	24.36%	-
Vitamin C (mg/100)	1290	422.8	158.77	323.75
Calcium (mg/100)	27	11.59	9.77	9.43
Ash	-	0.54	0.18	0.32

Source: Institut de Technologie Alimentaire (ITA), 1999

Training producers and women's groups helped expand knowledge on harvesting methods and processing and conservation techniques. Optimal harvesting methods can reduce harvest losses. Several nutrition-rich food products have been developed that can be used as a food ingredient (in a millet-based meal) and for industry (drinks, ice cream), thus allowing an improvement of the nutritional status of the populations.

Partners in the production and utilization of Ditax fruit are individuals, men's and women's group and local processing industries through local and international research institutes. Other potential users of project results are producer groups, rural populations, especially those in production areas (islands), women groups that process the fruit, and local industrial units (ice cream, fruit drinks, etc.).

Outputs

Some of the outputs of WASGP support of post harvest processing and improvement of the nutrition of basic diets include:

- Improved nutrition (energy, vitamin, protein, iron, calcium, etc.) of basic diets which can result in better health for both rural and urban populations;

- Increased production capacity of the fruit processing units with a combination of a solar dryer with gas dryers that also reduces drying time and alleviates the workload for women;

- Increased employment and income: more women are being employed in the processing plant that has increased its production meaning more income for members despite persistent marketing problems;

- Improved hygiene: required cleanliness practices at the plant have spilled over to family households, resulting in better hygiene conditions for them;

- Increased literacy for trained women members in accounting and bookkeeping.

4.0 CAPACITY BUILDING

4.1. Strengthening National Institutions

The initiative undertaken by OAU/STRC-SAFGRAD involved the establishment of Focal Units in NARS to serve as a pathway for research results to reach extension agencies, farmers, and other technology end-users. The establishment of Focal Units in the involved countries (i.e., Burkina Faso, Ghana, Mali and Senegal) linked NARS Networks and IARCs, as sources of technology, to clients such as farmers, microfood processors, agroindustry, etc.

The institutionalization of WASGP projects at the national level improved the commitment to monitoring and managing of projects at the country-level by the grantees themselves.

Workshops were held to address and articulate issues of technical and socio-economic constraints that impeded the transfer and utilization of research results; to strengthen functional linkages and partnerships among key stakeholders engaged in development and transformation of agricultural produce into value-added products.

A national workshop was held on 16 April, 1999 in Ouagadougou, Burkina Faso. More than 30 participants from research, extension, food science and processing units, and development support services attended the meeting. Institutional technical, and socio-economic constraints to technology transfer were identified and solutions to various constraints were proposed. The main theme was "Problématique de la valorisation des résultats de la recherche."

Another workshop took place on 20-21, April 1999 in Accra, Ghana, where 43 participants from the public and private sectors including research, extension, the Ministry of Food and Agriculture and food processors attended. The main theme of the workshop was: "Prospects for small-scale enterprise development in Ghana". Social, technical, and institutional problems encountered in the enhancement of technology transfer were discussed. The sub-themes of the workshop included: Manpower training, accessing market information, and credits.

A workshop was also held 10-11 May, 1999 in Dakar, at the Institut Senegalais de Recherches Agricoles (ISRA). The main theme was: Transformation and commercialization of agricultural produce". Technical, social, and institutional constraints that impede technology transfer and the development of agribusiness were also addressed.

4.2. Improving Technical Skills

As summarized in Table 6, 430 men, 334 women, and 47 children were trained in various aspects of food production and processing. These included soybean production and utilization to improve basic diets, commercial production of cowpea; seed increase of improved cultivars of millet, maize, cowpea and potato, modern husbandry of small ruminants; and on-farm enterprise and post harvest processing of fruits (mango), vegetables, and spices in three participating countries.

Training to improve specific skills was embodied in each project. For example, in food science and technology, several women (72) and men (29) received practical training in development and processing skills.

In Senegal, 15 women trainers attended a short course at the "Institut de Technologie Alimentaire" to train about 120 women of the NDame Lo Association in post-harvest processing of mango and other fruits, and in harvesting spices and condiments. With regard to harvesting and post harvest handling of Ditax fruit, 13 producers received training.

Table 6: **Improving Technical Skills In Food Production, Processing and Commercialization**

Activity	Men	Women	Children	TOTAL
1) Utilization of soybean for improving nutrient Content of basic diets in Ghana.	29	72	47	148
2) Post harvest processing of mango, other fruits, vegetables, spices and condiments: i) Burkina Faso ii) Senegal		60 and 110 (15) a		185
3) Commercial cowpea production storage, conservation and marketing in Burkina Faso.	93	2		95
4) Increase of improved potato seed production in Burkina Faso.	15			15
5) Post harvest-handling Ditax fruit in Casamance region of Senegal.	13			13
6) Millet and maize seed production technology using farmers as out growers of certified seed	49 (30) b			49
7) Community seed production of cowpea in five villages of Burkina Faso	36	55		91
8) Farm demonstration and improved production of soybean in northern Ghana	170	20 (?) c		190
9) Improved husbandry of small ruminants (fattening, shelter and veterinary services) in Burkina Faso.	25			25
TOTAL	**430**	**334**	**47**	**811**

a - number in parentheses refers to trainers
b - number in parentheses refers to trained farmers
c - estimated number of women trained in soybean production

Furthermore, the seed increase project supported in Senegal provided short-term training to forty-nine (49) participants. Thirty of them were farmers who received training in seed technology as out growers of certified seed (millet and maize). In collaboration with the UNDP poverty alleviation project and other educational and rural development agencies, 19 technicians also received training in seed production technology and processing.

In Burkina Faso, 60 women were involved in post harvest technology, processing and marketing of mango and other fruits and vegetables. Ninety-three men and two women received training in commercial cowpea production, storage, and conservation. In order to integrate the small ruminants' microenterprise into the predominant cropping systems in the Mossi Plateau of Burkina Faso, 25 farmers were trained in veterinary

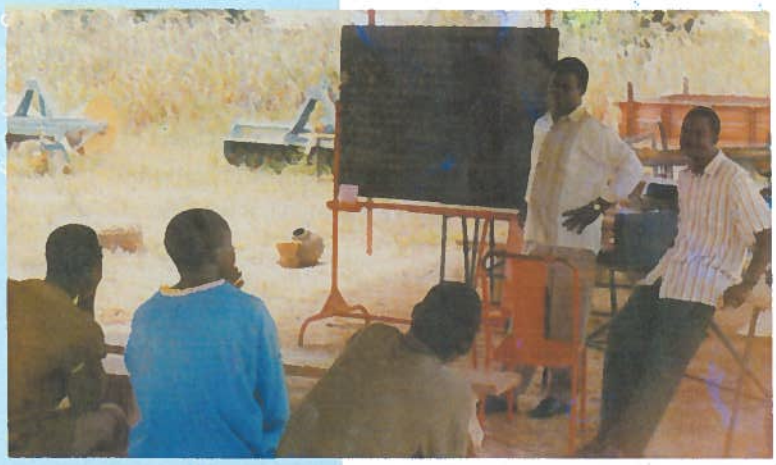


Fig. 17: Training in small ruminant production in Donsin, Burkina Faso

Fig. 18: Practical training on fodder bottling in Donsin, Burkina Faso

fattening of small ruminants (Fig. 17 and 18). The seed grower private enterprise of Yatenga trained 15 representatives of producer groups in the production of improved potato seed for farmer users.

In addition, 91 farmers (55 women and 36 men) from five villages of Burkina Faso (Saltouko, Thiougou, Tiakane, Manega and Sagnogo) participated in on-farm verification trials and improved their skills in cowpea production.

4.3 Institutional Framework for the Implementation of WASGP

The grant to OAU/STRC-SAFGRAD has strengthened partnerships of key stakeholders engaged in technology generation, transfer and farm-output commercialization involving the private sector, research and extension, farmers associations, policy makers, consumers and agroindustries. The program was aimed at improving the capacity and efficiency in delivering agricultural production support services. The medium term output of these programs can lead to the establishment and stabilization of agricultural growth, a condition necessary for poverty alleviation in the subregion.

The following mechanisms were realized in order to revitalize NARS capacity to enhance technology transfer.

4.3.1 Strengthening Collaboration with NARS

Building upon existing linkages and networking, a Memorandum of Understanding (MOU) was established between OAU/STRC-SAFGRAD and appropriate institutions of respective benefiting countries of the program (i.e. Burkina Faso, Ghana, Senegal, and Mali). The MOU defined the purpose of the agreement, the establishment of the Focal Unit (FU) as the mechanism for coordinating and implementing project activities, the specific roles and responsibilities of partners in the implementation of project activities, channelling and use of approved funds, and reporting and liasing with the regional coordinating entity (SAFGRAD).

4.3.2 Establishment of the Regional Technical Committee (RTC)

The RTC was established and comprised of the NARS' Directors, IARCs through networks and representatives from the private sector, women's groups, universities, microprocessors, etc. Some of the functions of the RTC are to review and approve grant proposals based on established criteria, monitor implementation of project activities, and provide guidelines to enhance efficiency of the implementation of project activities.

4.3.3 Establishment of Focal Units (FU) at the National Level

To ensure ownership and management of approved projects at the national level, OAU/STRC-SAFGRAD facilitated the establishment of Focal Units (FU) based on the established MOU with participating countries. In consultation with OAU/STRC-SAFGRAD, a Coordinator of the Focal Unit was identified from the existing NARS staff.

Focal Units were established to link NARS/or research results to clients; follow-up on the implementation progress of projects at the country level; assist groups such as farmers, micro- processors, and women's groups in the development of projects as well as linking NARS research to development; organize national workshops to address issues that affect technology transfer and commercialization; submit biannual reports on project activities to OAU/STRC-SAFGRAD; undertake new initiatives and research for developing markets and facilitating the reduction of production costs of agricultural technologies (including food processing) to improve competitiveness in local and international markets; facilitate the disbursement of justification of the use of funds on project activities; organize training, and promote agribusinesses.

In Burkina Faso, the Focal Unit (FU) was established in 1998 within the Center of Research and Scientific Technology (CNRST) of Burkina Faso. It linked INERA to its clients, monitored the implementation of the six projects at the national level, and facilitated the transformation of research results into value-added products by working with processors, organizing workshops, training, etc. Through consultations between CNRST and OAU/STRC-SAFGRAD, the coordinator of the Focal Unit was appointed.

In Ghana, the FU became operational in 1998. The consultation between CSIR (Ghana) and OAU/STRC-SAFGRAD led to the appointment of a coordinator who monitored the implementation of 6 projects; organized workshops, facilitated the development of proposals, and served as Secretariat for the National stakeholders committee.

In Senegal, the FU was established in 1998 at ISRA. The FU monitored project implementation, promoted utilization of technology, linked ISRA to users of research results, organized workshops and training sessions.

4.3.4 Coordination and Management

As outlined in Fig.19, SAFGRAD operates as an autonomous agency within the institutional legal framework and support of the Organization of African Unity. Strengthening partnerships with various research and development organizations including the private sector, agroindustries, etc. has been the key strategy of OAU/STRC-SAFGRAD for implementing programs and projects.

To sustain the flow of agricultural technologies from research to farmers and users, SAFGRAD utilizes its network linkages and collaboration with IARCs and other agencies. Over the last five years, SAFGRAD has developed partnerships with agroindustries, medium-scale food processors. Furthermore, it also strengthened partnerships with various technology transfer and rural development agencies. These linkages have facilitated not only the exchange of experiences, but also the testing and sharing of workable innovations.

The broad areas of OAU/STRC-SAFGRAD regional support include technical coordination to follow-up program implementation progress, financial disbursement and management, institutional support (such as training, workshops, management services), facilitation of exchange of technical information, and sharing of experiences through its linkages and networks.

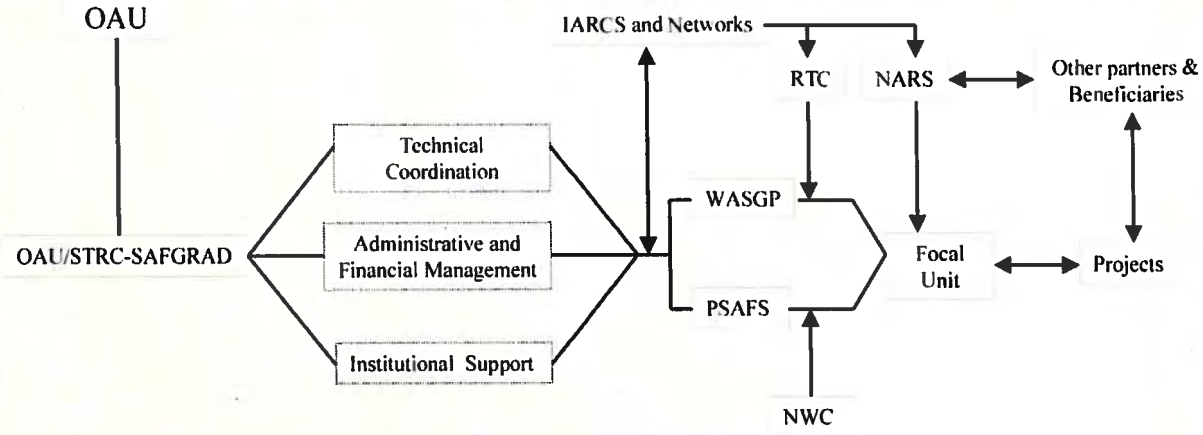


Fig.19: Schematic outline of linkages and OAU/STRC-SAFGRAD technical and administrative support for the implementation of WASGP and PSAFS Programs

OAU:	Organization of African Unity	NWC:	National Working Committee
SAFGRAD:	Semi Arid Food Grain Research & Development	PSAFS:	Production Support and Financial Services
WASGP:	West African Small Grants Program	NARS:	National Agricultural Research Systems
RTC:	Regional Technical Committee	IARCs:	International Agricultural Research Centers

5. LESSONS LEARNED

Among the documented lessons learned are:

1. The model employed for technology transfer, utilization and commercialization involved strengthening partnerships among key stakeholders, such as the suppliers and users of technologies. The model has revitalized not only the technology generation, transfer systems and linkages to market as a continuous process, but also improved the generation of income and employment of the involved communities.

2. NARS and IARCs, as technology providers have unfinished work to pursue, for example, in assessing the cost of agricultural production technologies. Recommendations regarding varieties, hybrids, etc. without determining the profitability and the market demand of technologies will not lead to improving the competitiveness of African agriculture. Linkages and partnerships of NARS and IARCs to clients, such as farmers, food processors in particular and agro industries in general, are crucial to broaden market opportunities and promote the transformation of agricultural production into value-added products.

3. Contractual agreements are crucial in formally linking farmers to market opportunities, securing the provision of quality products and services, reducing transaction costs, and fostering accountability among parties. Contracts between farmers and industrial processors are an efficient arrangement to ensure supplies of quality raw materials for processing units. However, the capacity of farmers to negotiate and sign legally binding and enforceable contracts with industrial partners is weak. Provision of market information and storage facilities can strengthen the ability of farmers to negotiate contracts. There is, therefore, a need to organize and train farmers to improve their management capacity, and access credit to avoid distress sales, etc.

4. Small farmers and/or their associations can meet the demand of certified seed at the community level. Assistance to private seed producers enterprises requires sustained linkages to research and extension, training in seed business management, easier access to financial resources and physical facilities for seed cleaning, storage and processing and organization of farmers. Meeting these conditions requires further technical and financial assistance to enhance the sustainability of the seed production enterprises.

5. Reinvestment of income by some WASGP beneficiaries has been a good management practice that must be encouraged, since it is a step toward ensuring the financial sustainability and continuity of private enterprises.

6. Post harvest losses of tropical fruits, such as mangoes ranges from 10 to 25 percent in the Sahel. Reduction of these post-harvest losses makes it possible to generate income and employment, and also enables farmers and women groups to broaden market opportunities.

7. Institutional mechanisms established at the national and regional levels, such as the Focal Unit in NARS and Regional Technical Committee have not only linked research to development, but also improved ownership and the desire to manage country - level projects. Furthermore, the mechanism put in place has minimized the hurdles for moving research results to clients by forging partnerships among key stakeholders.

6. SUGGESTIONS OF PROGRAMS FOR FOLLOW-UP PHASE OF WASGP

6.1 Implication for Market and Cost of Technology Research

Knowledge gaps to reach the ultimate goal of a successful technology commercialization exist at three levels: the technology market; the output market; and the required institutional setting.

With regard to agricultural inputs and technology, careful research is needed on both the demand and supply side.

On the technology demand side, research could address the following:

- Repackaging of technological components to reduce cost of production, marketing, etc.; and

- An assessment of the profitability of various technologies under real farming situations. This includes a careful assessment of the costs of production of crops using the technologies and the other micro and macro constraints faced by the producers using the technology. Constraints include access to inputs through credit or cash and the unavailability of labor.

The WASGP activities have shown that the market linkage has been the least developed. Most of these technology transfer projects were designed to:

i. Link agricultural technology suppliers to users

ii. To link farmers to the industry sector as market outlets for products.

In the process of the implementation of the technology transfer and commercialization projects, a number of issues have surfaced that have research implications.

The technology generation and transfer systems continue to be perceived on classic 'productivist' approach that the overriding concern is on solving problems of the technical production feasibilities. The social acceptability and economic profitability of technologies did receive little attention. The economic profitability criterion is a complex one as it embodies an array of parameters and factors. Application of this criterion requires analyzing demand not only for the technology to be adopted, but also for its outputs.

Determinants of demand for a technology by a rational potential user include at least its price, and how much its product would cost at various places. Cost of a technology from a potential user's perspective must be determined by research when it is being generated and, of course, before its transfer to users. Unfortunately, this has not been a regular activity of researchers since addressing this issue requires a multidisciplinary approach involving socio economists, farmers and other end-users of technologies. Demand studies are generally an add-on and under-researched area.

Furthermore, research on the structure of the cost of agricultural technologies and products in the West African region has shown that a significant part can be attributed to transport and communication. The resulting wide gap between farm gate and factory level costs can provide a strong disincentive to rational private industrial users to invest in new technologies.

The WASGP activities showed that lack of timely availability of market information also has weakened the market link. In Senegal, mango processing project, the Ndame Lo women group has serious difficulties selling its product in surrounding areas besides few outlets in Dakar. At the same time, their counterparts in Burkina (Bas-

nere project) have succeeded in exporting their processed mangoes to Europe. Market information exchange between entrepreneurs is essential to identify local and external market outlets.

On technology supply side, the potential market size and its functioning, the inefficiencies and constraints that should be alleviated will need to be addressed. With regard to product market, there is a need to assess current demand at national, sub-regional and international levels.

The case of maize and soybean imports for animal feed to the region illustrates the weak supply-demand link. Whereas significant maize quantities are being produced in the region, external sources are used to satisfy internal animal feed demand. To improve competitiveness, there is, therefore, a need for further research at regional level on market prices and opportunities to narrow information gap through networking, and to address organizational problems to lower transaction costs or policy issues (fiscal and other barriers to sub-regional trade). Country-level pilot projects can be undertaken to systematically address these issues by involving public and private sector institutions including policy makers.

With regard to institution building, two points should be considered:

i. The major knowledge gap concerns the appropriate way of phasing out the public sector to ensure a smooth transition to the private sector in the area of inputs delivery and services

ii. Research on alternative ways to the public and private handling of inputs should be undertaken. These include enabling and organizing farmers to assume the technology transfer and inputs delivery services.

To address the above issues, pilot project studies can be undertaken in a few countries.

6.2 Stimulating the Economic Growth of the Rural Sector

To stimulate economic growth in the rural sector, the future programs of WASGP should include:

6.2.1 *Revitalizing NARS Technology Verification and Transfer Systems*

The establishment of FU at the level of NARS has improved the pathway of research results to clients, such as farmers and agroindustries. Focal Units also serve as a mechanism of consultation and for articulating policy issues pertaining to technology transfer and commercialization. The development of these units in a number of countries will stimulate networking for exchange of information on technology transfer and commercialization, as well as to forge linkages to agroindustries. There is a need to share this experience by involving more NARS.

6.2.2 Adding Value to Crop Commodities

Women cooperatives in Burkina Faso and Senegal were assisted in post harvest processing of fruits (mango) vegetable and condiments; These enterprises have generated income and employment.

In West Africa, groundnut and soybean are important oil crops. Oil mills purchased soybean and groundnut to extract cooking oil. The cake as by-products has also been used in livestock feed. Linking production of these crops to industrial oil mills has also generated income and employment to farming communities. The commercial production of legumes, such as cowpea, soybean, groundnuts and developing markets for tropical fruits have linked agriculture to industry to enhance the commercialization of value-added products which diversified farm income. Much more work needs to be done to promote the transformation of agricultural produce into value-added products.

6.2.3 Promotion of Seed Production Enterprises

Although several technological options (i.e. varieties, hybrids, inputs etc.) are available, the majority of small farmers practice subsistence agriculture. The scheme of multiplication and distribution of seed has also been dominated by the public sector which failed to deliver improved cultivars, hybrids, fertilizer, etc to farmers. To promote private seed production enterprises, WASGP supported two projects on seed increase and distribution in Burkina Faso and Senegal. The output of these and other projects showed that farmers/and their associations can produce certified seed successfully.

However, the transformation of farmers/or their associations into viable private certified seed producers requires sustained support of research, training in seed technology and production and to improve organizational and management capacity.

During the next few years, the aim of pilot projects in few countries will be to enable the private sector to play a key role in the provision of production support services (i.e. seed, fertilizer, etc).

6.2.4 Contracting Technical Services

i) Research and extension

To enhance demand driven research and technology development, WASGP also facilitated contracting between farmers associations and with those organizations that provide technical services (i.e. research, extension and veterinary services). This study showed that contracting between providers and users of technical services has improved partnerships and accountability of the delivery of technologies. This has been a limited experience. But this best practice will need to be further developed in the next few years to particularly build awareness among farmers and the public sector, organizations and to regularize payment practices to technical services rendered. In the long-run, contracting may facilitate private funding support for research.

ii) Between suppliers of agricultural raw material (farmers) and agro industries including food processing units

One of the lessons learned include that contractual agreements between farmers and agroindustries not only secure the provision of raw material in desired quality and quantity, but also legally bind industrial partners to respect agreed prices and volume of purchase. There is, therefore, a need to organize farmers to improve their negotiating, managerial and production capacity (through the private sector involvement). Furthermore, farmers as contract producers for industry use high input technology to substantially increase production which has positive implication in attaining food security.

6.2.5 Microfinance Program

Most farm cooperatives and associations projects, for example, seed production enterprises, fertilizer distribution, agricultural processing and marketing etc.) were hampered by serious financial constraints due to lack of or low rural savings.

Matching locally mobilized funds and encouraging reinvestment of profits by project beneficiaries in profitable business ventures can ensure the sustainability of funding. However, initial financial microfinance program is needed to build sustainability of various enterprises that will lead to self financing.

6.2.6 Intervention for Improving the Nutritional Level of Households

Much progress has been made on improving the basic diets based on sorghum, maize, millet and cassava by the fortification with soybean, cowpea and other grain legumes. Further research and commercialization is needed in product packaging, marketing, and distribution to commercialize the products through the development of microenterprises.

6.2.7 Capacity Building

Training activities that will be undertaken will improve the managerial capacity of producers organizations. These include strengthening the negotiating capabilities of farmers and their associations; improving know-how for searching markets; and to improve the administative and financial management efficiencies of cooperatives and farm associations (including women groups). Specialized training will be emphasized on agribusiness, food processing leading to value-added products and in seed production technologies.

Annex 1

Partnerships between ISRA/UPSE and Stakeholders in Seed Technology Transfer and Commercialization Project, Senegal

Partners	Specific roles	Institutions/Functions
UPSE/ISRA	Seed technology and production	Training producers in seed production
ENCR	Facilitated training of four students in seed production	School for engineers with collaborative teaching-research program.
NGO AQUADEV Louga	Facilitated training of 15 producers in seed production	NGO in the Louga region
UNDP	Facilitated training of 15 producers in seed production	Poverty alleviation program
Millet Producers (9)	Produced millet seed	Contract for seed production
Maize Producers (7)	Produced maize seed	Contract for seed production
CNRA/Bambey	Supply of improved millet and maize cultivar	Part of the national agricultural research center ISRA
Millet/Sorghum Network	Exchange of technical information on the performance of improved cultivars	ICRISAT and NARS
Maize/Cowpea Networks	Access to early and extra-early maturing maize cultivars	ITA and NARS
UNIS	Assure seed production and marketing nation-wide	Private interprofessional group of the seed subsector
WINROCK	Facilitated diffusion of the improved seed	NGO involved in rural development
World Vision	Facilitated the distribution of improved seed	NGO to enhance rural development
AFRICARE	Facilitated seed distribution in the Kaolack region	NGO supporting food production
SODEVA	Facilitated seed distribution in the Louga region	A parastatal (being dismantled) involved in agriculture extension and development
RODALE	Facilitated diffusion of seed in the Thies region	NGO supporting sustainable agricultural development
US Peace Corps	Helped disseminate use of improved seed	US organization providing volunteer work in various areas of rural development
CNCR, Jeunesse Mouride, Mbouroise, Developpement	Helped disseminate use of improved seed	Farmer organizations with national or local rural development agendas
Individual Farmers	At least 51 and 10 farmers purchased respectively more than 5kg each of certified seed of millet and maize to cultivate these crops.	Food crop growers
SAFGRAD	Facilitates &supports technology transfer & capacity building	Regional coordination for strengthening collaborative research and development

Source: ISRA/UPSE, Report 2000

Annex 2

Partnerships between farmers and stakeholders in soybean production -Northern Ghana

Partner	Role played	Institutional arrangements
Farmer Associations	Organize farmers into groups to source production support and access markets	Have leadership roles and management controls
Nucleus farmer	• provision of certified seed • tractor services as well as extension services to outgrow farmers • assist in accessing market	• Agreement contract with farmers on the mode of payment for services • sign supply agreement with BOSBEL and CRS
SARI	• Provision of breeder seeds • extension on improved soybean production practices • link farmers to marketing sources	Informal working relation with farmers • formal working relation with MoFA and NGOs
MoFA	• Production of foundation seed • extension on improved soybean production practices • link farmers to marketing sources	• formal working relation with SARI and NGOs •Informal working relation with farmers
BOSBEL	• Facilitate production and processing of soybean • provide market of soybean grain	• MOU with farmer associations and nucleus farmer for the purchase of grains • informal working relation with SARI and MoFA
CRS (NGO)	• inventory credit and financial assistance to farmers • purchase soybean grain	• Agreement on modalities for repayment of credit • working relations with SARI and MoFA
MAID (NGO)	• Inventory credit • training in farm management practices	• Informal working relation with farmers • formal working relation with sister NGOs, MoFA and SARI

Source: SARI field data, 2000

Annex 3

Partnership Development by the N'Dame Lo Women Group under the Fruit Processing Project in Senegal.

PARTNERS	ORIGIN/AREA OF INTERVENTION	ACTIVITIES
Clients : La Dakaroise des Fruits	Dakar	Buyer of processed fruits
Free Work Services	Dakar	Idem
Army of Senegal	National	Potential buyer of dried mango
Women Group	N'Dame Lo, Thies region	Produced and processed fruits and vegetable.
ITA-Food Technology Institute	Dakar	Technical assistance and training to N'Dame Lo women group.
SAFGRAD	International partner	Facilitator: provided funding through WASGP and facilitated linkages to research.
Photovoltaic Solar Energy Project Germany – Senegal	Former International Partner	Provided equipment for solar dryer
CNCAS – Agricultural Credit Bank	National	Provided funds for acquiring one gas dryer
UNIDO - UN Organization for Industrial Development	Former International Partner	Provided assistance to women group in engaging into fruit processing.
Government of Japan	Idem	Funded the UNIDO Project
ACCT – Agency for Technical and Cultural Cooperation	Idem	Funded group to build storage unit, meeting rooms, packaging bags, etc.

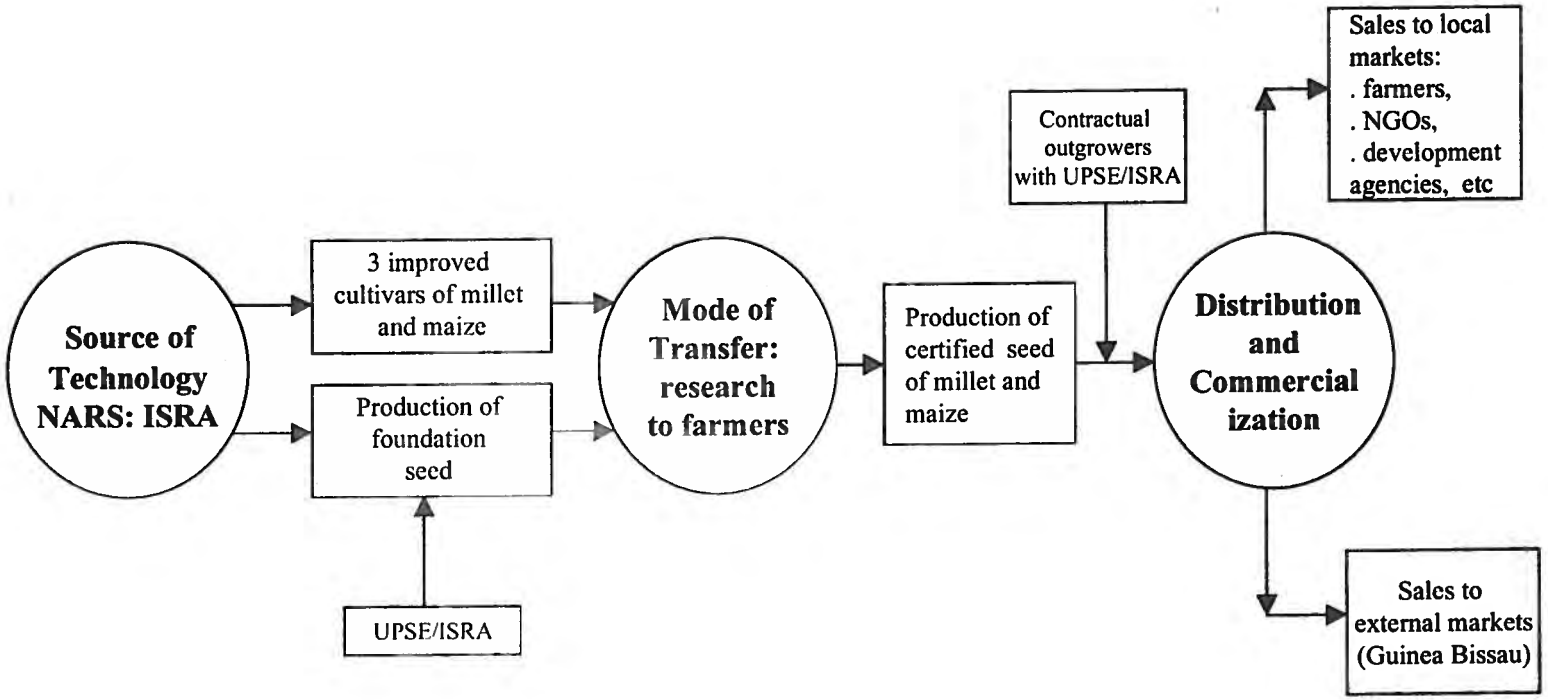
Source: ITA Report, 2000

Annex 4

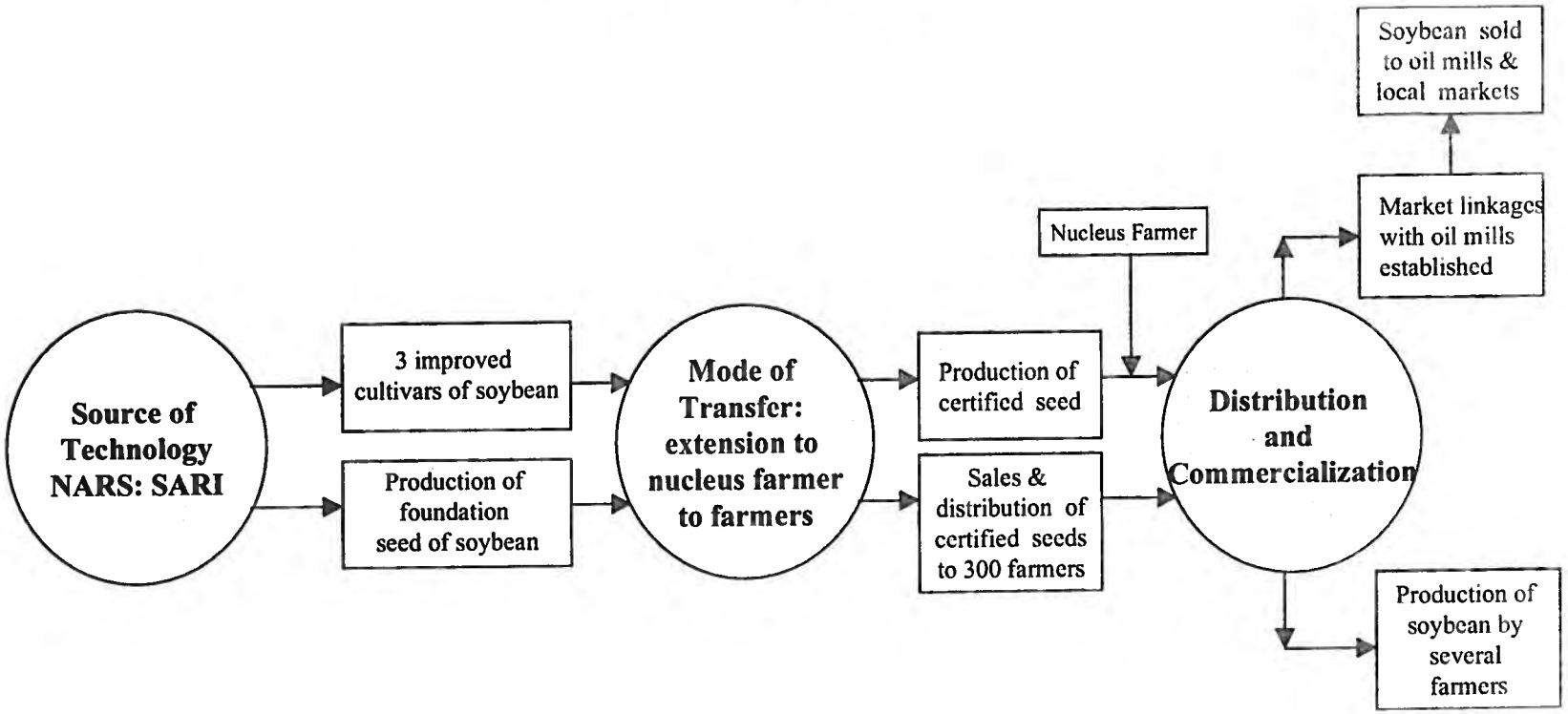
Partnership in the utilization of soybean products to improve the nutritional status of basic diets in Ghana.

PARTNERS	INSTITUTIONAL ACTIVITY AND SPECIFIC ROLES
1) Farmers in the villages of Samsam-Odumase and Mimpemihoasem	As beneficiaries cultivate and utilize soybean
2) The Ghana Grains and Legume Development Board	Promotion of soybean production to meet demand (300,000)
3) NARS of CSIR including Food Research Institute (FRI)	Develop improved varieties and improve nutrition of basic diets using a soybean.
4) University of Ghana (Home Science Department)	Collaboration of FRI to develop recipes and training activities.
5) Bosbel vegetable oil mill	Production of Soy oil and cake for marketing and distribution
6) Extension Services of Ministry of Agriculture	Transfer of soybean production and utilization technologies
7) NESTLE Ghana Ltd.	Produce soybean based high protein food for commercial purposes, for example, infant foods
8) Dodo Foods	Production and marketing of soy based high protein foods
9) ADRA	Distribution of soy based high protein food for children
10) Darkruby and Delabac Enterprises	Processing and marketing of soybean based food products: receive technical assistance and collaboration from FRI
11) OAU/STRC-SAFGRAD	Facilitated project support and implementation through funding of USAID and linkages with other projects.

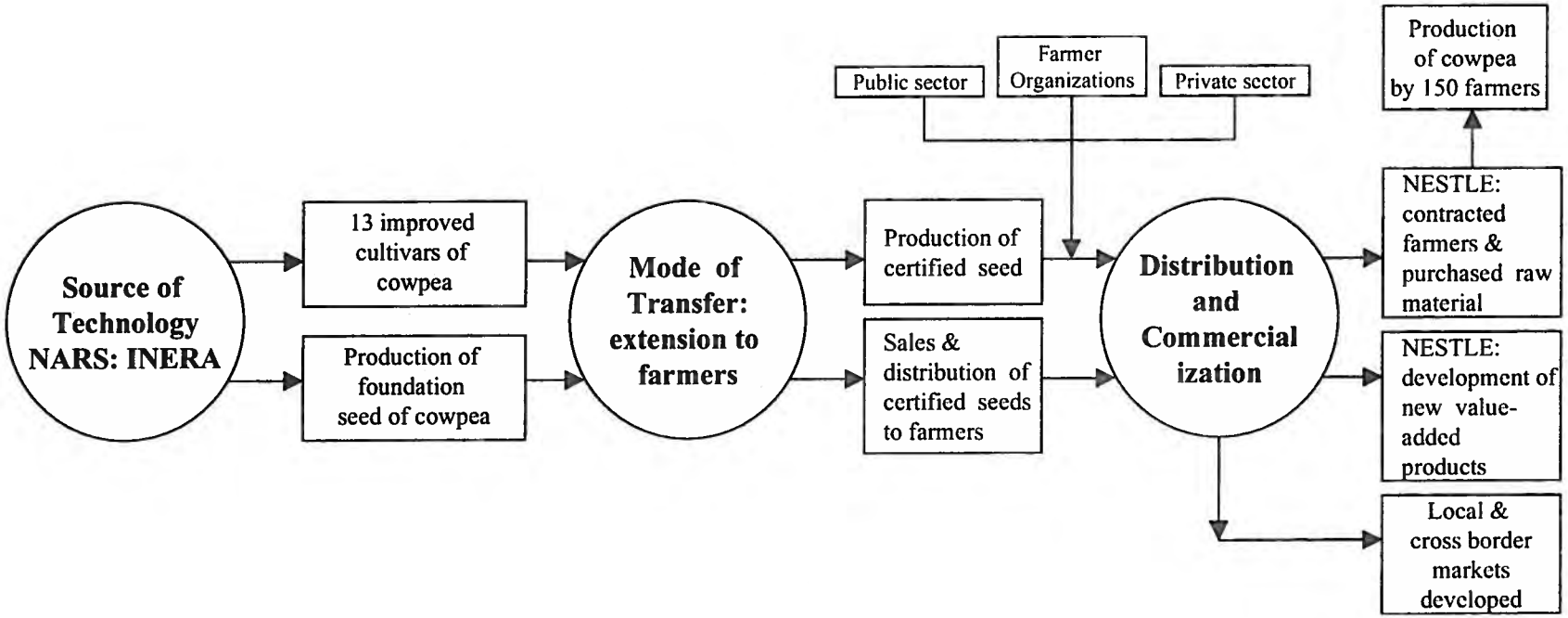
Annex 5a : Technology Transfer and Commercialization of Millet and Maize in Senegal



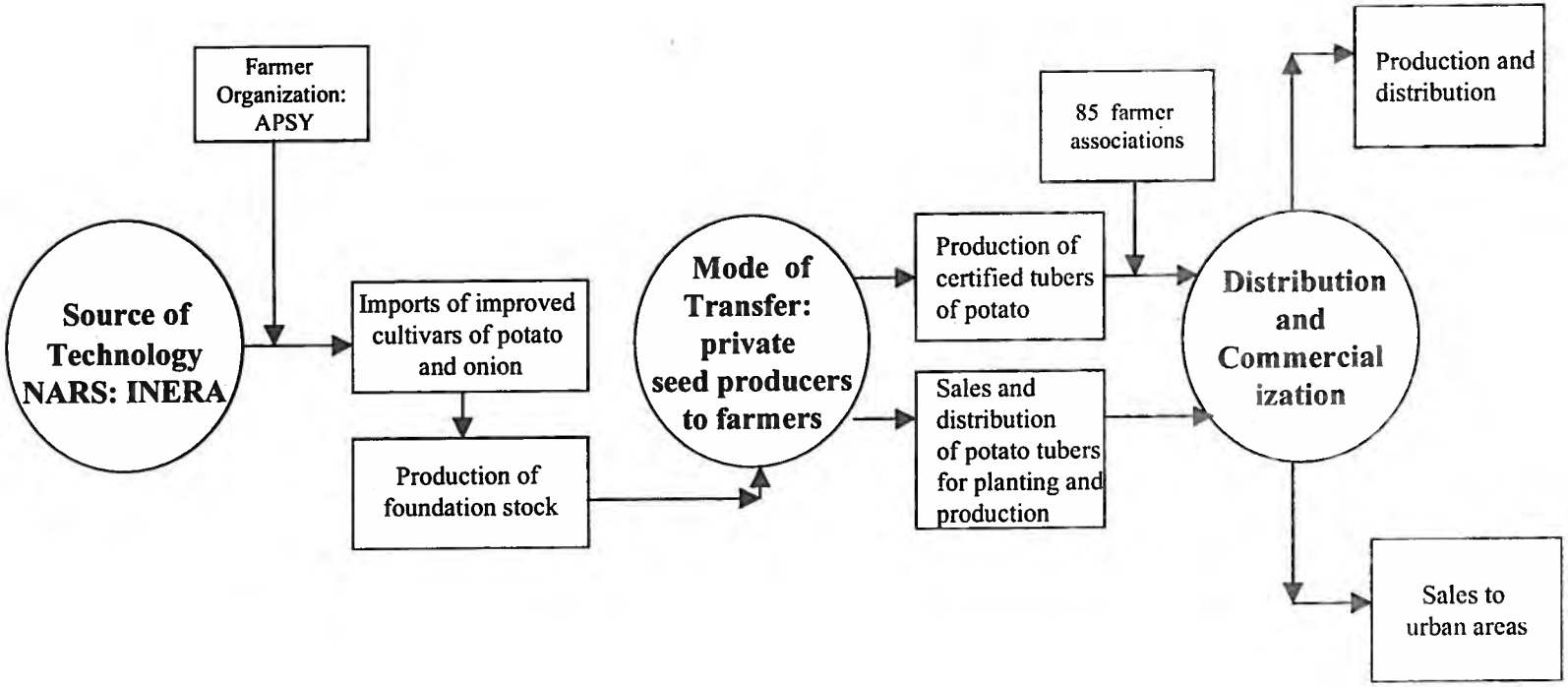
Annex 5b : Technology Transfer and Commercialization of Soybean in Ghana



Annex 5c : Technology Transfer and Commercialization of Cowpea in Burkina



Annex 5d : Technology Transfer and Commercialization of Potato and Onion in Burkina



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OAU/STRC-SAFGRAD Professional Staff

Management

International Coordinator
Taye Bezuneh

Administration and Finance
Evenunye Adanlete

Researchers

Taye Bezuneh, PhD, Director of Research
Mahama Ouedraogo, PhD, Breeder/Agronomist
Bocar Diagana, PhD, Agricultural economist
Ali Ouattara, Msc, Agricultural economist

Collaborating Institutions

Centre National de Recherche Scientifique et Technologique (CNRST), Ouagadougou, Burkina Faso
Institut de l'environnement et de Recherches Agricoles (INERA), Ouagadougou, Burkina Faso
Departement de Productions animales, INERA, Ouagadougou, Burkina Faso
Departement de Technologie Alimentaire, IRSAT, Ouagadougou, Burkina Faso
University of Ouagadougou, Burkina Faso
Ministry of Livestock Resources, Burkina Faso
Ministry of Agriculture, Burkina Faso
Ministry of Food and Agriculture, Ghana
University of Ghana, Legon, Accra, Ghana
Council for Scientific and Industrial Research, Accra, Ghana
Food Research Institute (FRI), Accra, Ghana
Savanna Agricultural Research Institute (SARI), Niankpala, Ghana
Animal Research Institute (ARI), Accra, Ghana
Institut Sénégalais de Recherches Agricoles (ISRA), Dakar, Sénégal
Institut de Technologie Alimentaire (ITA), Dakar, Senegal
Unité de Production de Semences (UPSE), ISRA, Bambey, Sénégal
Institut Togolais de Recherche Agronomique (ITRA), Lomé, Togo
Institut d'Economie Rurale (IER), Bamako, Mali

Focal Unit Coordinators

Zoundi J Sibiri, Zootechnician, INERA, Ouagadougou, Burkina Faso
Kwasi M. Setsoafia, Soil scientist, CSIR, Accra, Ghana
Abdou Fall, Zootechnician, ISRA, Dakar, Senegal
Bakary Coulibaly, Agricultural economist, IER, Bamako, Mali

Project Beneficiaries

Burkina Faso
Association Song Koaadba (ASK)
Association des Producteurs Semenciers du Yatenga (APSY)
Basnere women Group
Farmer association of Siltougou
Farmer association of Thiougou
Farmer association of Tiakane
Farmer association of Manega
Farmer association of Sagnogo

Senegal
Ndame Lo Women Association
Medina Sabakh Producer Association
Institut de Technologie Alimentaire and villages in Casamance Region
ISRA Seed Production Unit and Certified Seed Producers

Ghana
Karaga district soybean producers
Delabac Venture
Darkruby Enterprise
Samsam Odumase women group
Mimpemihoasem women group
Glass Jar Users Association
Sota Women Association
Babi Women Association
Minya Women Association

Togo
Wogba Women Association
Lolonyo Women Association

The Semi-Arid Food Grain Research and Development Agency of the Scientific, Technical and Research Commission of the Organization of African Unity (OAU/STRC-SAFGRAD) was established in 1977 to advance agricultural research, development, and natural resource management in semi-arid ecology in more than 30 countries of sub-Saharan Africa.

For more than two decades, OAU/STRC-SAFGRAD has mobilized scientific talents and resources of National Systems and those of International Agricultural Research Centers (IARC's) to enhance food security and sustainable agricultural development.

To contribute to Africa's food production increase and poverty alleviation challenges, SAFGRAD has revitalized and broadened its program scope to make small-farm holdings more profitable. The four new niches of SAFGRAD include: first, to promote linkage of agricultural production to small and medium-scale industries to enhance the transformation of agricultural produce into value-added products; second, diversify farm enterprises by integrating on-farm production systems to induce complementarities and synergies in the use of resources, generation of income and employment; third, promote demand-driven research and packaging of more productive technological options to increase agricultural production and productivity and fourth, to promote the development of agribusiness by exploiting both local and export markets.

The main thrust of SAFGRAD program is to:

i. Enhance agricultural research and development capabilities of member states through short and long-term training;

ii. Facilitate addressing agricultural policy issues through conferences, workshops, symposia and government contacts;

iii. Promote the transfer, adoption, and commercialization of agricultural technologies to generate income and employment in sub-Saharan Africa.

iv. Facilitate the industrial transformation and utilization of food grains into value-added products.

v. Promote productive agriculture and environmental conservation through an integrated farming systems.

vi. Build the knowledge base on semi-arid agriculture in SSA through its publication, specialized seminars, etc..

Within the Scientific, Technical and Research Commission of OAU, SAFGRAD is governed by the Regional Technical Advisory Council comprised of representatives from various organizations.