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SEMI-ARID FOOD GRAIN RESEARCH AND DEVELOPMENT  
RECHERCHE ET DEVELOPPEMENT DES CULTURES VIVRIERES DANS LES ZONES SEMI-ARIDES

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2. A Compilation of Best Practices and Lessons Learned  
in Technology Transfer and Commercialization

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## Introduction

The WASGP is a pilot program implemented in Burkina Faso, Ghana, and Senegal. One of the objectives of the program was to document best practices and lessons learned in order to facilitate the replication of success stories and of course avoid the shortcomings in other countries. My assignment today is to reflect on what has been done within this program in the above countries, and draw what can be learned from it. The model and institutional mechanism for implementation were already discussed by my collaborator.

1. **Development of Private Seed Production Enterprise**
  - 1.1 **Increase of Improved Potato and Onion Cultivars in the Sudano Sahelian Zone of Burkina Faso**

**Community Name:** Ouahigouya, Burkina Faso

**Beneficiaries:** The Yatenga Seed Producers Association (APSY), comprised of more than 85 farmer organizations and individual farmers.

## Project description

Potato and onion are important crops in 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 planting of improved cultivars of potato (var. Sahel) and two onion varieties (violet de Galmi and Garango).

The main problems to be addressed are that potato and onions seeds are imported, expensive, and not available on time.

This project was designed 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.

## Indicators of Success:

- Seed production was done on 1 ha for potato and 2 ha for onions (Table 1)
- Training was provided to producer groups in potato, tomato and onion production using demonstration and production fields.
- Reinvestment of project income: ASPY has improved the capacity of its enterprise by reinvesting income generated in 1998. This financial investment provided for the purchase of farm implements (Table 2), an improved storage facility and its repair, a cold room for keeping the seed, and land preparation.

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In 1998/99 APSY produced 11 tons of potato seed tuber meeting 66 percent of the demand (Table 1). Fifteen producer associations purchased all of the potato tuber seed produced which was distributed to several locations in Yatenga province. The gross income generated from potato and onion sales amounted to twelve thousand (\$12,000) and seven thousand (\$7,000) per hectare, respectively.

Table 1. Gross revenue generated from potato and onion seed sales by APSY

	Potato (1 ha)		Onion (2 ha)		Total revenue
	Production (Tons)	Value FCFA	Production	Value FCFA	
Year 1 (1998/1999)	11	7250 000 (\$12,083)	10 bags	350 000 (\$583)	
Year 2 (1999/2000)	11.15	7 287 500 (\$12,146)	405 kg	8 100 000 (\$13,500)	
Total	22.15	14537 500 (\$24,229)		8 450 000 (\$14,083)	22 987 500 (\$38,312)

Table 2. Reinvestment of project income – ASPY (Burkina)

Item	Constraints resolved	Amount FCFA	Amount in \$US*
Farm implements - 2 oxen - Seed grading - Accessory of tractor	Improvement of animal traction	185 000	308
	Separation of different size of potato	2 200 000	3 667
	Facilitation of land preparation	3 500 000	5 833
	Conservation of seed	1 150 000	1 917
Storage Cold room connection to power			
Land preparation	Increase in area of cultivation	2 000 000	3 333
Wages distributed to contractual labor	Labor input	720 000	1 200
<b>Total</b>		<b>9 775 000</b>	<b>16 258</b>

\* \$1 US is about 600 FCFA

**Keys to Success:**

- Excellent groundwork/planning and partnership development in early stages
- Entrepreneurship of the association
- High demand for the seed produced

## 1.2 Seed Increase and Distribution of Improved Millet and Maize Cultivars in Senegal

**Community Name:** ISRA, Senegal

**Beneficiaries:** Farmer groups and individual producers.

### Project description

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).

The sluggish growth of cereal production, besides the chronic low and erratic rainfall patterns can be explained by a number of factors: limited use of modern inputs--improved cultivars of seeds and fertilizer; limited technical skills of seed producers; ineffective input delivery systems; and, difficulty in accessing credit and other financial services.

Among ways to boost grain production, is promoting the timely access to sufficient quantities of high quality seeds. Technologies are available, especially at ISRA for seed production. But these results have not been transferred successfully to farmers because of some of the above-mentioned constraints. Sufficient seeds of improved cultivars of millet and maize, two important food crops for farmers, are still lacking.

To address the seed problem, ISRA/UPSE, with a grant of \$16,667 from SAFGRAD/WAGSP embarked on a millet and maize seed production project. The technology being transferred and commercialized is production of improved maize and millet seeds.

### Indicators of success

Success of this project is evidenced by:

- Production and sales of millet and maize seeds; Over the two years of the project, about 17,000 kg and 13,000 kg of certified seed of millet and maize respectively, were produced under contract by 9 and 7 private producers. This seed output, valued at a total of almost 15 million CFA, can be used to plant an estimated area of 2797 ha. of millet and 624 ha. of maize.
- 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.
- Contracts were signed with two groups of farmers which allowed them to get substantial income from seed production; and, the farmer groups successfully produced and sold certified seeds, which met the standards of UPSE/ISRA.

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- A total of forty-nine people were successfully trained in seed production, treatment and conservation: thirty as pilot producers in different production zones; fifteen in collaboration with other partners (UNDP, AQUADEV, NGO); and, four students in agricultural engineering from ENCR.

## **Lessons Learned in Development of Private Seed Production Enterprise**

### **Lessons learned:**

- 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 APSY enterprise in Burkina Faso has been the reinvestment of its first year's income to improve both production capacity and management. An internal stimulating process of revolving funds that helps broaden the activity base and secure its continuation through potentially sustainable funding is a good management practice. This dynamic internal recycling mechanism of project funds is critical for sustainability of the enterprise.
- 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.

## **2 Crop production and Farm Enterprise Development**

### **2.1 Production and Commercialization of Cowpea in Central Burkina Faso**

**Community Name:** Donsin, Burkina Faso

**Beneficiaries:** 95 farmers of the Farmers' Association Song-Koodba (ASK) with more than 2100 members based in Donsin and surrounding villages

#### **Project description**

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 under this project.

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, partnerships of key stakeholders were established among the farmers' Association de Song-Koodba (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. NESTLE, through SAFGRAD and INERA, provided inputs and technical services to farmers in particular 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 commercial production and participated in the technology transfer and cost of production studies. The aim was to:

- to provide technical assistance in cowpea production for yield increase
- to improve farmer income through commercialisation of cowpea to industry
- achieve sustainability through establishment of revolving funds;

Technology: Improved cowpea varieties (K VX 61-1, K VX 414-22-2, K VX 414-22-72, IAR 7/180-4-5-1); improved cowpea production practiced

Problem addressed: promote cowpea production to help farmers diversify their production and generate income.

#### **Indicators of success:**

Effect of extension services and new production technology

- The group of farmers who received both extension services and inputs had 200 percent higher yield of cowpea compared to the national average of 400 kg/ha.
- Farmers receiving only input obtained yields 187% higher than the national average
- The group outside the project obtained yields 170% higher than the national average because of a spill over effect and use of organic manure.

Effect on income generation

Revenue 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.

## **2.2 Integrating small ruminant fattening and cowpea production**

**Community Name:** Donsin, Burkina Faso

**Beneficiaries:** 25 members of the Farmers' Association Song-Kooadba (ASK) with more than 2100 members based in Donsin and surrounding villages

#### **Project description**

The commercial production of cowpea gave the impetus to raise small ruminants not only to further diversify income, but also to improve the fertility of the soil, restore and protect the environment, and improve food security. Around 25 farmers of the ASK took up

sheep fattening and most of them also cultivated cowpea. Improved feed rations determined through a contractual agreement between ASK and the regional extension and NARS included concentrates, cotton oil cakes, cowpea, fodder, groundnuts and crop residues. The fattening of sheep was undertaken twice per year, targeting holiday seasons.

#### Indicators of success

- Around 25 farmers of the ASK took up sheep fattening (10 heads/household) and continue the activity at the end of 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 (Table 3).
- 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 gains 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)
Group 1: received inputs and extension services	78 310	63 196	42 023	185
Group 2: received inputs only	54 967			160
Group 3: received neither (outside project)	31 792			137
Mean groups 1 and 2	66 638	63 196	42 023	171

\* Figures are calculated on a per hectare basis even though, under the project, each farmer cropped .5 ha of cowpea.

\*\* \$1 US valued at CFA 600.

### 2.3 Increasing Vegetable Oil Seed Production and Processing in Northern Ghana

Community Name: Karaga/Ngushiegu District, Northern Ghana

**Beneficiaries:** Nucleus farmers and more than 300 farmer outgrowers.

### **Project description**

Soybean production in Northern Ghana has been on the increase in recent times. Yields are, however, low due to the use of non-certified seeds by farmers. This has been attributed to inadequate supply of improved seeds. Developing the crop is also hampered by a lack of markets for farmers' produce.

To overcome these problems, the Savanna Agricultural Research Institute (SARI) in collaboration with the Ministry of Food and Agriculture (MOFA) and Bosbel Oil Mills established the project titled 'Increasing Vegetable Oilseed Production and Processing in Northern Ghana.

WASGP supported the above soybean project, first, to enhance the dissemination of improved soybean cultivars by SARI and the extension unit of the sub-region; second, to evaluate an alternative approach of technology transfer based on 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 key agent for seed multiplication, and transfer of technology to members.

### **Indicators of success**

#### **- Seed Production**

Existing Community Certified Seed Project activities of the Savanna Agricultural Research Institute (SARI) and the Ministry of Food and Agriculture (MOFA) were expanded within six districts of the Northern Region by the addition of thirty-one seed grower groups. These groups were assisted in acquiring foundation seeds of soybean, and given technical guidance for producing certified seeds from them.

#### **- Grain Production**

In 1998, 122 farmers in six districts were assisted to acquire soybean seed and given technical guidance to prepare their lands. Fifty four (54) hectares of soybean were cultivated and the produce sold to Bosbel Oil Mill in 1998. A nucleus farmer/outgrower scheme involving 100 farmers was given technical advice.

In 1999, similar forms of assistance were given to one group in the Yendi district and to the nucleus farmer/outgrower scheme whose membership had increased from 100 to 309 farmers.

The project has helped to improve the socio-economic welfare of the farmers, especially women through increased income generation from soybean production.



Studies undertaken by Gyasi *et al.* (2000) on the relative importance of major cash crops revealed that farmers ranked soybean as the most important source of household income. Gender analysis revealed that 23.9% more women (85.7 %) than men (61.8%) ranked soybean as the important cash crop. Increasing proportion of income accruing to women as a result of soybean production can have significant contribution to household food security status, health and welfare of children.

### **Lessons Learned in Crop Production and Farm Enterprise Development**

- Linkages between large industries and small-scale producers do not necessarily guarantee a reliable and safe market for the produce of the latter.
- Effective linkages between large companies and small-scale producers require commitment in the form of contract and legal mechanisms to enforce them.
- The nucleus farmer/outgrower scheme is effective in the transfer and commercialization of technologies.

### **3. Value Added in Agriculture Production**

#### **3.1 Post harvest processing and drying mango and vegetable for export and local market in Northern Burkina Faso**

**Community Name:** Ouahigouya, Burkina Faso

**Beneficiaries:** 60 members of the Basnere Women's Association in Ouahigouya

#### **Project description**

Throughout the Sahel, mango is an important tropical fruit both for the domestic and export markets. During the 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 also enables food processors to take advantage of existing markets.

In Burkina Faso, the main beneficiaries included the women's group (Women's Association) of Basnere, based in Ouahigouya about 170 km north of Ouagadougou. The assistance to this group of women included capacity building and the introduction of technology for drying mango, potato, banana, papaya, tomato, onions, etc. both for export and local markets.

The aim of the project was to:

- to improve local processing (drying) and packaging of mango and other fruits in order to reduce post harvest losses
- Generate employment and increase women's income
- Sustain drying activities through the establishment of revolving funds and investment of net revenue

**Technology:** 4 Gaz drying units, sanitation, quality control and grading of mango fruits

**Indicators of success**

- More than 80 tons of mango processed in 2000.
- Introduction of technology for drying mango, potato, banana, papaya, tomato, onions, etc. both for export and the local market
- This activity has generated employment for 20 additional women on a permanent basis.
- The Women's Group raised their business gross income to the level of 12,513,000 FCFA (US\$20,855) in 1999 and 17,249,000 CFA (US 28748) in 2000.
- This, in turn, raised the gross income of permanent members of the association to the level of 1,808,000 FCFA (US\$3,000) in 1999 and 5,490,540 FCFA (\$9000) in 2000.
- Other beneficiaries of the project include farmers who sold mango to the women's association for a total of 3,209,980 FCFA (US\$5,350 dollars) in 1999 and 4,350,460 (\$7250) in 2000; transports (trucks and donkey cart, etc Fig. 11), that generated income of 899,275 FCFA (US\$1,500 dollars) in 1999 and 1,560,000 FCFA (\$2,600) in 2000.
- Increase in dried mango exports to a number of countries like Germany, England, Belgium, France, Italy, and Switzerland.

**4. Improving the Nutritional Quality of Basic Diets**

**4.1 Utilization and Commercialization of Soybean Products**

**Community Name:** Samsam Odumase and Mimpemihossem, Ghana

**Beneficiaries:** Populations in the two communities

**Project description:**

Among the local legumes and other available sources of protein, soybean has a tremendous potential for alleviating malnutrition in developing countries. It is an economical source of high quality protein, consisting of about 40% protein with a good balance of amino acids.

The utilization study of soybean at the household and small-scale enterprise levels was undertaken in two farming villages, *Samsam Odumase* and *Mimpemihossem*. This project was, therefore, conceived to extend the experiences gained in earlier projects to two villages in Ghana's Central Region: *Samsam Odumase* and *Mimpemihossem*. The project started in June 1998 and was completed in June 2000. The approved budget was US\$29,500.

#### Objectives

- To document the status of soybean production, processing and utilization in *Samsam Odumase* and *Mimpemihossem* villages in Ghana
- To determine food consumption patterns and food preparation techniques in the selected rural communities
- To develop home-level and small processing technologies for soybean based food for the rural population, taking into account local preferences
- To fabricate and introduce appropriate soybean processing equipment for household-level processors and small-scale enterprises
- To train rural communities and extension personnel in soybean production, processing and utilization techniques
- To disseminate the results of the study amongst interested government bodies, development organizations, and individuals in Ghana.

#### Indicators of success:

- The status of soybean production, processing and utilization in *Samsam Odumase* and *Mimpemihossem* villages was documented in a report on the baseline study of soybean utilization at the small-scale enterprise level in the Greater Accra area.
- The food consumption patterns and food preparation techniques in the two villages were also included in the report on the baseline study of soybean utilization at the small-scale enterprise level in the Greater Accra Area.
- Two soybean-based products (full fat soy flour and soybean paste) with good nutritional and microbiological characteristics were developed using village level techniques.
- Village level processing technologies (equipment) have been fabricated for the production of soy flour and soybean paste.
- A total of 17 recipes with desirable nutritional qualities (energy, protein, vitamin B and B2, calcium and iron) and sensory characteristics were developed [(a) soy based

recipes for eight staple foods; (b) five soy recipes for soups and stew; and, (c) soy milk and chocolate soy milk]. 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 and drinks); soybean wheat stews and soups; soybean incorporated into basic staple foods and soybean in cassava flour.

- 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 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.
- The two rural communities and extension personnel were trained in soybean production, processing, and utilization techniques.

### **Lessons Learned**

- Adoption rate and commercialization of new technologies will be improved when built on existing practices or knowledge of local communities.
- The determination of sensory attributes of any new crop, or the utilization of an improved variety of a crop already in use in a local community facilitates adoption and eventual commercialization of the crop.

## **4.2 Utilization of Forest Ditax Fruit as Source of Vitamin C**

**Community Name:** *Senegal*

**Beneficiaries:**

**Project description:**

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 Grant Program provided support for the exploitation of Ditax fruits (*Detarium Senegalense*) as a source of vitamin C. This forest tree product is increasingly consumed in fresh and processed forms.

Problem addressed: high demand for fresh and processed fruits, which are highly perishable and in a form not suitable for conservation. Their potential in nutritionally rich-derived products (drinks, marmelade, etc.) is untapped. From the supply side, little is known about how these fruit trees are grown, and how they could be domesticated and disseminated for expanded production.

With a funding from the WASGP, ITA collaborated with rural households, producer groups, processors, and other local and international research institutes (ISRA/DRPF and CIRAD/France) to carry out this Ditax valorization project over the 1998-2000 period.

This project can be characterized as a mixture of research, and development of technology. The research focuses on supply side issues of the raw material (plant); and the technology development component focuses on processing of the fruits. Consequently, it does not meet the condition of "Technology Transfer" and "Commercialization" of the WASGP.

The objectives were:

- To diversify and increase farmers' incomes;
- To improve food security and nutritional status of the population through use of vitamin rich Ditax products;
- To develop appropriate technologies for transformation and conservation of Ditax in order to facilitate the development of a small microprocessor for Ditax based products;
- To facilitate the development and commercialization of Ditax based products (marmalade, fruit juices, powder, paste, jams, etc.);
- To facilitate the commercialization of the Ditax fruit, by creating demand for it; and,
- To efficiently domesticate the tree to ensure proper regeneration of its natural productive capacity and wider distribution.

#### **Indicators of success**

- Success is evidenced by the achievement of the following: determination of ditax flavors and conservation of Ditax; training on Ditax collection has been conducted for 13 village residents; an agroforestry study was done on characteristics, production

- zones, marketing channels; determination of the optimum period of harvest; and determination of biochemical composition of ditax based products.
- Five products (natural pulp, sugared pulp, nectar, marmalade and dried paste) have been developed; and village level processing technology has been developed.
  - The training of producers and processors has helped with the diffusion of harvesting methods, and processing and conservation techniques. Optimal harvesting methods can reduce harvest losses, increase production, and therefore income from sales.
  - Partners in the production and utilization of Ditax fruit are individuals, men's and women's group farmers, 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.).

## LESSONS LEARNED

Among the lessons documented 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 continuum 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 agroindustries 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. Contract 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 practice 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% in the sahel. Reduction of these 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.



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