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Transfer of Sorghum, Millet Production, Processing and Marketing Technologies in Mali Quarterly Report January 1 – March 31, 2009

INTSORMIL

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Quarterly Report
January 1 – March 31, 2009

USAID/EGAT/AG/ATGO/Mali
Cooperative Agreement # 688-A-00-007-00043-00

Submitted to the USAID Mission, Mali

by

Management Entity
Sorghum, Millet and Other Grains Collaborative Research Support Program (INTSORMIL CRSP)
Leader with Associates Award: EPP-A-00-06-00016-00

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Transfer of Sorghum and Millet Production, Processing and Marketing Technologies in Mali

Introduction

This report details the recent progress achieved under the Cooperative Agreement # 688-A-00-007-00043-00. The report covers progress in the **Production-Marketing**, **Food Processing** and **Décrue Sorghum** components from January1 to March 31, 2009.

The noted scientist Carl Sagan has stated that "Advances in medicine and agriculture have saved vastly more lives than have been lost in all the wars in history (see box below). This project promotes advances in agriculture by moving sorghum and millet production technologies onto farmers' fields, linking farmers' organizations to food and feed processors and by commercializing processing technologies so as to enhance markets. To achieve this we improve the supply chain from the farm level to the consumer. This project also promotes improved nutrition and thus contributes to the betterment of human health in one of the most impoverished areas of the earth.

Objectives

- Facilitate adoption of production and marketing technologies to improve the productivity of sorghum and millet in targeted areas and increase the incomes of farmers
- Introduce micro fertilization strategies and associated agronomic improvements into the décrue farming systems in the northern regions
- Introduce strategies to counter output price collapses to farmers' groups while linking them to food and feed processors
- Develop stronger farmers' groups and enhance farmers' groups marketing power
- Assist in producing a cleaner supply of millet and sorghum and assisting farmers in getting paid a quality premium for the higher quality product
- Facilitate the development of markets for food use for millet and sorghum and as a poultry feed for sorghum
- Extend select mechanized processing technologies to entrepreneurs and processor groups
- Upscale the seed sector at project sites

"Advances in medicine and agriculture have saved vastly more lives than have been lost in all the wars in history."

Carl Sagan

Executive Summary

The budget for Cooperative Agreement # 688-A-00-007-00043-00 was modified to take into account the additional funding received reflecting the years 2007-2012. A detailed budget justification for year 2008-2009 for each of the project components is described.

An extensive summary of the results of the 2007 season of the ***Production-Marketing project*** is provided. Each year we report the productivity and income consequences of the technology and marketing strategy introduction from the previous year. Of the five marketing strategies employed during the summer of 2007 the farmers and the farmers' associations in the project benefited most from (i) producing a cleaner grain and charging a price premium for it and (ii) storing and selling grain later in the year to benefit from the seasonal price increase. Within the community of Nangola, the village of Magnambougou had the highest increase in revenue. Farmers in Magnambougou raised their revenues by 61,038 FCFA/Ha due to increased yields. The 15 FCFA/Kg price premium further increased farmer's revenue by 19,393 FCFA/Ha for a total revenue gain of 80,431 FCFA/Ha, or almost double the cost of the technology package. The area under this project has increased from 328 ha in 2007 to 500 in 2008. In the summer of 2009 the area will be over 1,000 ha with an extension into the northern regions (both the Mopti and the Kayes regions). Moreover, in the crop year 2009 the Production-Marketing Project will be putting 200 ha of sorghum into production in three locations of Koutiala (Garasso, Kaniko, and Finkolani) through a subcontract established with AMEDD **(**Association Malienne d'Eveil au Developpement). This is an opportune time to e introducing alternatives t the cotton zone with the declines of both productivity and prices for cotton.

Bonnie Pendleton, INTSORMIL PI, West Texas A&M University visited the Production-Marketing project in March to review the problem of pests in the field and in stored sorghum and millet. Farmers in Pissa reported that birds were a severe constraint in their millet fields. In Koutiala grain was sold early because the farmers feared the damage of storage insects. This fact prevents the farmers from selling grain later in the year to benefit from the seasonal price increase which is one of the five marketing strategies in the Production-Marketing project. In collaboration with Niamoye Yaro Diarisso, IER Entomologist and Scientific Coordinator for Irrigated Crops, Dr. Pendleton will prepare handouts (in French) on the management of insect and mite pests of stored sorghum and millet to provide to farmers. In addition, they will prepare 20 different reader friendly laminated posters in Bambara and French to be used in training farmers in the management of insects pests in stored sorghum and millet.

Scott Staggenborg reports on the visit to the sites of the ***Décrue activities*** in the Gao region villages of Bintagoungou and Toukabongou. Seven top yielding sorghum varieties that have potential for further testing have been identified. Three of these varieties were IER releases and four were varieties collected from the Lakes region last February. Other results from 2008 were that fertilizer and pesticide treatments did affect yields and that increasing plant densities (from 1 x 1m to 0.6 x 0.6m planting patterns) is likely to increase yields. The group decided that IER stations in Dire and Gao could be effective sites for selecting varieties for the décrue cultures. They will not provide a perfect mimic of the lakes soils, but will provide information on potential varieties and the research will be conducted under lower risk conditions. In meetings with collaborating farmers they were very receptive to the 2008 results and were very interested in collaborating with the décrue project in 2009.

Farmers in the Gao area indicated that the primary areas needing attention are (1) improved varieties, (2) planting geometry, (3) genetic erosion, and (4) lack of information on décrue sorghum production. Genetic erosion is the loss of varieties when drought occurs. It occurs in the following manner. First farmers plant the best varieties available to them. If they

plant all of the seed in a given planting season and a drought results in no grain/seed being produced, seed for this variety is no longer available for future plantings. This situation can be compounded if several years of drought are experienced in succession as then the next best variety is lost the next year and slowly the best varieties are lost. The group indicated that over the past 30 years, they believe that they have lost 13 of 25 rice varieties and 3 of 5 promising sorghum varieties.

Conservation of biodiversity is an area where IER and other research organizations can help. Staggenborg observed wheat and rice seed being grown at the IER station at Gao for the sole purpose of distributing seed to farmers in the region. These crops were being grown under irrigation so as to not only increase seed yields, but to also insure that seed was produced in a given year. The cost of this activity was not determined but would be a good use of resources directed toward this region to not only maintain well adapted varieties, but to also improve seed quality. Another function of any one of the organizations involved in this project or in the region would be the collection and storage of well adapted varieties. This would be easy to accomplish through field surveys during the harvest season. The greatest challenge is developing a database to keep track of the varieties and a place to store them. This would require that one organization take the lead on this portion of the project.

There is thus a need for farmer training on seed production, handling and storage. It is likely that if hybrids are introduced into the region in the next decade, this type of education program will coincide with it. However, in the near term some simple educational programs or materials on seed selection and storage may be useful. Although farmers may be doing an adequate job at harvesting and storing seed, such programs further emphasize the importance of maintaining high quality seed. Also, it is possible in most of the décrue regions to help farmers or a village to develop some irrigation capabilities to support seed production. Small irrigated fields would reduce the risk of genetic erosion and may increase overall yields if seed quality is improved.

Significant progress was made via three activities of the ***Food Processing Technology*** component. (1) A questionnaire was developed and a survey conducted in the Mopti and Gao area. The results will be presented at the May 26-29 Processing Workshop to be held in Mopti. (2) Equipment and supplies have been ordered to establish the food processing units and the Training Center of the IER Food Processing Laboratory. Contracts will be signed prior to final setup of the equipment for a "payback" agreement for a significant percentage of the equipment cost. (3) Training of the recipients of the equipment will occur in two workshops. The first workshop will be held May 26-29, 2009 in Mopti. The topic of the workshop is "*Primary education of technologies of processing of high quality, competitive millet and sorghum products, the fundamentals of quality management and packaging, and contracting farmers for high quality grains*." A second workshop will be planned for late summer in Gao. The workshop topic is "*Marketing and management of a unit of local cereal transformation."*

A subcontract for the ***Training*** component has been awarded to Purdue University. Coordinator of the training program, Jess Lowenberg-DeBoer, Director of International Programs in Agriculture has made two trips to Mali to coordinate the training. IER has identified eight students, five academic (degree) and three short term. The academic and short term students will be trained at Purdue University and Kansas State University. The academic trainees are scheduled to begin their English language training at Purdue June 1, 2009.

Management Entity

Modification #2: Cooperative Agreement #688-A-00-07-00043-00 The USAID Mali Mission Associate Award for 2008-2009 ($1,000,000) 03/02/2009

There are six components to this award for 2008-2009:

1. INTSORMIL Management
2. Degree Training
3. Production-Marketing
4. Food Processing
5. Décrue Sorghum
6. Mali Project Management

Each component has specific goals and activities and following is the budget justifications for each component:

INTSORMIL Management: Drs. John Yohe and E.A. Heinrichs

Personnel: INTSORMIL office staff, which are responsible for all aspects of this award, including budgets, planning, facilitating transfer of funds to IER, and backstopping all scientists involved with the program.
Consultants: Depending on expertise needed to advise and assist with program management, consultants will be used as needed.
Travel: Travel for staff at least twice a year to assist in planning and monitoring
Supplies, Communications, Publications: Office supplies, telephone, and preparing and distributing quarterly reports, annual reports and other project information.

Production-Marketing: John Sanders, Ouendeba Botorou

There are three principal activities of this project: first, expanding the on-farm activities. This includes the diffusion of new technologies and marketing strategies to farmers and developing the farmers' associations; secondly, documenting the effects of the program and doing the background studies to facilitate the marketing strategy focus of the project; third, training of the Malians to take over the project and to provide inputs into the monitoring and development of IER and other national agency staff.

The principal program expense is for the approximate 1,000 ha to be put into new technologies in ten sites all over Mali in the summer of 2009.This development is funneled through 10 farmers' organizations and represents a doubling of project area (see Table 1). In the initial year of operation in any region a rotating fund for input purchases is set up. This rotating fund combined with supervision and some overhead costs for the extension agency totals approximately $8,600 per 50 ha. Also with this funding are the costs for project personnel, IER and extension staff to regularly visit the sites three to four times per year. Gasoline and hotels expenses are high. We pay low per diems of 20,000 CFA in the field and 25,000 CFA in the capital. This technology transfer had an estimated cost of $96,000 in 2009.

Under personnel is 5/6 of the salary of Dr. Ouendeba Botorou, the Project Coordinator of the Production-Marketing Project. The travel expenses are for project personnel and consultants.

Consultants are employed to help produce the annual bulletin evaluating the impact of the project and studies to identify the potential for further market expansion including intensive poultry production in Mali in 2009. Field costs of these bulletins range from $5,000 to $10,000

Training costs involve our contributions to the training of the farmers' associations. We get outside support for most of this activity. Also they include specific short term training for IER and other agency collaborating personnel.

Planned area increase and total area in new cultivars and associated technologies in Mali for the crop year of 2009.

Region	New Cultivar	Extension Partners[1]	Increase in Area in 2009 (ha)	Total Area in 2009 (ha)[5]
1. Mopti:				
Bankas/Pizza	**Toroniou (millet)**	**DRA (the Malian**	**60**	**60**
Dwanza/Wakoro	**Toroniou (millet)**	**national extension**	**60**	**60**
		agency)		
2. Koutiala				
Garasso	**Grinkan (sorghum)**	**AMEDD (Malian**	**100**	**150**
Finkolani	**Grinkan**	**NGO concentrating**	**50**	**50**
Kaniko	**Grinkan**	**in southern Mali)**	**50**	**100**
3. Kayes	**Seguifa (sorghum)**	**DRA**	**75**	**75**
Diang. Camara				
4. Segou				
Tingoni	**Toroniou**	**SG2000[2]**	**--**	**150**
Dioila	**Nachitchama (sorghum)**	**ULPC[3]**	**50**	**150**
5. Koulikoro	**Nachitchama**	**IER[4]**	**--**	**100**
Kafara	**Seguifa**	**DRA**	**60**	**110**
Kolokani	**(sorghum)**			
Total Area			**505**	**1,005**

1 Note that IER, the national agricultural research agency, is our principal partner in all our activities. We work together with them and the new cultivars come out of their breeding programs.

2 Japanese supported NGO that collaborates with the Jimmy Carter Foundation in Atlanta, GA and is largely staffed by former CIMMYT employees. Focus is on extension of new agricultural technologies in developing countries.

3 Malian NGO evolving from a Swiss development project that focused on storage and marketing of a range of agricultural products in Dioila.

4 This is the traditional region where the breeding program of IER has tested their new material. So they have done the extension work here.

Food Processing: Bruce Hamaker

Consultant ($18,000)

The consultant to the processing project is processing specialist, Mr. Mamadou Diouf, retired from ITA, Dakar, Senegal. He is budgeted at $200/day for 60 days ($12,000) and travel expenses to Mali for work at IER and the Mopti/Gao region for 4 trips at $1,500 each ($6,000).

Travel ($24,600)

For internal travel by the IER, $8,000 will be transferred for travel to the Mopti/Gao region and will include expenses for the IER PI (Yara Kouressi) and driver, and vehicle costs. The remaining funds will be used for travel by B. Hamaker to Mali and the Mopti/Gao region (3-4 trips).

Technology Transfer ($10,000)

Three workshops will be conducted per year and the technology transfer funds will be used for bringing in additional experts from the region in microenterprise management, accounting, and promotion.

Equipment ($75,000)

This and the previous equipment allotment for equipment includes purchase of the initial mechanized cereal processing equipment for our six entrepreneur partners, IER Sotuba Cereal Technology Pilot Plant, and a vehicle ($35,000) that will be stationed at IER Sotuba for the larger project.

Supplies ($15,000)

Includes computers (2), printers (2) and associated small supplies for entrepreneur processing facilities (entrepreneurs are each required to contribute by building structures to house equipment).

Training ($5,000)

This will fund travel and per-diem for entrepreneurs and their associates for three training workshops in this funding period.

Décrue Sorghum: P. V. Vara Prasad

KSU Investigators: P.V. Vara Prasad and Scott A. Staggenborg
Agronomy Department, 2004 Throckmorton Hall
Kansas State University, Manhattan, KS 66506

Mali Investigators: Abdoul Wahab Toure, M. Diourté, IER, Mali and their Team.

Project Title: Transfer of Sorghum and Millet Production, Processing and Marketing Technologies in Mali – Décrue Sorghum

Project Duration: 2007 – September 2012

Project Goal and Objectives:

The goal of our project is to generate agronomic techniques with appropriate décrue sorghum cultivars to sustain food production and foster economic improvement of northern Mali.

Specific objectives include:

1. To determine farmers' perceptions, knowledge about current management practices and farmers needs and preferences and at the same time to collect sorghum cultivars grown in the area.

2. To conduct research on integrated soil, water, nutrient and décrue sorghum management techniques for improved productivity and diffuse the generated improved technologies into the entire region.

Activities and Methods:

Décrue sorghum activities will be conducted in collaboration with sorghum program scientists from IER, Sotuba and experiments will be conducted at multi-locations in Mopti, Tombouctou and Gao region. These activities include cultivar collection, identification of perceptions and research needs followed by testing of various cultural practices (cultivars, planting techniques, fertilizer management, water management and pest management including weeds, insects and plant diseases).

Deliverables and Responsibility

This program will help generate improved technologies and methods for improving productivity of décrue sorghum to provide food security in northern Mali. In addition, training of IER scientists will help build institutional capacity

Dr. Scott A. Staggenborg and Dr. P.V. Vara Prasad will serve as PIs and they will collaborate with Dr. Mamourou Diourté, Sorghum Program Leader and Abdoul Wahab Toure, Agronomist at IER, Sotuba and their research and extension team. They will collaborate with other scientists from IER or NGOs working in the region to implement research on Décrue sorghum in Northern Mali.

Budget Justification

A. Personnel: This portion of the budget will be used towards payment of salaries for personnel involved in conducting various experiments, data collection, and report preparation. These will also include payment to consultants from NGOs who help with planning, data collection and other activities related to Décrue sorghum research.

B. Travel: This will include the travel (round trips), per diem and lodging for the two U.S. PIs to travel northern Mali for planning and monitoring research. They will travel twice a year and duration of stay may range from 10 to 15 days. In addition, this also includes travel of in-country PIs and their crew for planting, monitoring, data collection and harvesting of experiments.

C. Technology Transfer: Once the technologies are identified significant efforts would be made working with IER and NGO to transfer the identified technologies into farmer's fields and expand to other regions of décrue sorghum production. This portion of budget will be used to conduct multi-location tests to diffuse identified technologies.

D. Equipment: The equipment costs will include laboratory supplies for soil and plant samples analyses, purchase of dryers (dry plant samples), and repair cost of equipment used to conducting this research.

E. Supplies: This portion of the budget will be used to purchase supplies necessary for conducting research, data collection, data processing and analyses and report preparation. Typical costs will include fertilizer, seed, planting costs, expendables supplies, harvest costs, soil analyses, plant analyses, dry weights, bags, fuel and software for data analysis.

F. Communication: This portion of budget will be used to communicate and expand the identified technologies through extension publication, local news, radio talks, and also to publish the research results in the magazines and journals.

G. Training: We anticipate training extension agents, NGOs, producers and other people who actively participate towards agricultural improvement of northern Mali. This budget will be used to organize such meetings.

H. Indirect Costs: Standard indirect cost of 26% of the direct costs is charged to the project.

Note: The budget, budget categories and justification for the following years would remain the same, unless there is strong need for change of budget categories. This will be communicated to the management entity as necessary.

Décrue Sorghum Budget (2008 – 2009)

Décrue Sorghum	**IDC / 26%**	**Exempt IDC**	**IER funds**	**Total**
WBS: 25 6805 0043 006	060	061	062	
(Prasad & Staggenborg)				
A. Personnel	9,000			
Consultant				
B. Travel	23,250			
C. Technology Transfer	10,000			
D. Equipment		5,000		
E. Supplies	7,090			
F. Communications/Publications	3,000			
G. Training	8,000			
Sub-Total	**60,340**	**5,000**		
H. IDC (26%)	15,680			
TOTAL	**76,020**	**5,000**		**81,020**

Mali Project Management

The initial plans for the personnel budget were to contract a scientist/extension person to locate in the north to support the new activities there. Given the large distances this is very important for program support and more focus for on-farm activities in the north. Apparently, one of the IER scientists will be able to undertake this function rather than a new hire. We will still need to support this liaison person logistically so this budget category will include providing transportation. This personnel category also includes partial support for the management and coordination functions of this project undertaken by E.A. Heinrichs.

The travel will be for the coordination by E.A. Heinrichs of one or two trips per year from Nebraska to and then all over Mali. Also this item funds the local extension person above to regularly visit the northern sites and respond to the scientific and extension requirements there.

The consultant budget is to support management or scientific activity defined by the management as pressing to the overall program or one of the categories of the program but lacking funds. This gives management some flexibility in defining constraints and reacting to them as the program evolves.

Supplies and communication funds provide a similar function of giving management flexibility in supporting the overall program and specific projects within it as necessary. For instance each year the Production-Marketing Project does a review and assessment of the economic impact of their activities. As the two other projects evolve similar assessments will be done and they can be combined in one overall bulletin by the management. Presently, this is done in a descriptive manner but with little systematic data collection. As the program evolves the reporting will become much more specific and analytical.

Modification of the budget (2007-2012)

Item	Initial yr. 2007-2008	Year 1 2808-2009	Year 2 2009-2010	Year 3 2010-2011	Year 4 2011-2012	Total (US$)
Personnel	49,891	160,773	160,773	160,773	160,773	692,892
Consultants	24,244	95,128	81,773	95,128	95,128	391,402
Travel	40,987	178,624	189,870	205,280	205,280	820,040
Technology transfer	45,000	147,970	111,400	111,400	111,400	527,170
Equipment	17,000	139,000	158,680	106,465	106,465	527,610
Supplies	16,283	49,300	76,965	76,965	76,965	296,479
Communications/Pubs.	11,932	42,762	27,532	27,532	27,532	137,290
Training (Academic)		203,920	203,920	203,919	203,919	815,678
Training (Short term)	4,109	31,846	36,983	51,365	51,365	175,669
Sub-Total	209,446	1,049,323	1,047,896	1,038,827	1,038,827	4,384,320
Indirect Cost (26%)	40,554	195,994	202,232	213,451	213,451	865,680
Total (US$)	**250,000**	**1,245,317**	**1,250,128**	**1,250,278**	**1,250,278**	**5,250,000**

Production - Marketing
Dr. John Sanders

Summary of the 2007-2008 Season

Forward

Each year the Production-Marketing project makes an evaluation of the yields, prices, and income results for the previous year. There is a delay after harvest as sales normally take place up to shortly before planting in the next year. This report is part of the activities of the 2008 season but reports on the results of the 2007 season. This was an adverse rainfall year with too little rain at the beginning and end of the season and too much rain and flooding in the middle. Sorghum yields were especially affected as sorghum is generally planted on the heavier, lowland areas. In a year of this type the marketing activities are especially important to stabilize incomes as yields go down in the lowlands. A good measure of program success in this type of year is repayment and continuation in the program in spite of the adverse climate. Repayment was high and demand to continue in the program did not go down. Farmers realize the importance of taking some risks in order to make money and casual observers can overstate the importance of risk especially in the better agricultural regions such as the cotton zone.

The Production-Marketing project takes several measures to conserve the available water for drought years. Year 2007 was a difficult year for the lowland farmers. Farmers planting higher up or on lighter soils, as with millet, did very well in 2007. Fortunately 2008 was an excellent rainfall year and with the new intermediate height cultivars which respond better to fertilizer, yields were excellent reaching 2 to 3 tons/ha on the best farmers' fields.

1. Introduction

The 2007/08 production season was a challenging season due to low land flooding in much of Mali. In Dioila, one of the villages in the program, total rainfall reached 1042 mm which was 52 percent higher than the previous year. In Tingoni, another of the program villages, total rainfall reached 1971 mm or 188 percent higher than the average rainfall of the previous two years. Yields collapsed in the low lands. So this year was instrumental for evaluating by how much the marketing strategies helped in reducing income losses. We also need to investigate yield insurance for some farmers in these types of adverse rainfall years.

The project has put an emphasis in combining its technology introduction with marketing and the institutional development of farmers associations. The marketing and production project has concentrated on five marketing strategies: (i) producing a cleaner grain and charging a price premium for it; (ii) storing and selling later in the year to benefit from the seasonal price increase; (iii) selling (and purchasing) bulk quantities of outputs and buying inputs in bulk to increase negotiating power; and (iv) selling to premium markets that are willing to pay more like food processors and the animal feed industry; and (v) convincing policy makers not to drive down the price increases of bad rainfall years with food aid or subsidized food imports.

Farmers and farmers' associations in the project benefited from storage as they captured part of the substantial seasonal price increase. Farmers also increased their prices by marketing their grain at a premium after cleaning it better at harvest. The Production-Marketing project has been most successful with these two proposed marketing strategies. Even these two strategies can be more effectively implemented with more widespread contributions by farmers to cooperative storage and marketing at later in the year and with better negotiating with food processors for the premium prices for clean grain. Given the adverse production conditions for

cereals in most of Mali in 2007/08 there was a potential for making even larger returns with the marketing strategies.

In the next sections we will analyze individually the results for each of the villages in the program. We will concentrate on evaluating yields, the returns to technology and marketing, and institutional development for each of the farmers associations. With respect to marketing we will estimate the benefit received by farmers and the cooperatives from storage and from selling a higher quality grain.

Regions, Villages, and Number of Farmers in the Project in 2007/08

In 2007/08 a total of 190 farmers participated in the INTSORMIL-IER production and marketing project in Mali with a total area harvested of 300 ha (Table 2.1). The program intervened in three regions in Mali (Koulikoro, Sikasso and Segou). Dioila was added to the program in 2007/08. In Tingoni in 2007/08 area under production was increased to 150 ha from 50 ha in 2006/07. In Kaniko and Kafara crop area was maintained at around 50 ha.

2.1 Distribution of Farmers and Harvested Areas in the INTSORMIL-IER Production and Marketing Program in 2007/08.

Region	Village	Number of Farmers	Harvested Area (Ha)
Koulikoro	Dioila	45	48
Koulikoro	Kafara	39	56
Sikasso	Kaniko	42	48
Segou	Tingoni	68	150
Total		**190**	**300**

2. DIOILA

In Dioila, the INTSORMIL-IER Marketing and Production project has partnered with the cereal farmers cooperative union, ULPC. The project introduced the sorghum variety Soumba along with a technology package that consisted of 100 kg of the complex fertilizer NPK (17-17-17) and 50 kg of Urea (46-0-0). For Dioila 2007/08 was the first year in the program. Our discussion of results for Dioila will start with the comparison of yields between the program variety, Soumba, and farmers' traditional variety. We will then analyze the returns to storage and marketing first for the farmers and then for the cooperative.

2.1 Yields of Program Farmers in Dioila

In Dioila a total of 54 farmers in two communities and 4 villages participated in the program. Our analysis of yields will be based on a survey of 34 farmers (or 76 percent of total farmers) participating in the program.

Total sorghum production using the Soumba variety promoted by the production and marketing program in Dioila was 40.2 tons. In total 48 Ha were harvested by the 45 program farmers. The average yield for farmers in the program was 838 Kg/Ha. But there were marked differences in yields between the communities in the program of Nangola and Wakoro that can be largely explained by differences in topography. Nangola is located in higher ground relative to Wakoro. Wakoro is close to the river bed that passes through Dioila and therefore suffered much more from the excess rains.

In Nangola yields increased overall 42 percent over farmers' traditional variety (Table 2.2). Of the two villages in the community of Nangola, farmers in Magnanbougou had the highest yield increases. Farmers in Magnanbougou increased their yields over their traditional variety by 125 percent (Table 2.2). In contrast in the village of Kenie yields increased 7 percent by using the program variety over their traditional variety.

In the community of Wakoro yield gains were lower relative to the community of Nangola. On average, in Wakoro the program variety increased farmers' yields by 13 percent (Table 2.2). In Tonga, one of the two villages in the community of Wakoro, farmers increased their yield by 26 percent. In contrast, in the village of Wakoro farmers increased their yields by 3 percent (Table 2.2).

Table 2.2 Yields of Soumba variety sorghum compared to the traditional variety in two communities and four villages of Dioila, Mali.

	Kg/Ha		
	Soumba	Traditional	Difference (%)
Community of Nangola	**1,182**	**830**	**42**
Village of Magnambougou	**1,293**	**575**	**125**
Village Kenie	**1,096**	**1,029**	**7**
	-		
Community of Wakoro	**725**	**641**	**13**
Village of Wakoro	**761**	**738**	**3**
Village of Tonga	**689**	**545**	**26**

Source: Farm Household Surveys and ULPC.

2.2 Returns to Technology Packages

The principal priority for the production and marketing project is to increase income by raising yields and prices received. Our discussion begins first by presenting the costs of the technology package offered by the program. Then we discuss the average returns by village in Dioila of the technology package. We finish by presenting the returns to marketing for the farmers' cooperative ULPC in Dioila.

2.2.1 Cost of Technology Package

The technology package for farmers in Dioila was the same for the two communities in terms of fertilizer and seed quantity. For one hectare farmers received 2 bags or 100kg of the complex fertilizer NPK and 1 bag or 50kg of the nitrogen based fertilizer Urea. The total cost for fertilizer was 38,500 FCFA/Ha. Farmers also received 4 Kg of seed of the sorghum variety Soumba, at a cost of 200 FCFA/Kg. Farmers in Nangola also opted to receive an additional 5,000 FCFA/Ha to pay for labor in order to ridge their fields for water harvesting. Therefore in Nangola farmers received a total credit with fertilizer of 44,300 FCFA/Ha while in Wakoro farmers' total credit was 39,300 FCFA/Ha (Table 2.3).

Able 2.3 Cost of Technology Package in the Communities of Nangola and Wakoro for ULPC-INTSORMIL Farmers in 2007/08.

Technology Package Costs in the Community of Nangola						
NPK	12,750	Fcfa/Sac	2	Bags	25,500	Fcfa/Ha
UREA	13,000	Fcfa/Sac	1	Bags	13,000	Fcfa/Ha
Seed	200	Fcfa/Kg	4	Kg	800	Fcfa/Ha
Labor for Field Ridging	5,000	Fcfa/Ha	1	Unit	5,000	Fcfa/Ha
Total					44,300	Fcfa/Ha
Technology Package Costs in the Community of Wakoro						
NPK	12,750	Fcfa/Sac	2	Bags	25,500	Fcfa/Ha
Urea	13,000	Fcfa/Sac	1	Bags	13,000	Fcfa/Ha
Seed	200	Fcfa/Kg	4	Kg	800	Fcfa/Ha
Total					39,300	Fcfa/Ha

Source: ULPC

2.2.3 Yield and Marketing Gains from Technology Packages in Dioila

In this section we will focus on the returns from increased yields and marketing for farmers and to the cooperative ULPC. With regards to marketing the program promotes various strategies. One strategy is to produce cleaner grain by threshing on plastic tarps instead of bare ground as is traditionally done. A cleaner grain results in farmers being able to demand a premium price from the market. Another concept promoted by the project is for farmers to hold and store their grain rather than selling at harvest when prices collapse. This enables farmers to benefit from the seasonal price increase. The price increases can double from harvest prices in adverse weather years such as 2007. Given that the farmers with whom the program works are in a cooperative, the farmers association then can search for premium markets in which they can sell in bulk at higher prices. Some of these markets are food processors (millet) and intensive poultry producers (sorghum).

2.2.3.1. Farmers' Returns from Yield Increases and Marketing

At harvest, between November and December, in 2007/08 prices for sorghum in Dioila were 85 FCFA/Kg (Table 2.4). The ULPC cooperative in Dioila gave farmers in the program a 15 FCFA/Kg price premium for the quality of their grain. This represented a 17 percent increase over the harvest price for farmers.

Table 2.4 Prices at Harvest, Price Premium, and Farmers Sale Price in 2007/08 in Dioila, Mali.

Harvest Price	Price Premium for Quality Grain	Sale Price (FCFA)
FCFA/Kg		
85	15	100

Source: Farm household interviews and ULPC

In Dioila farmers in the community of Nangola from an increased production of 352 Kg/Ha were able to raise their revenues by 29,906 FCFA/HA (Table 2.5). The increases in revenues from increased production covered 68 percent of the cost of the technology package. The additional 15 FCFA/Ha from selling a cleaner grain increased revenues further by 17,730 FCFA/Ha, which represented 40 percent of the cost of inputs. Therefore, total gains for farmers in Nangola were on average 47,636 FCFA/Ha or 108 percent of the cost of the technology package promoted by the program (Table 2.5).

Within the community of Nangola, the village of Magnambougou had the highest increase in revenue. Farmers in Magnambougou raised their revenues from increased yields by 61,038 FCFA/Ha (Table 2.5). The 15 FCFA/Kg price premium further increased farmers' revenue by 19,393 FCFA/Ha for a total revenue gain of 80,431 FCFA/Ha or almost double the cost of the technology package.

In contrast in Kenie the yield and price premium gains only increased farmers' revenues by a total of 22,129 FCFA/Kg (Table 2.5). The increased revenue for farmers in Kenie covered only 50 percent of the cost of the technology package. For farmers adversely affected by rainfall conditions we need to develop an insurance program. However, some farmers did not practice good agronomy in spite of the project emphasis on that. We need to distinguish between the two explanations for poor yields.

Table 2.5. Per Hectare Monetary Gains from Increased Yields and Higher Quality Grain Sales for Farmers in Dioila in 2007/08

	Yield Gain	Gain from Increased Yield	Gains from Sales at Harvest with a 15 FCFA/Kg Quality Premium	Total Gains	(%) of Technology Cost Covered by Gains
	(1)	(2)	(3)	(4)	(5)
	Kg/Ha		FCFA/Ha		
Community of Nangola	352	29,906	17,730	47,636	108
Village of Magnambougou	718	61,038	19,393	80,431	182
Village Kenie	67	5,692	16,437	22,129	50
Community of Wakoro	84	7,104	10,875	17,979	46
Village of Wakoro	23	1,975	11,417	13,392	34
Village of Tonga	144	12,233	10,333	22,566	57

Source: Authors Calculations from ULPC and Survey Data. Column (1) is the difference between farmers' yields using their traditional variety and farmers yields using the program variety Soumba and 150 Kg/Ha of fertilizer; (2) The yield gains in (1) were multiplied by the harvest price of 85 FCFA/Kg; (3) Gains from the quality premium are calculated by multiplying farmers yields using the Soumba technology package by 15 FCFA/Kg; (4) Total gains are the sum of (2) and (3); (5) is the ratio of total gains to the cost of the Soumba technology package with fertilizer.

In the community of Wakoro the increase in farmers' revenue from better yields and selling a higher quality grain were on average smaller relative to the community of Nangola. In the

community of Wakoro the extra 84 Kg/Ha increased farmers' revenue at harvest by 7,104 FCFA/Ha which covered 18 percent of cost of the technology package (Table 2.5). The 15 FCFA/Ha price premium further increased farmers' revenues by 10,875 FCFA/Ha covering 28 percent of the cost of the technology package. The total increase in farmers' revenues from better yields and selling a cleaner grain was 17,979 FCFA/Ha or 46 percent of the cost of the technology package (Table 2.5).

Of the two villages in the community of Wakoro farmers gains in revenue, from increased yields and higher prices from selling a cleaner grain, were especially important in the village of Tonga. In Tonga the increased yields and prices raised farmers' revenues by 22,566 FCFA/Ha which represented 57 percent of the total cost of the technology package.

2.2.3.2. Returns to the Cooperative ULPC from Marketing

In total the cooperative in Dioila, ULPC, marketed approximately 31 tons of grain (Table 2.7). Almost 20 tons or 64 percent of the grain commercialized came from farmers' reimbursement of their input credit. Farmers reimburse their input credit in grain which the cooperative then sells and uses the revenues plus profits to buy fertilizer and seed for the following season. Therefore this grain constitutes a revolving fund for the cooperative. More than 11 tons or 36 percent of the marketed grain came from the surplus grain sold by farmers to ULPC (Table 2.7). In Dioila the program was successful in recovering 100 percent of the total input credit given to farmers at planting despite the bad rainfall year and moderate yield gains.

Table 2.6. Quantity of Sorghum Grain Commercialized by ULPC by Source and Community in 2007/08.

Community	Reimbursement	Purchase From Farmers	Total
		Kg	
Wakoro	11,004.00	2,017.00	13,021.00
Nangola	8,860.00	9,169.00	18,029.00
Total	**19,864.00**	**11,186.00**	**31,050.00**

Source: ULPC

ULPC marketed the grain bought from farmers and received as reimbursement for the input credit in three sales. ULPC bought farmers grain at harvest for 100 FCFA/Kg. According to ULPC at the time of the sales, between March and May, the price for sorghum was 115 FCFA/Kg in the local market. The first two sales occurred at a price of 125 FCFA/Kg which included a 10 FCFA/Kg price premium for grain quality (ULPC Verbal Communication, 2008) (Table 2.7). This means that for the first two sales ULPC gained 15 FCFA/Kg or 15% from the harvest price of 100 FCFA/kg at which they purchased the grain from farmers and received an additional 10 FCFA/Kg or 10% from the market because of the clean grain (Table 2.7). These two sales represented the bulk of the quantity marketed. The last 5 percent of marketed grain was also sold at a higher quality premium. ULPC received an additional 20 percent or 20 FCFA/Kg because of the quality of the grain in addition to the price gain from storage (Table 2.7). The gains from storage for this sale were the same as the first two sales.

Table 2.7. Price Gains from Storage and Grain Quality for Program Grain Marketed by ULPC in 2007/08

Sale	Harvest Price	Gains From Storage	Gains from Grain Quality	Sale Price	Quantity Sold
		FCFA/Kg			(Mt)
1	100	15	10	125	20
(% Gains from Harvest Price)		15	10	25	
2	100	15	10	125	10
(% Gains from Harvest Price)		15	10	25	
3	100	15	20	135	1.5
(% Gains from Harvest Price)		15	20	35	
Weighted Average	100	15	10	125	
(% Gains from Harvest Price)		15	10	25	

Source: Authors Calculations from ULPC data.

To purchase the excess grain from farmers (after reimbursement of their input credit) ULPC borrowed the funds from a local microcredit institution. The financial costs incurred by ULPC amounted to an annual rate of 18.3 percent (Verbal communication ULPC, 2008). Given the amount purchased from farmers this amounted to a cost of 0.02 FCFA/Kg. The storage cost at the central storage depot that ULPC owns amounts to 12.25 FCFA/Kg (Verbal communication ULPC, 2008). Therefore per Kg sold ULPC had to recover a total of 12.27 FCFA/kg in storage and financial cost. Given the distribution of sales, the gains from storage and grain quality, and taking into account storage and financing cost the weighted average benefit from marketing the program grain for ULPC was 13.21 FCFA/Kg (Table 2.8).

Table 2.8. Returns to Marketing for ULPC, Dioila, Mali.

Sale	Gains From Storage	Gains for Quality	Storage and Financing Cost	Net Benefit	Quantity Sold
		FCFA/Kg			(Mt)
1	15	10	12.27	13	20
2	15	10	12.27	13	10
3	15	20	12.27	23	1.5
Weighted Average	15	10.48	12.27	13.21	

Source: Authors calculations from ULPC data.

None of the additional benefit of 13.21 FCFA/Kg obtained by ULPC from storing and selling at a price premium was redistributed back to the program farmers. The farmers governing body, composed of the representatives of the different villages associations that form ULPC, voted to invest these earnings in the construction of a new building to house their offices. Currently the building that they use is being rented and this rent is being paid by a donor that will stop paying the rent in the future. The benefit of 13.21 FCFA/Kg obtained by ULPC from storing and selling at a higher price therefore can be considered an additional benefit that farmers decided to reinvest.

Given the proportion of sorghum sold by farmers to ULPC in excess of the grain required for reimbursement of their inputs, farmers' total gains from the program further increase from the additional 13.21 FCFA/Kg. On average in the community of Nangola farmers revenue increases by an additional 6,981 FCFA/Ha or close to 15 percent when taking into account the benefit obtained by ULPC from storing and marketing (Table 2.9). In the community of Wakoro the benefit obtained by ULPC from storing and selling increase farmers revenue by an additional 1,232 FCFA/Ha or almost 7 percent (Table 2.9). The total gains for farmers in the communities of Nangola and Wakoro averaged 54,616 FCFA/Ha and 17,979 FCFA/Ha respectively (Table 2.9)

Table 2.9. Per Hectare Monetary Gains from Increased Yields, Higher Quality Grain Sales, and Sales to ULPC for Farmers in Dioila in 2007/08

	Gain from Increased Yield	Gains from Sales at Harvest with a 15 FCFA/Kg Quality Premium	Gains from Sales to ULPC	Total Gains	Total Gains Without Gains from Sales to ULPC	(%) of Technology Cost Covered by Gains
	(1)	(2)	(3)	(4)	(5)	(6)
			FCFA/Ha			
Community of Nangola	29,906	17,730	6,981	54,616	47,636	123
Village of Magnambougou	61,038	19,393	8,711	89,142	80,431	201
Village Kenie	5,692	16,437	5,635	27,763	22,129	63
Community of Wakoro	7,104	10,875	1,232	19,211	17,979	49
Village of Wakoro	1,975	11,417	1,455	14,847	13,392	38
Village of Tonga	12,233	10,333	1,010	23,576	22,566	60

Source: Authors Calculations from ULPC and Survey Data. Column (1) is the difference between farmers' yields using their traditional variety and farmers yields using the program variety Soumba and 150 Kg/Ha of fertilizer multiplied by the harvest price of 85 FCFA/Kg; (2) Gains from the quality premium are calculated by multiplying farmers yields using the Soumba technology package by 15 FCFA/Kg; (3) Is the amount of sorghum per hectare sold to ULPC by farmers, after reimbursement of their input credit, multiplied by 13.21 FCFA/Kg the weighted average benefit obtained by ULPC from storing and selling late in the year; (4) Total gains are the sum of (1) through (3); (4) is the sum of (1) and (2); (6) is the ratio of total gains to the cost of the Soumba technology package with fertilizer.

2.3 Conclusions

Despite the adverse weather conditions farmers were convinced of the benefits of fertilizer on new sorghum cultivars. For the 2008/09 season all the farmers that started with the program remained. Famers' yields increased over the traditional varieties by more than 20 percent. Of the two communities in the program in Dioila, the gains obtained by farmers in the community of Nangola were more than double the cost of the technology package. In the community of Wakoro the gains obtained only covered 38 percent of the technology costs. This highlights the problems of the low lands where flooding was serious.

In terms of the organizational structure, the structure and organization of ULPC is a very strong point for the program. ULPC has established relations with the local microcredit institutions in the region giving its members access to credit. In addition their marketing organization is also well developed. But despite its strengths and organization only a small part of the benefits from

marketing the program grain were passed on to farmers. Sorghum prices increased 47 percent from harvest time to the final sale price at which ULPC sold. Farmers only captured 17 percent of that increase with the remainder 30 percent going to the cooperative. In the future more of these gains will need to be redistributed back to farmers in order to encourage further participation.

3. Tingoni

In 2007 the cooperative of Tingoni, in the village of the same name, started its second year in the INTSORMIL Production-Marketing project. A total of 68 farmers who harvested 150 Ha participated in the program. Our evaluation is based on survey interviews of 32 of those farmers. In Tingoni the program focused on introducing the millet cultivar (Toroniou) as this area is an important millet producer.

We will begin our discussion by first discussing farmers' yields using the program technology package versus yields under farmers' traditional cultivars. Then we will discuss the economic returns to farmers of using the technology package. Finally, we discuss the returns to marketing first for farmers and then for the local cooperative.

3.1 Farmers Yields

Before final harvest results were obtained, with the aid of SG 2000, the cooperative of Tingoni projected yields using crop cuts from a 25 m^2 plot. Yields for the program millet were expected at 1075 Kg/Ha. Actual[5] yields from the population sample puts them at 1,333 (Table 3.1). In our analysis we use the actual yields even though they only cover 47 percent of the population. We consider them to be more accurate as all the farmers grain was weighed before being put into community storage.

The factor that impacted yields the most was rainfall. First of all because of the lack of rainfall at the beginning of the season farmers had to replant. Later with the excess water the millet crop was not able to take full advantage of the fertilizer. In our discussion with some farmers they reported that part of the fertilizer applied was washed away before the plant could assimilate it. Despite these problems in Tingoni, farmers saw an increase in yields of 34 percent when using the program millet cultivar and fertilizer relative to using the traditional millet cultivar and no fertilizer (Table 3.1). Farmers using the program cultivar in addition to fertilizer harvested 341Kg/Ha more then when using their traditional cultivar.

Table 3.1 Crop Cuts and Actual Millet Yields for farmers in the INTSORMIL program in Tingoni 2007/08

Yields	Program Millet	Traditional Millet	Difference
	Kg/Ha		%
Actual	1,333	993	34
Crop Cuts	1075	660	63

Source: Actual (n=32); Crop Cuts (n=68).

3.2.1 Cost of technology package

The technology package for farmers in Tingoni in the project consisted of 100 Kg/Ha of the complex fertilizer NPK (15-15-15) and 50 Kg/Ha of Urea (46-0-0). In total farmers were provided on credit with 2 bags of NPK and 1 bag of Urea. The total cost per hectare for fertilizer alone came to 40,500 FCFA/Ha (Table 3.2). In addition, the technology package included 6 Kg of seed and access to two seed treatment packages. The reason for providing farmers with two seed treatment packages was that one of the seed treatments sold out locally. Farmers total cost

[5] At the end of the season when farmers harvested the cooperative of Tingoni weighed each farmers individual production prior to deducing their input credit. Thererfore the yields given to us by farmers in Tingoni are actual and not projected as with the crop cuts.

of the technology package including seed and seed treatment came to 43,200 FCFA/Ha (Table 3.2). In addition to the cost of the technology package farmers also had to pay 10 FCFA/Kg to thresh their grain in the cooperatives mechanical thresher. Farmers were required to repay all input costs in grain at harvest.

Table 3.2 Cost of the INTSORMIL Technology Package given to Farmers in Tingoni, Mali

				Total	
NPK	13,500	FCFA/Bag	2 Bag/Ha	27,000.00	FCFA/Ha
Urea	13,500	FCFA/Bag	1 Bag/Ha	13,500.00	FCFA/Ha
Seed	250	FCFA/Kg	6 Kg/Ha	1,500.00	FCFA/Ha
Seed Treatment 1	1,200	FCFA/Bag	1 Bag/6 Kg of Seed	1,200.00	FCFA/Ha
Seed Treatment 2	600	FCFA/Bag	1 Bag/6 Kg of Seed	600.00	FCFA/Ha
Total with Seed Treatment 1				43,200.00	FCFA/Ha
Total with Seed Treatment 2				43,200.00	FCFA/Ha

Source: SG 2000 and Farmers Cooperative in Tingoni

3.2.2 Returns to Marketing in Tingoni

The Production-Marketing project encourages farmers to sell a higher quality grain by promoting threshing off the ground. In addition it encourages farmers to store and sell later in the year to take advantage of the seasonal price increase. In conjunction with these strategies, the program also encourages bulk sales through the cooperative to premium markets. Examples of premium markets in Mali are the food processors and animal feed industries. As we will discuss in more detail the cooperative and farmers have made advances in applying these strategies.

3.2.2.1 Returns to Marketing for Farmers in Tingoni

We begin our discussion of returns to farmers by first discussing the distribution of millet grain obtained by using the program variety. Knowing the distribution of millet grain helps to better quantify the benefits obtained by farmers. In Tingoni, farmers did not sell any of their excess production to the cooperative. Farmers only deposited the required amount of millet grain in the cooperative to reimburse their input credit. The cooperative in Tingoni does not yet have access to funds to purchase any excess grains from farmers hence farmers do not sell to the cooperative. Nevertheless, farmers stored and sold on their own. For reimbursement purposes farmers deposited a total of 450 Kg/Ha or 34 percent of their yield in the cooperative (Table 3.3). They consumed on a per hectare basis 646 Kg or 48 percent of their millet and the remainder was stored and sold later in the year (Table 3.3).

Table 3.3. Average Distribution of Farmers Yields in Tingoni in 2007/08.

	Yield	**Reimbursement**	**Individual Sales**	**Consumed**
		Kg/Ha		
Average	1,333	450	238	646
(% of Yield)		34	18	48

Source: Survey data (n=32).

In terms of the value of the grain reimbursed to the cooperative, the grain was valued at 100 FCFA/Kg by the cooperative in Tingoni. At the time of reimbursement the market price for millet was 75 FCFA/Kg. Therefore farmers earned 25 FCFA/Kg or 33 percent more over the market price because of the quality of grain (Table 3.6). In terms of individual sales, none of the

farmers interviewed reported receiving a premium for the quality of grain. Nonetheless, farmers earned an additional 33 FCFA/Kg or 44 percent more from storing and selling later in the year (Table 3.6)

Table 3.3. Price Returns to Farmers from Marketing in Tingoni, Mali

	Harvest Price	Gains From Grain Quality	Gains From Storage	Sale Price
		FCFA/Kg		
Reimbursement to Cooperative	75	25	0	100
(% Gain from Harvest Price)		33	0	33
Individual Sales	75	0	33	108
(% Gain from Harvest Price)		0	44	44

Source: Authors calculations from survey data and the Tingoni Cooperative.

Given the distribution of production and prices received by farmers, from the additional 341 Kg/Ha produced by farmers from using the program millet, they gained 25,551 FCFA/Ha more (Table 3.4). From the 25 FCFA/Kg quality premium, given by the cooperative of Tingoni to farmers for their millet grain, farmers gained an additional 11,250 FCFA/Ha. From storing on their own and selling later in the year farmers earned an additional 7,846 FCFA/Ha (Table 3.4). They also incurred a cost of 13,333 FCFA/Ha for cleaning their grain through the cooperative. When we deduct the cleaning cost total gains to farmers was 31,314 FCFA/Ha or 72 percent of the cost of the technology package (Table 3.4).

Table 3.4. Per Hectare Monetary Gains from Increased Yields and Higher Quality Millet Grain Sales for Farmers in Tingoni in 2007/08.

Yield Gain	Gain from Increased Yield	Gains from Sales at Harvest with a 25 FCFA/Kg Quality Premium	Gains from Storage	Cleaning Cost	Total Gains	(%) of Technology Cost Covered by Gains
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Kg/Ha			FCFA/Ha			
341	25,551	11,250	7,846	13,333	31,314	72

Source: Authors calculations from survey data. Column (1) Yield Gain is the difference between farmers' yields using their traditional variety and farmers' yields using the program millet variety Toroniou and 150 Kg/Ha of fertilizer; (2) The yield gains in (1) were multiplied by the harvest price of 75 FCFA/Kg.; (3) Gains from the quality premium is the product of the multiplication of the amount of grain given to the cooperative for reimbursement times the quality premium; (4) Gains from storage are the average amount stored and sold by farmers using their own storage times the reported price difference between harvest and period of grain sold; (5) Cleaning cost is the yield under the new variety Toroniou times the cleaning charge of 10 FCFA/Kg.

3.2.2.2 Returns to the Cooperative of Tingoni from Marketing

In 2007/08 the cooperative of Tingoni marketed a total 68 mt, this was 3.55 mt more than the amount required to reimburse the input credit. Farmers in Tingoni therefore reimbursed more

than 100 percent of the value of the total input credit received at planting. With farmer approval, the sales from the surplus grain were incorporated into the capital of the cooperative and not redistributed back to farmers. The surplus arose from the fact that the cooperative chose to demand a fixed quantity per member based on the total debt of the group and not on individual farmer debt. At a grain valued at 100 FCFA/Kg the quantity demanded per farmer to reimburse the input credit was 450 Kg/Ha. The cooperative marketed the grain in 3 sales. The first two sales were carried out to a food processor from Bamako at a price of 140 FCFC/kg initially and then at a price of 120 FCFA/Kg. The reason for the difference in prices is that the food processor considered that the second batch was less clean. These sales accounted for 29 percent of the total grain marketed. The remaining 71 percent was sold at market price due to the fact that the cooperative needed to recover its revolving fund to purchase the inputs needed for the 2008/09 crop cycle.

Table 3.8 Distribution of sales by the Cooperative of Tingoni in 2007/08 in Mali.

Sale	Quantity Sold	Sale Price
	(Mt)	(FCFA/Kg)
1	15	140
(% of Total)	22	
2	5	120
(% of Total)	7	
3	48	115
(% of Total)	71	
Total	**68**	

Source: SG 2000

When analyzing the distribution of sales, the weighted average return to storage for the cooperative was 15 percent and the premium for quality was 6 percent (Table 3.9). In FCFA/Kg this means that on average the cooperative received an extra 21 FCFA/Kg from the harvest price at which they valued the grain. The cooperative did not incur storage cost given that they did not invest in treating the grain or pay for facilities as they used borrowed ones. In the 2008/09 season this will change as they have finished building their own storage unit.

Table 3.9. Price Gains from Storage and Grain Quality for Program Grain Marketed by the Cooperative of Tingoni, Mali 2007/08

Sale	Harvest Price	Gains from Storage	Gains from Grain Quality	Sale Price	Quantity Sold
		FCFA/Kg			(Mt)
1	100	15	25	140	15
(% Gain)		15	25	40	
2	100	15	5	120	5
(% Gain)		15	5	20	
3	100	15	0	115	48
(% Gain)		15	0	15	
Weighted Average	100	15	6	121	
(% Gain)		15	6	21	

Source: Authors Calculations from survey data.

Given observed yields in the 2007/08 crop season the cooperative of Tingoni needed 32 Fcfa/Kg to recover the input fund to finance the inputs for the 2008/09 season (Table 3.10). With a weighted average price of 121 Fcfa/Kg that the cooperative received for grain marketed the cooperative receive a net benefit of 89 Fcfa/Kg (Table 3.10)

Table 3.10 Net benefit from Marketing for the Cooperative of Tingoni

	FCFA/Kg
Total Revenue	121
Value of Inputs	32
Net Benefit	89

None of the gains from the marketing efforts by the cooperative of Tingoni were distributed back to farmers. The net benefits were kept to increase the capital base of the cooperative. This was an additional benefit approved by farmers to strengthen their cooperative. Therefore, we add this forgone benefit back to farmers' gains. Farmers in Tingoni deposited 450 Kg/Ha to reimburse their input credit. From marketing this grain the cooperative made a profit of 89 Fcfa/Kg. Had this profit been redistributed back to farmers, their total gains would have increased by 39,866 Fcfa/Ha (Table 3.11). With this additional income gain farmers cover 226 percent of the total cost of the technology package given to them in 2007.

Table 3.11. Per Hectare Monetary Gains from Increased Yields and Marketing by Farmers and the Cooperative of Tingoni in 2007/08.

Yield Gain	Gain from Increased Yield	Gains from Sales at Harvest with a 25 FCFA/Kg Quality Premium	Gains from Own Storage	Cleaning Cost	Gains from Marketing by the Cooperative	Total Gains	(%) of Technology Cost Covered by Total Gains
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Kg/Ha			FCFA/Ha				
341	25,551	11,250	7,846	13,333	39,866	97,846	226

3.3 Conclusions

In Tingoni despite the adverse year faced by farmers, yields for the program millet were 34 percent higher than farmers' traditional millet cultivars. But the yield and marketing gains were not enough in this bad year to cover the total cost of the technology package. Without any of the gains from marketing obtained by the cooperative being redistributed back to farmers, the gains from yield and farmers own marketing effort covered 72 percent of the total cost of the technology package. When the gains of the marketing efforts of the cooperative are included, farmers cover 226 percent of the cost of the technology package.

More needs to be done to continue improving the returns to farmers. First of all, because of lack of funds the cooperative is not able to purchase grain from farmers. Therefore farmers do not market through the cooperative and thus do not have access to the same markets. Additionally the cooperative has only benefited partially from storage given that it is unable to hold grain for long periods of time because of the need to recover the revolving fund to purchase inputs.

In terms of benefiting from premium markets, one positive aspect is that with the help of SG 2000 the cooperative has started to sell to a food processor that is willing to pay a premium for the grain. Additionally SG 2000 is also helping the Tingoni cooperative to put out contracts for 2008/09 in the Malian Cereal board where prices are usually higher.

With regards to institutional development, Sasakawa Global 2000 (SG 2000) has helped the cooperative obtain legal recognition and establish formal relations with micro-credit institutions. In the crop year 2008/09 farmers in the cooperative of Tingoni obtained credit for both inputs and grain purchases from a local microcredit institution.

4. Kaniko

In 2007/08 the village of Kaniko, located in the region of Sikasso, was in the second year of the project. In Kaniko the Production-Marketing project has been working in collaboration with the NGO AMEDD. In total 42 farmers participated in the program, total production was close to 29 tons in the 48 hectares harvested. Our evaluation of results for farmers in the program is based on 27 farm interviews.

The evaluation of the program in Kaniko centers on three aspects. First, we will compare the yield gains farmers had using the variety and technology proposed by the program relative to their traditional cultivar. IER provided farmers with the sorghum variety Nieta in 2006/07 and has let farmers produce their own seed of this cultivar since then. In addition farmers implemented a revolving fund from the first year of input repayments to pay for inputs in succeeding years.

After discussing yields we will then look at the economic returns to farmers from using the technology package proposed by the program. We end our discussion by examining the potential gains farmers had from using the marketing strategies also promoted in the program.

4.1 Farmers Yields

In 2007/08 the weather conditions in Kaniko were adverse. Rainfall set in late June, a month later than usual, and total rainfall was substantially higher than the trend causing flooding in lowland farmers' fields. Given these conditions farmers saw very small yield gains over their traditional variety. Farmers' sorghum yields using the program variety were on average 5.58 percent higher than with their traditional cultivars (Table 4.1). The yield for the program variety averaged 989 Kg/Ha. In contrast, the traditional cultivar used by farmers had a yield of 937 Kg/Ha.

Table. 4.1. Yield for IER-INTSORMIL Project Sorghum and Traditional Sorghum in Kaniko, Mali in 2007/08

	Program Sorghum	Traditional Sorghum	Difference
	Kg/Ha		%
Yield	989	937	5.58

Source: Authors calculations from survey data. n=27.

4.2.1 Cost of Technology Package

The cost of the technology package supplied to farmers in Kaniko had a total cost of 34,845 FCFA/Ha (Table 4.2). Of this amount 95 percent corresponds to the cost of fertilizer. The remainder is the cost of the seed.

Table 4.2. Cost of Technology Package for Farmers in the IER-INTSORMIL Program in Kaniko, Mali in 2007/08

NPK	**2**	**Bags/Ha**	**11,000.00**	**FCFA/Bag**	**22,000.00**	**FCFA/Ha**
UREA	1	Bags/Ha	11,125.00	FCFA/Bag	11,125.00	FCFA/Ha
Seed	4	Kg/Ha	430	FCFA/Kg	1,720.00	FCFA/Ha
Total Cost					34,845.00	FCFA/Ha

Source: AMEDD

4.2.2 Distribution of Sorghum Production and Farmers Returns to Technology

The cooperative in Kaniko required farmers to deposit the totally of their program sorghum into the cooperative. The cooperative in return promised to redistribute gains back to farmers. The cooperative in Kaniko undertook this policy for two reasons, first to assure full recuperation of the revolving fund for fertilizer. The second reason was to have enough product volume that would allow them to be better positioned to sell. Farmers only partially complied with the association's request. Instead they withheld grain for own consumption and to market as well. On average, on a per hectare basis, farmers gave 65 percent of their total production to the association (Table 4.3). For consumption farmers kept 21 percent and for individual sales they set aside 14 percent.

Table 4.3. Average Distribution of Millet Production by Program Farmers in Kaniko, Mali.

	Yield	Reimbursement	Surplus Grain Sold to the Cooperative	Individual Sales	Consumed
			Kg/Ha		
Average	989	465	176	142	206
(% of Yield)		47	18	14	21

Source: Authors calculations from survey data.

The farmers' association in Kaniko valued farmers' sorghum grain at the harvest price of 75 FCFA/Kg. The price gain (from selling later in the year or from selling a quality grain) was returned to farmers in proportion to the excess grain they deposited with the cooperative after covering their input credit. The cooperative in Kaniko increased its prices by 41 percent or 31 FCFA/Kg by storing and selling 4 months after harvest (Table 4.4). Neither the cooperative nor the farmers were able to obtain a quality premium for their grain. Farmers were able to capture a higher price increase. From storing and selling later in the year farmers increased their prices by 60 percent or 45 FCFA/Kg (Table 4.4).

Table 4.4. Price Returns to Farmers from Marketing in Kaniko in 2007/08, Mali

Sale	Harvest Price	Gains From Storage	Gains From Grain Quality	Sale Price
		FCFA/Kg		
Sales to the Cooperative	75	31	0	106
(% Gain from Harvest Price)		41	0	41
Individual Sales	75	45	0	120
(% Gain from Harvest Price)		60	0	60

Source: Cooperative of Tingoni-AMEDD

Given the prices farmers obtained and the distribution of production farmers increased their revenues by 3,921 FCFA/Ha from the higher yields of the technology package (Table 4.5). The gain in revenue from storage by selling to the cooperative was 5,354 FCFA/Ha. From storing and selling on their own farmers increased their revenue by 6,407 FCFA/Ha. The total gains in revenue from the program in 2007/08 for farmers was 15,682 FCFA/Ha or 45 percent of the cost of the technology package.

Table 4.5. Per Hectare Monetary Gains from Increased Yields and Higher Quality Millet Grain Sales for Farmers in Tingoni in 2007/08.

Yield Gain	Gain from Increased Yield	Gain from Sales to the Cooperative	Gain from Storage	Total Gains	(%) of Technology Cost Covered by Gains
(1)	(2)	(3)	(4)	(5)	(6)
Kg/Ha			FCFA/Ha		
52	3,921	5,354	6,407	15,682	45

Source: Authors calculations from survey data. Column (1) Yield Gain is the difference between farmers' yields using their traditional variety and farmers' yields using the program sorghum variety and 150 Kg/Ha of fertilizer; (2) The yield gains in (1) were multiplied by the harvest price of 75 FCFA/Kg.; (3) Gains from sales to the cooperative are the product of the price increase obtained by the cooperative times the amount sold by farmers to the cooperative in excess of their reimbursement; (4) Gains from storage are the average amount stored and sold by farmers using their own storage times the reported price difference between the harvest price and the price reported by farmers at which they sold; (5) Total gains are the sum of columns (2) through (4); Column (6) is the ratio of total gains (5) to the total cost of the technology package.

Even though farmers did not cover half of the cost of the technology package with the total gains from the program the results obtained highlights the importance of marketing in bad years. Of the 45 percent of the cost of the technology package covered by the gains from the program 34 percent came from farmers benefitting from one of the marketing strategies promoted, storing and selling later in the year. Farmers in Kaniko need more support in selling their grain to

markets that are willing to pay more, such as food processors and the animal feed industry. The cooperative in Kaniko in 2007/08 had no contact with such markets or support to market to them. They were also not able to get a quality premium.

4.2.3 Gains from Marketing for the Cooperative of Kaniko

The cooperative of Kaniko marketed a total of 28.7 mt in 2007/08. The only gain from marketing that the cooperative was able to capture was from storage (or the seasonal price increase). The cooperative was unsuccessful in finding a premium market willing to pay more for higher quality grain. Additionally only 95 percent of all farmers paid their input credit. Nonetheless, the cooperative on average was able to benefit from a 41 percent average price increase from the sale of the grain a few months after harvest (Table 4.6). On average the cooperative gained an extra 31 FCFA/Kg from the harvest price of 75 FCFA/Kg.

Table 4.6. Price Gains from Storage for Program Grain Marketed by the Cooperative of Kaniko, Mali 2007/08

Sale	Harvest Price	Gains from Storage	Sale Price	Quantity Sold
		FCFA/Kg		(Mt)
1	75	30.5	105.5	28.0
(% Gain from Harvest Price)		41	41	
2	75	45	120	0.7
(% Gain from Harvest Price)		60	60	
Weighted Average	75	31	106	
(% Gain from Harvest Price)		41	41	

Source: Authors calculations from data provided by the Cooperative of Kaniko

The total cost of inputs distributed to farmers by the cooperative of Kaniko had a value of 64 FCFA/Kg (Table 4.7). At the weighted average price at which the cooperative sold this left the cooperative with a benefit of 42 FCFA/Kg after recovering the revolving fund (Table 4.7). Of the net benefit obtained by the cooperative 39 FCFA/Kg or 96 percent of it was given back to farmers. The cooperative kept only 3 FCFA/Kg or 4 percent for itself (Table 4.7).

Table 4.7. Net Benefit, Average Annual Rate of Return, and Distribution of Benefit of Grain Sales by the Cooperative of Kaniko in 2007/08.

	FCFA/Kg
Total Revenue	106
Total Value of Input Credit	64
Net Benefit	42
Farmers Share of Net Benefit	39
(% of Total Net Benefit)	94
Cooperatives Share of Net Benefit	3
(% of Total Net Benefit)	6

Source: Authors Calculations from the data provided by the Cooperative of Kaniko

4.3. Conclusions

Farmers yield gains in Kaniko from using the technology package proposed by the program over their traditional variety were minimal in 2007/08. Farmers only increased yields by 5.58 percent. This small yield gain was due to the excess rain that farmers received and a cultivar that was too tall and responded poorly to moderate fertilization.

Farmers did benefit from selling later in the year and from their cooperative dividing the profits from selling late in the year as well. But with all this, the gains in price and the poor yield gains, farmers were only able to pay off 45 percent of the additional cost of the technology.

Even though farmers in Kaniko only benefited from one marketing strategy, storing and selling latter in the year, this strategy provided the majority of the benefits in this bad year. The cooperative and farmers need to improve their marketing efforts. They need to access premium markets that are willing to pay more for their product. Neither group is obtaining a premium for the higher quality clean grain that they are producing. This situation might discourage farmers from continuing to clean their grain if the only markets they have access to is the local markets. Moreover, quantities of grain handled by the farmers' cooperative are becoming sufficiently high that there should be a premium to increased search for higher paying markets. Finally a better cultivar is being introduced in the summer of 2008 of intermediate height with a much better response to moderate fertilizer levels.

5. Kafara

In the 2007/08 the Production-Marketing project was in its second year in the village of Kafara. During this particular production season a total of 39 farmers who harvested 56 hectares participated in the program. Our evaluation of program results for farmers and the farmers' cooperative in Kafara is based upon farm interviews of 17 farmers who participated in the program. Our discussion will concentrate on yield gains for farmers and marketing gains for farmers and their cooperative from participating in the program. In terms of yields gains we will compare the gains in yields from using the technology package proposed by the program to the farmers' traditional technology. The program package calls for the use of the improved sorghum variety Natchitchama, and of 150 Kg/Ha of the complex fertilizer NPK (17-17-17) and the nitrogen based fertilizer urea (46-0-0).

In terms of marketing the project encourages farmers to produce a cleaner grain by threshing off the ground. By producing cleaner grain farmers can potentially capture higher prices. Additionally farmers are motivated to search for premium markets that need cleaner grain and are willing to pay a premium for it. The program also recommends that farmers store and sell their grain after harvest to take advantage of the seasonal price increase. Therefore we will highlight the gains in terms of prices obtained by farmers and the association by following the recommended marketing strategies.

5.1 Yield Gains

The 2007/08 production season was a difficult year with respect to rainfall for farmers in Kafara. Farmers faced an excess of rainfall during this season that averaged more than twice the normal amount rainfall causing severe flooding. Despite the rain, farmers in Kafara realized gains in terms of yields by using the program technology package. On average farmers increased their yields by 26 percent or 221 kg/ha more than their traditional cultivar (Table 5.1).

Table 5.1. Yields for IER-INTSORMIL Program Sorghum and Traditional Sorghum in Kafara, Mali in 2007/08

	Program Sorghum	Traditional Sorghum	Difference
	Kg/Ha		%
Yield	1050	836	26

Source: Authors calculations from survey data

5.2. Returns to Technology Package

After discussing the yield gains that farmers achieved from using the program technology package we will now discuss its economic return to farmers. We will begin our discussion by first looking at the cost of the technology package given to farmers in Kafara. Then we will discuss farmers' distribution of their sorghum production between sales to the cooperative, individual sales, and consumption. Knowing farmers' distribution of production helps us to better establish the benefits to farmers from the marketing and production project. We follow this discussion by presenting farmers returns to the technology package and marketing. Then we discuss the returns to marketing for the cooperative.

5.2.1 Cost of Technology Package

Farmers in Kafara were provided credit in 2006/07 to purchase inputs for 1 hectare. At the end of the 2006/07 season farmers had to repay this package in grain according to the valuation that the cooperative in Kafara established for sorghum at harvest. In 2007/08 the technology package was paid for by the farmers' association from the sales of the grain from the previous season. In total farmers were provided credit for 2 bags of the complex fertilizer NPK and 1 bag of the nitrogen fertilizer, Urea, per hectare. The total value per hectare of fertilizer was 36,205 FCFA/Ha (Table 5.2). In addition farmers were advanced 4 kg/ha of seed at a cost of 150 FCFA/Kg. Farmers also had the choice to opt for 5,000 FCFA/Ha to pay for labor to ridge their fields for water harvesting purposes. Therefore depending on the package chosen farmers were advanced a credit of 36,805 FCFA/Ha or 41,805 FCFA/Ha (Table 5.2).

Table 5.2. Cost (FCFA) of Technology Package for Farmers in the IER-INTSORMIL Program in Kafara, Mali in 2007/08

					Total (FCFA)
NPK	12,265	FCFA/Bag	2	Bags/Ha	24,530
Urea	11,675	FCFA/Bag	1	Bag/Ha	11,675
Seed	150	FCFA/Kg	4	Kg/Ha	600
Labor for Ridging	5,000	FCFA/Unit	1	Unit/Ha	5,000
Total Cost With Labor for Ridging					**41,805**
Total Cost With Out Labor for Ridging					**36,805**

Source: Cooperative of Kafara

5.2.2 Distribution of Sorghum Production and Farmers Returns to Technology

On average, on a per hectare basis, farmers needed 32.4 percent of their total production to reimburse the cooperative for their input credit (Table 5.3). In addition they sold 7.1 percent of their excess production to the cooperative. On their own farmers sold 12.4 percent of their total production. For home consumption farmers kept 48.1 percent (Table 5.3).

Table 5.3. Average Distribution of Program Sorghum Production by Farmers in Kafara, Mali.

	Yield	**Reimbursement**	**Sales to Cooperative**	**Individual Sale**	**Consumed**
Average (Kg/Ha)	1056	342	75	131	509
(% of Yield)		32.4	7.1	12.4	48.1

Source: Authors calculation from survey data.

Farmers in Kafara sold their production between the cooperative and the local market. Recognizing the quality of the sorghum grain the cooperative valued farmers' sorghum at 100 FCFA/Kg when the market price at the time was at 75 FCFA/Kg (Table 5.5). Farmers earned a premium of 33 percent from selling to the cooperative. With regards to individual sales farmers were not able to capture a price premium for the quality of the grain. Since farmers were able to store they increased their price by 57 percent from the harvest price (Table 5.5)

Table 5.5. Price Returns to Farmers from Marketing in Kafara, Mali

Sale	Harvest Price	Gains From Storage	Gains From Grain Quality	Sale Price
		FCFA/Kg		
Sales to the Cooperative	75	0	25	100
(% Gain)		0	33	33
Individual Sales	75	43	0	118
(% Gain)		57	0	57

Source: Authors calculations from survey data. (n=17)

Given the price obtained by farmers and the distribution of production farmers increased their revenue by 23,547 FCFA/Ha which covered 60 percent of the average cost of the technology package (Table 5.6). The yield increase of 214 Kg/Ha raised farmers' revenue by 16,053 FCFA/Ha which covered 41 percent of the total cost of the technology package. The remaining 19 percent of the 60 percent of the technology package costs covered by farmers gain from the program came from the marketing strategies followed by farmers. The sales to the cooperative at a price premium for cleaner grain contributed to increasing farmers' revenue by 1,866 FCFA/Ha. From storing and selling later in the year farmers increased their revenue by 5,628 FCFA/Ha (Table 5.6). Even though the yield gains covered most of the cost of the technology package in this bad year, marketing narrowed even furthered the gap between farmers gains from the program and the cost of the technology. Marketing in bad rainfall years, in this case a year with excessive rainfall reduces the risk of using fertilizer by increasing its return.

Table 5.6. Per Hectare Monetary Gains from Increased Yields and Higher Quality Millet Grain Sales for Farmers in Tingoni in 2007/08.

Yield Gain	Gain from Increased Yield	Gains from Sales to the Cooperative	Gains from Storage	Total Gains	(%) of Average Technology Cost Covered by Gains
(1)	(2)	(3)	(4)	(5)	(6)
Kg/Ha			**FCFA/Ha (2-6)**		
214	16,053	1,866	5,628	23,547	60

Source: Authors calculations from survey data. Column (1) Yield Gain is the difference between farmers' yields using their traditional variety and farmers' yields using the program sorghum variety and 150 Kg/Ha of fertilizer; (2) The yield gains in (1) were multiplied by the harvest price of 75 FCFA/Kg.; (3) Gains from sales to the cooperative are the product of the price increase obtained by the cooperative times the amount sold by farmers to the cooperative in excess of their reimbursement; (4) Gains from storage are the average amount stored and sold by farmers using their own storage times the price difference between the harvest price and the price at which farmers sold their sorghum; (5) Total gains are the sum of columns (1) through (4); Column (6) is the ratio of total gains (5) to the average cost of the technology package.

5.2.3 Marketing Gains for the Cooperative of Kafara

The cooperative of Kafara in 2007/08 marketed a total of 22.8 mt of sorghum. Of the amount marketed 14.95 mt came from farmers' reimbursement of their individual input credit. The remainder of the grain came from the purchases of farmers surplus carried out by the cooperative. The cooperative kept any additional profits generated from the purchase of this surplus. The decisions to keep these profits was taken by the cooperative and not consulted with farmers as was done in the other villages where the project is involved. The cooperative marketed all the grain in one sale. At the time of the sale the price in the market was 100 FCFA/Kg, the same price as the purchase price for the cooperative. Therefore the cooperative did not gain from storage (Table 5.7). However they obtained an additional 25 FCFA/Kg or 25 percent more from the buyer because of the quality of the grain.

Table 5.7. Price Gains from Storage and Grain Quality for Program Sorghum Marketed by the Cooperative of Kafara, Mali 2007/08

	Harvest Price	Gains From Storage	Gains From Grain Quality	Sale Price	Quantity Sold
		FCFA/Kg			(Mt)
	100	0	25	125	22.8
(% Gain from Harvest Price)		0	25	25	

Source: Authors calculation from data provided by the cooperative of Kafara.

To recover the revolving fund to purchase fertilizer the cooperative needed 66 FCFA/Kg (Table 5.8). Therefore given the price return from the market the cooperative had a net benefit of 59 FCFA/Kg.

Table 5.8. Net Benefit and Average Annual Rate of Return of Grain Sales by the Cooperative of Kaniko in 2007/08.

	FCFA/Kg
Total Revenue	125
Total Value of Inputs	66
Net Benefit	59

Source: Authors calculations from data provided by the cooperative of Kafara.

5.3 Conclusions

In 2007/08 despite the adverse rainfall year farmers in Kafara were able to increase their yields by 26 percent. The yield gains covered 41 percent of farmers cost of the technology package. Farmers also increased their price by selling at a premium price and storing and selling later in the year. With the marketing strategies farmers covered 19 percent of the cost of the technology package.

The gains for the cooperative were also significant; because of the quality grain that the cooperative marketed they received a price premium of 25 percent over the market price. The only downside is that farmers that sold their surplus grain after repaying for inputs did not see any additional gains from the marketing efforts of the cooperative. If the cooperative does not

eventually redistribute part of its gains to farmers it will discourage them from participating in the cooperative or marketing through it.

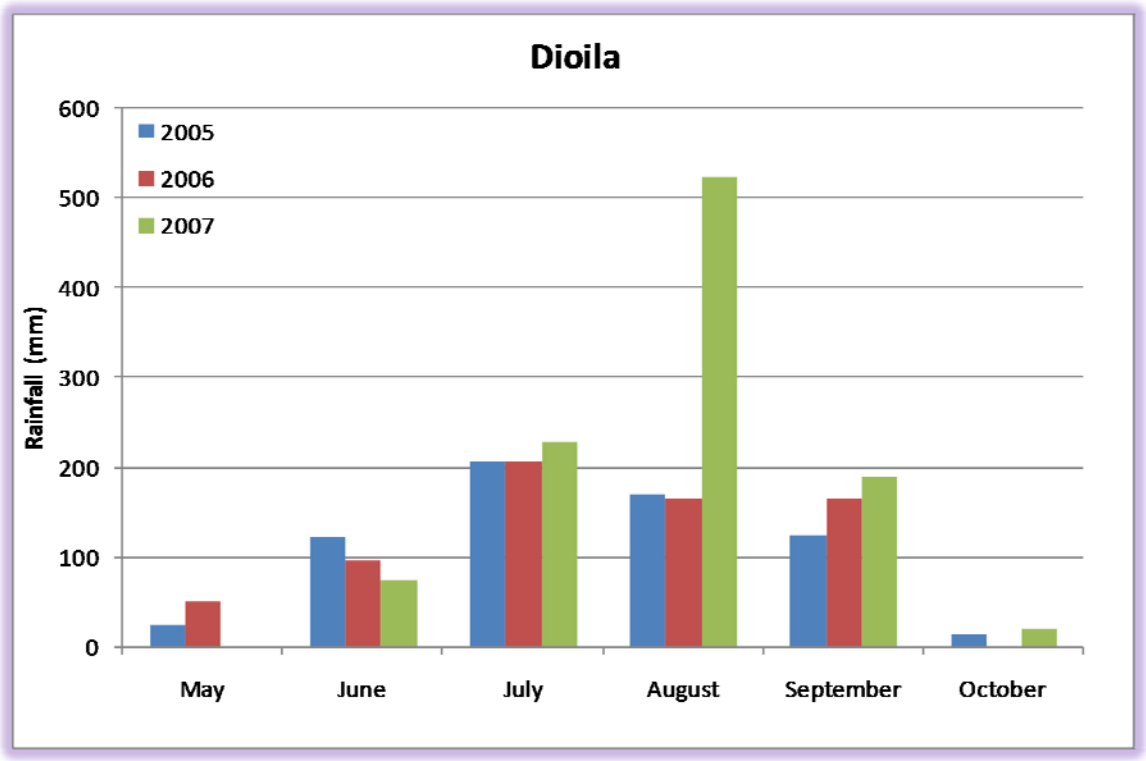
6. General Conclusions

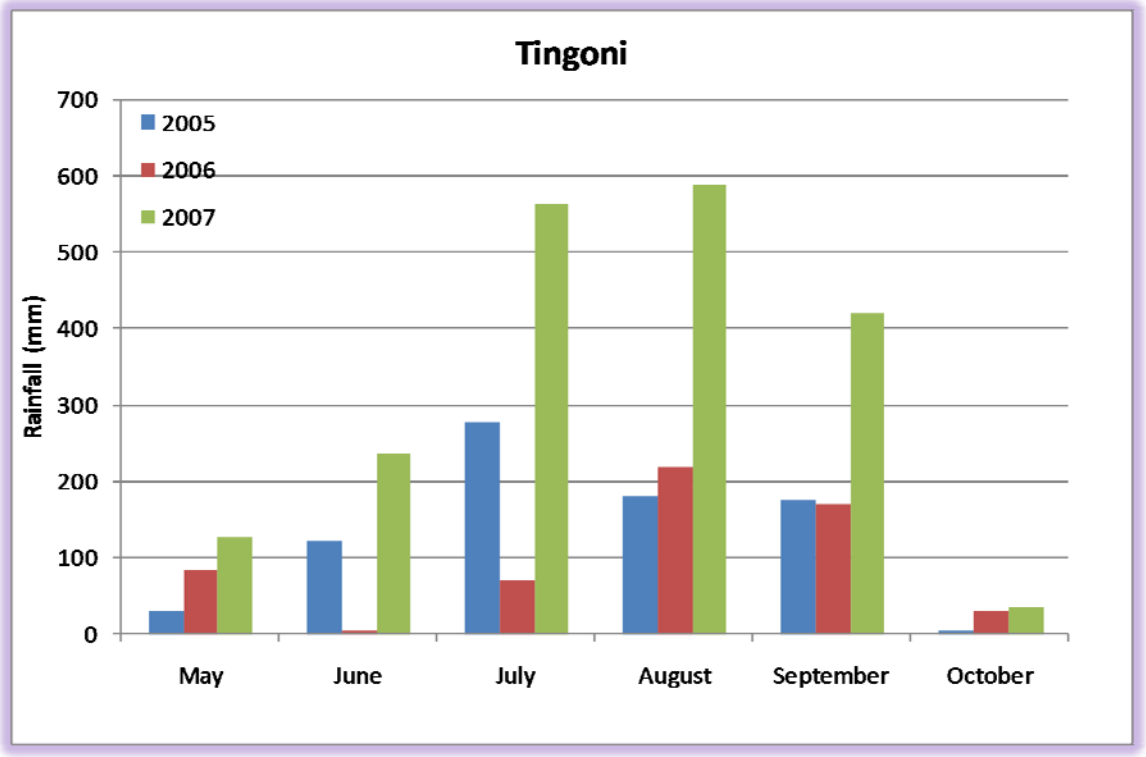
The 2007/08 crop season was a bad year in Mali and farmers in the program because of excessive rainfall. Despite the flooding though farmers in the program were able to obtain moderate yield increases. The increases in yields were not sufficient to cover the total cost of the fertilizer based technology package offered to farmers.

A bad year, due to rainfall is likely to occur about a third of the time in Mali. The marketing strategies with which the technology introduction efforts have been coupled have the objective to mitigate the effects of such years and reduce the risk of using moderate fertilizer levels. The IER-INTSORMIL marketing and production project has concentrated on five marketing strategies: (i) producing a cleaner grain and charging a price premium for it; (ii) storing and selling later in the year to benefit from the seasonal price increase; (iii) selling (and purchasing) bulk quantities; and (iv) selling to premium markets that are willing to pay more especially food processors and the animal feed industry; and (v) convincing policy makers not to drive down the price increases of bad rainfall years with food aid or subsidized food imports.

In the 2007/08 the marketing strategies helped farmers recover more than half of the input costs. In some cases such as Dioila the gains from the technology package and marketing covered more than double its costs. But more needs to be done to increase the benefits that farmers obtain from marketing. All the farmers' cooperatives in the program are at the initial phase of implementing these strategies. More aggressive efforts in searching for new markets are still needed and the program needs to support farmers in doing that.

The program in 2008/09 was successful in retaining all the program farmers. Farmers, despite the bad year of 2007/08, were convinced of the benefits of the use of fertilizer and the potential benefits that they can still get from increasing their marketing efforts. In 2008 better intermediate height cultivars with increased potential to respond to moderate inorganic fertilizer levels were being introduced in most regions. Now we need to establish better ties to the food processing, feed mixing and intensive poultry producers in Mali.





Three Year Rainfall Distributions for Dioila in the region of Koulikoro and Tingoni in the region of Segou, Mali, West Africa

Current status of Production-Marketing Activities

Area under new cultivars and technologies

Area increase and total area in new cultivars and associated technologies in Mali for the crop year, 2009.

Region	New cultivar	Partners	Increase in Area in 2009	Total Area 2009
1. Mopti	Mil Toroniou	DRA/IER		
Bankas/Pissa			60	60
Dwanza/Wallo			60	60
2. Koutiala	Sorghum/Grinkan	AMEDD/IER		
Garasso	-	-	100	150
Finkolani	-	-	50	50
Kaniko	-	-	50	100
3. Kayes Diang. Camara	Millet Toroniou	DRA	75	75
4. Segou				
Tingoni	Millet/Toroniou	SG2000	-	150
Dioila	Sorghum/N.tchama	UPLC	50	150
5. Koulikoro				
Kafara	Sorghum/N.tchama	IER	-	100
Kolokani	Sorghum/Seguifa	DRA/IER	60	110
Total area			**505**	**1005**

Subcontract established with AMEDD (Association Malienne d'Eveil au Developpement)

Actitivities

In the crop year 2009 the Production-Marketing Project will be putting 200 ha of sorghum into production in three locations of Koutiala (Garasso, Kaniko, and Finkolani). The budget of Garasso for 100 ha is $16,507.29. For both Kaniko and Finkolani the budget is $8,253.65 each. The details of these costs in the different categories are included in the original document. The receipts corresponding to these budgets for each locality need to be kept in a dossier titled "INTSORMIL" in the AMEDD accounting office. The proper organization of expenses will facilitate the control of expenses by the INTSORMIL Management Entity at Nebraska as well as by the team in the field.

Visit to Sites of Production-Marketing Activities

5-16 March 2009

Bonnie B. Pendleton

West Texas A&M University
Canyon, TX USA

7 March — Met with Dr. Niamoye Yaro Diarisso, IER Entomologist, and Scientific Coordinator for Irrigated Crops, to discuss, ***translate into French, and prepare handouts on management of insect and mite pests of stored sorghum and millet to give to farmers.***

8 March — Drove with Drs. John Sanders, Ouendeba Botorou, Jeremy Foltz, and Niamoye Yaro Diarisso to Sotuba Research Center to pick up Dr. Mamourou Diourté, INTSORMIL Mali Country Coordinator. Drove to Tingoni and met with 13 farmers involved with the farmer's cooperative and Sasakawa Global 2000. Sandina Camara is the agent for Sasakawa Global 2000. Macoule Tanpara is the Extension agent from Segou, the capital of the region. Mamourou introduced everyone and gave an overview of the production and marketing project for the farmers. Ouendeba explained the importance of using seeds of improved sorghum varieties and inorganic fertilizer. John discussed with the farmers millet marketing economics for this year. Jeremy talked about risk and insurance when obtaining loans and storing the grain. Niamoye discussed how to manage insect pests of stored grain. The farmers told us ***termites and secondary storage insect pests were most damaging***.

9 March — Drove to Koutiala to see Bougouna Sogoba, Director of the AMEDD NGO. Went with Bouare from AMEDD to N'Garasso to meet with 20 farmers involved with the farmers' cooperative (and 22 children). Bourema Sanogo is President of the farmers' cooperative. ***Grinkan sorghum yielded 2,000 kg/ha, while the local guinea sorghum yielded only 1,500 kg/ha***. Some farmers planted too late and preferred earlier varieties of sorghum. The farmers used organic fertilizer to supplement the inorganic fertilizer of the Production-Marketing project. Some grain weight was lost between harvest and the second time the trader came to buy grain. ***Grain was sold early because the farmers feared insect pests and prices were high***. The sorghum was infested by stalk borers but cattle usually graze the stalks and destroy the borers. Sorghum was stored by hanging it from the ceiling. The farmers usually layer leaves of local botanicals with grain to manage storage insects. Benefin is used to prevent insect pests in stored grain of local sorghum varieties for 3-4 years but is not as effective for improved sorghum. Neem trees and acacia also are used as botanical insecticides. Some botanicals are dried to powder. A new storage facility is being built to store grain.

10 March — Drove to Finkoloni in the morning to meet and discuss sorghum production and

marketing with 30 farmers including 5 women. Finkoloni is a new village involved with the project. The farmers obtained a 10% interest rate on their loan on their five month loans[6]. The women recognized flour beetles as being pests in their stored sorghum grain.

Drove to Kaniko in the afternoon and met with Sadou Sanogo, Chief of the village, and 60 farmers including 20 women. They had not yet sold their Grinkan sorghum grain. The farmers had 35,000 FCFA in expenditures provided by the Production-Marketing project as input credits for fertilizer, seed, and seed protection. This credit needs to be repaid to the farmers' association in grain at harvest and becomes a rotating fund for input purchases. They obtained a 10% interest rate on their loan from the bank in their village (see footnote 6 about this interest rate). Neem and phostoxin are used to manage insect pests in stored grain. Toured the storage granary at Kaniko.

11 March — I had a debriefing with Bougouna Sogoba, Director of AMEDD. ***By October or November, Niamoye and I will prepare 20 simple, laminated posters in Bambara and French languages to tell farmers how to manage insect pests in stored grain***. Drove to Sevare and Mopti.

12 March — Met with Soungala Traore, Extension agent from Mopti. Drove to Bankass where we met Bakary Diakite, the Extension agent, and then drove to Pissa village to meet with 83 farmers including 43 women. Pissa is a new site involved in the Production-Marketing project. ***The farmers have problems with birds in their millet.*** The village of Pissa does not have a storage facility yet.

13 March — Drove to Douentza and the village of Wallo to meet with 30 farmers in the Cooperative Agricole de Walla. Ahmadou Tandina is the Extension agent. Sixty-five men farm 50 hectares and 101 women farm the other 10 hectares involved with the Production-Marketing project.

14 March — Drove to Segou.

15 March — Drove to Dioila village. Douda Traore is President of the Uman Locale des Producteurs de Cereales (ULPC) composed of 2,061 farmers in 36 villages and 5 communes. Dramane Keita is Technical Director of ULPC that works with sorghum, millet, and maize. Drove to Magnabougou village and met with 23 farmers. The seed of the improved Nachtichima sorghum was late arriving and then drought conditions were so bad that most farmers gave up on waiting for seed and thus used the inorganic fertilizer on their Soumba variety of sorghum that they thought was better adapted to drought. Yields of one farmer who planted Soumba sorghum varied from 1.5 tons per 0.5 hectare and 1.5-1.6 tons per hectare for a few other farmers who used the improved Nachtichima sorghum. In the neighboring Wakallo village, the farmers produced 1.4-2.6 tons per hectare of improved Nachtichima sorghum. Tarps were used for threshing the grain. Each farmer sold 0-15 bags of grain to the Cooperative that in turn sold the grain for 100 FCFA. Grain is stored at the Union facilities. We toured the storage facility and found a rice weevil and smelled contamination by flour beetles.

[6] On an annual basis this is the standard interest rate of 24% with a very high risk premium of 10 to 15%. One objective of the Production-Marketing project is to get the risk premium down when the local financial organization knows the farmers' organization and farmers provide pressure on each other to repay. The objecti ve is a 15% annual interest rate.

Observations, Suggestions and Recommendations

I was very impressed by the farmers and various organizations with whom we met to discuss sorghum and millet production and marketing in Mali. Hundreds of farmers, including women, seemed eager to participate in the project. All farmers planted the new sorghum variety recommended by the Project, except for farmers in Wakallo village, where farmers planted Soumba, which was also a new cultivar introduced by ICRISAT, because seed of the new sorghum variety recommended by the Project was late arriving. The farmers uniformly used the inorganic fertilizer. Few farmers, except those at Kaniko, stored their grain to try to obtain a better price later after harvest but prices at harvest were unusually high this year. But, drought was bad in several areas of Mali this year, so prices obtained for selling sorghum and millet directly after harvest were good and it was wise for the farmers to sell their grain early. Most farmers seemed reluctant to obtain credit or pay interest on loans. ***Most farmers also seemed reluctant to store grain for very long because they feared storage insect pests, especially beetles that infest grains damaged by primary insect pests in the field.*** The farmers used different methods, including botanical insecticides, to try to prevent insect pests from infesting stored grain. Women seemed eager to participate in the project, but it might prove difficult for as many as the 101 women in the village of Wallo, for example, and elsewhere, to farm only the 10 hectares allotted to them by the project. The problem confronted by the Production-Marketing project is that the women do not have access to land. There is communal land controlled by the household head and private plots available to all adults in the household but these plots are very small, generally about 1/10 ha. Thus, until women get greater access to land they will be pooling their land quota and probably also producing higher value, more labor intensive crops, than sorghum and millet. So this provides a dilemma for the Production-Marketing project of looking the other way and letting the women use the project for obtaining fertilizer on credit or eliminating the women from the project. ***Perhaps the sorghum and millet production and marketing project could be expanded and diversified to enable participating women farmers to rotate sorghum and/or millet with legumes and/or vegetables that would enrich the soil, decrease potential pests, and be more culturally suited for women farmers in Mali.*** The scientists, extension agents and farmers involved with this project seem to be doing good work. Dr. Mamourou Diourte is to be especially commended for all the coordination work he does for this project and the other INTSORMIL activities in Mali.

Meeting with farmers of the N'Garasso, Mali farmers' cooperative. March 2009.

Meeting with farmers of the Douentza and Wallo villages, Mali at the Cooperative Agricole de Walla. March 2008.

Jeremy Foltz (L), Fulbright Fellow and Botorou Ouendeba, Mali Project Coordinator, INTSORMIL, meeting with farmers of the Diola village, Mali. March 2009.

Botorou Ouendeba,Mali Project coordinator, INTSORMIL explaining the goals of the Production-Marketing Project at a meeting with farmers of the Diola village, Mali. March 2009.

Décrue Sorghum
Drs. Vara Prasad and Scott Staggenborg

Trip Report for March 1 through March 13, 2009
Submitted by:
Scott Staggenborg, Kansas State University, Manhattan, KS
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March 4

We arrived in Goundam and spent the afternoon discussing the 2008 results from Bintagoungou and Toukabongou. These results have been detailed by Abdul Wahab Toure in previous reports. In summary, they identified seven top yielding varieties that have potential for further testing. Three of these varieties were IER releases and four were varieties collected from the Lakes region last February. These were identified from 13 local varieties and 20 IER lines around Bingtagounou. Plots near Toukabongou were lost to animal damage in 2008. Other results from 2008 were that fertilizer and pesticide treatments did affect yields and that increasing plant densities (from 1 x 1m to 0.6 x 0.6m planting patterns) is likely to increase yields.

March 5

We met up with Ousmane Sanghou who is the agronomist/technician for Office Pour la Mise en Valeur du Systeme Faguibine – Goundam (OMVFS). We met with the leader of the local farmers

Abdul Wahab Toure (IER) and Abdulye Diallo (IER) (standing on left) Ousmane Sanghou (OMVFS) (standing to right), meeting with farmers from Angaberra in March 2009.

association and village leader of Goundam that morning. They indicated that many of the farmers were working in the fields planting cowpeas and preparing ground for décrue sorghum planting in about a month.

Next we traveled to two villages along Lake Tele. We did not work along Lake Tele last year and were interested in expanding the collaborative work to increase the sphere of influence in the region. First we traveled to Angaberra and found five farmers getting ready to go to the field for the day. We made arrangements to meet them Friday evening to discuss research results and needs for the upcoming year.

We then traveled to Bougoumaira and met with seven farmers in the village. We asked them about collaborations for the 2009 research trials. They were very interested and indicated that water scarcity and pests were problems for them. Water storage and conservation was what they were talking about because they mentioned that they needed to find ways to make the stored water from the lake last longer into the dry season. Every time this comment comes up, I think of no-till systems that we employ in eastern Colorado and western Kansas on the Great Plains. Residue management is the key to retaining water. I know that the biggest challenges here are animal feeding removing residue and the tropical environment breaking it down rapidly during the "winter" or non-crop seasons. I did however see a lot of millet residue standing during this trip. The other great limitation to adopting no-till or higher residue cropping systems is the lack of herbicides to control weeds. Last year in the lake regions, the farmers indicated that they did not want to use fertilizer for fear that it would pollute and ruin the lake. They may have similar reservations about herbicides.

The pests that were mentioned were not described well, but they did indicate there was a pest that attacked seedlings very early after planting. We will continue to try getting this pest identified and test seed treatments to see if they provide effective control.s pest.

Ousmane Sanghou (OMVFS), Abdul Wahab Toure (IER) and Abdulye Diallo (IER) (three to the right) discussing results from 2008 field research and potential collaborations for 2009 with farmers from Bougoumaira in March 2009.

From a cropping systems perspective, the farmers indicated that they grow sorghum, okra, peanut, “oseille” or a hibiscus, sweet potato, and millet. In fact, we asked them about the cowpeas and they indicated that they plant the short season cowpea early and then follow it immediately (double-crop) with millet. I was glad to hear this as that indicates they are at least taking advantage of any fixed nitrogen the cowpea may supply. I was concerned that this N might be lost during the flooding and subsequent anaerobic conditions. We might be able to find a short season sorghum that could be used in this system and provide better yields than millet.

They described the sorghum varieties that they used. ‘Saba Tienda’ is a very productive variety when water is available. They plant it because of its up-side potential. ‘Diberra’ and ‘Saba Soto’ are earlier maturing and are more drought tolerant. I suspect that what is really happening here is similar to what we recommend in the Great Plains, that shorter seasoned hybrids will yield more when late season drought is encountered because that variety is farther into grain fill (more yield has been developed) when the plant terminates growth because of drought. In the same situation, a variety that is five to seven days longer will have fewer caryopses per head and the grain will be smaller. However, when water is not limiting, the longer season variety has a greater yield potential (will produce bigger heads) than the shorter seasoned varieties. The farmers also mentioned a variety called ‘Humbo’ that is difficult to process and is used only for animal feed.

Side Note: This discussion prompted our group to decide that the use of IER stations in Dire and Gao could be effective variety selection sites. Although the Dire station would not have the high water holding capacity that the soils around the Lakes have, it would still experience the same day lengths and temperatures that the lakes regions would experience. Later discussions in Bamako revealed that several of the IER varieties tested last year at the lake never produced a head because of day length sensitivity. I believe that the soil water holding capacity differences could be overcome at the Dire station by more frequent irrigations. It will not be a perfect mimic of the lakes soils, but will provide information on potential varieties and the research will be conducted under lower risk conditions.

March 6

We traveled to Bintagoungou to meet with four farmers. Some were cooperators in last year’s plots in the area. Wahab presented last year’s research results on variety selection, planting time insecticides and fertilizer. The discussion that followed was very similar to that I have experienced in Kansas, first they wanted to know how soon they could get access to the two IER varieties that performed well. They also responded in typical farmer fashion with regard to the fact that the seed applied insecticides had no impact. They indicated that pests were not always a problem, but definitely wanted that trial repeated in 2009. Their response to the fertilizer results was very positive. Yields were reduced by fertilizer applications in 2008. The day prior to this meeting, Wahab and I had discussed the fact that the fertilizer was probably in contact with the seed and the salts from the fertilizer reduced germination. The farmers were quick to point out that exact same thing at this meeting. The quote translated back to me was “we told you that we did not need fertilizer and your tests confirmed that, but we are interested in you continuing the work because we are not sure about other fertilizers (phosphorous) in our system” Our soil tests from last year indicated that N fertilizer would not be needed. If we use the K-State Nitrogen Recommendation equation and their soil tests, the recommended N fertilizer to be applied to these fields would be zero because of the high soil test N levels and lower yield levels. However, the soil tests do indicate that their soils are very low in phosphorous (3-4 ppm), suggesting that P containing fertilizer is likely to provide a yield response if we can develop the proper technique to apply the fertilizer near the seed, but not in contact with it.

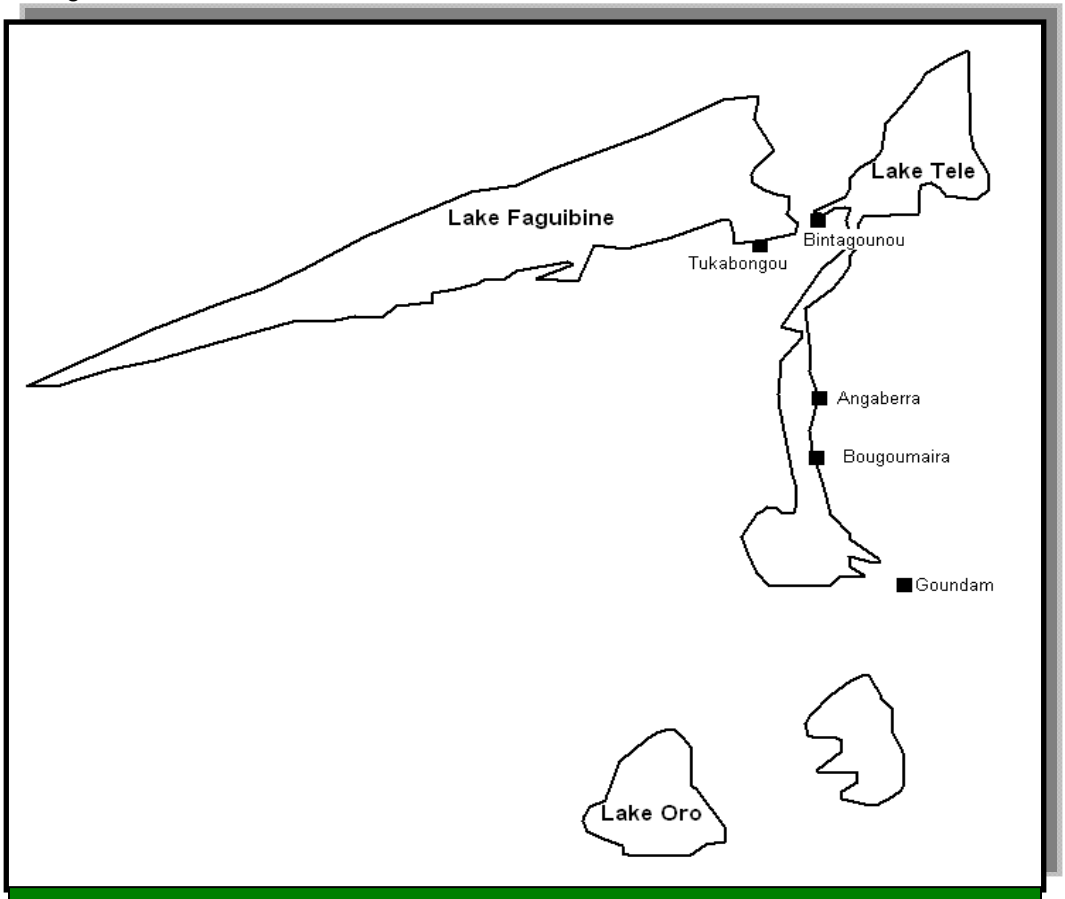
They were very interested in more work on planting geometry because of the positive results from the 2008 studies. They also indicated that when picking varieties, they looked for those that yield. When asked about taste or other utilization characteristics, they indicated that this is not often a problem. They did mention that they do like the ‘Humbo’ variety which is a black variety. The rest of the varieties that they picked last year were white grained varieties.

Abdul Wahab Toure (IER) and Abdulye Diallo (IER) Ousmane Sanghou (OMVFS), (left to right in front of room) discussing results from 2008 field research and potential collaborations for 2009 with farmers from Bintagoungou in March 2009.

Village Association Meeting in the evening.
Adramon Assese is the leader of the Farmer's Association in the Lake Tele region. We attended a meeting that evening in Goundam with three farmers. They were Mohaman Essa, Hamidue Bacha, and Alisone Bodle. Wahab discussed the results from the 2008 trials near Bintagoungou. They were very receptive to the results and were very interested in collaborating with us in 2009. The discussion largely focused on the logistics of how the trials would be conducted. They agreed that one replication of each of the three studies in each field would be the best way to reduce the risk of a complete failure due to weed infestations or livestock damage. I reminded them that this is likely to increase overall variability, but would provide the greatest probability of some results being attained.

March 7
We traveled to Toukabongou-Tao. We met with village leaders. They were interested in the IER varieties. Many of the farmers were out in the field planting corn and they indicated that they would survey the farmers on their interest in collaborating with us in 2009 and their needs. He would then communicate this information through Sangho.

We then stopped at Toukabongou-Djene. They were the group who collaborated with us last year, but the plots were lost to livestock feeding. They apologized for the loss of the plots last year and were committed to doing a better job this year. They were very excited to be working with us again.



Villages around Lake Fagiubine and Lake Tele where we plan to conduct collaborative studies in 2009.

March 8

We traveled to Gao via Douentza. The trip went well. Paving the road from the ferry to Douentza would be a great boon to the Tombouctou area.

March 9

We met with nine different individuals representing four different NGOs at the IER center in Gao. Those attending the meeting are listed in the table below. The Gao area was well represented with a majority of the people from Gao. One person from the ONG, New Horizons was from Kidall. Ossumane Mamadou explained to the group that décrue sorghum is very important to the region. He also stated that there are three types of décrue sorghum in the region. The *first* is the rainfed system similar to that around the lakes in the Goundam region. The *second* décrue system is where sorghum is planted very late (Sep-Oct) after the rains and is harvested for grain and forage. The *third* system is planted in January through March and is ratoon harvested. The first harvest is for forage around March-April. The plant is left in the field during the dry season and regrows when the rains come during the summer and is harvested in the fall for grain.

Several things are quite different about the status of sorghum in this area. It was mentioned more than once that sorghum is viewed as a cash crop. The forage is often sold and so is the grain. Many groups in the area do not eat sorghum. In fact, it was mentioned that several groups would only eat sorghum if they were starving. This is a very different approach to sorghum than in other places in the region. This may also make the introduction of new varieties easier if food quality to the grower is less of an issue. Sorghum being a cash crop will likely alter our outreach operations here. If we are attempting outreach activities focused on sorghum here during a food shortage, it may not be well accepted and even viewed negatively as a waste of resources. We could lose credibility and must always keep this in the back of our minds.

Table 1. List of those attending Décrue Sorghum meeting in Gao on March 9, 2009

No.	Name	Organization Represented
1	Wahab Abdul Toure	IER
2	Sekon Jala Cuendo	IER
3	Mahomadou Athyabou	ONG Nouyeoux Horizons
4	Ousmane Mamadou	CFP-PAS/AEDMS
5	Hachuimy Maiga	ONG AEDMS
6	Balkissa Maiga	CONFIGES
7	Moussa Cisse	CONFIGES
8	Mohomed Atteys	TAMALA
9	Abrahim Nouhou	TAMALA
10	Mahamane Yeya Maiga	ONG Nouyeoux Horizons – Kidall
11	Mohamad Malomu Toure	CRRA-Gao
12	Abdulye Diallo	IER
13	Scott Staggenborg	Kansas State Univ.
14	Ally Soumare	CRRA-Gao/IER

The original discussion was directed back to décrue sorghum at this time and Ossumane and Moussa Cisse (CONFIGES) both mentioned that décrue sorghum is important to the success of other crops. It supplies forage and can supply animal and human food during times when other crops may not be growing. In the Gao area, some of the sorghum grown for forage is grazed in March-April rather than harvested. They mentioned that prussic acid and nitrates can be a problem in this system.

They stated that the primary areas needing attention are improved varieties, planting geometry, genetic erosion, and lack of information on décrue production. They indicated that the yield potential of décrue sorghum is 400 to 600 kg/ha. Another important issue to them was that production potential can vary considerably based on the area that can be planted each year. In dry years, they have fewer hectares to plant which obviously reduces total production. This has never been mentioned as an issue in the Lakes area.

Next, Moussa Cisse indicated that he has tested some sorghum varieties in décrue systems near Tellens. This brought up the topic of genetic erosion. Genetic erosion is the loss of varieties when drought occurs. It occurs in the following manner. First farmers plant the best varieties available to them. If they plant all of the seed in a given planting season and a drought results in no grain/seed being produced, seed for this variety is no longer available for future plantings. This situation can be compounded if several years of drought are experience in succession as then the next best variety is lost the next year and slowly the best varieties are lost. Depending on the origin of the variety, it may exist in another region. However, as you recall from the Lakes region, four of the best varieties were those we collected from the farmers. We are assuming that these were released to them by some organization and the farmers slowly improved the varieties over time by selecting the best phenotypes each year at harvest to save back for next year's seed. So it is possible that a given variety may have originated from a group like IER or ICRISAT, but was improved by the farmers. Regardless, this can still be a serious problem. Mousse Cisse

indicated that he was working with IER's division that is responsible for distributing seed to farmers to assist in maintaining varieties. The group indicated that over the past 30 years, they believe that they have lost 13 of 25 rice varieties and 3 of 5 promising sorghum varieties.

This is an area that IER and other research based organizations can help. We observed wheat and rice seed being grown at the IER station at Gao for the sole purpose of distributing seed to farmers in the region. These crops were being grown under irrigation so as to not only increase seed yields, but to also insure that seed was produced in a given year. I am not certain how much this would cost, but would be a good use of resources directed toward this region to not only maintain well adapted varieties, but to also improve seed quality. Another function of any one of the organizations involved in this project or in the region would be the collection and storage of well adapted varieties. This would be easy to accomplish through field surveys during the harvest season. The greatest challenge is developing a database to keep track of the varieties and a place to store them. This would require that one organization take the lead on this portion of the project.

This brings up the subject of education on seed production, handling and storage. It is likely that if hybrids are introduced into the region in the next decade, this type of education program will coincide with it. However, in the near term some simple educational programs or materials on seed selection and storage may be useful. Although farmers may be doing an adequate job at harvesting and storing seed, such programs further emphasize the importance of maintaining high quality seed. Also, it is possible in most of the décrue regions to help farmers or a village to develop some irrigation capabilities to support seed production. Small irrigated fields would reduce the risk of genetic erosion and may increase overall yields if seed quality is improved. I have read articles where this approach was employed with rice seed.

Other seed related facts of interest were the discussion about some sorghum varieties that were used for dyes, medicinal purposes and to feed horses. A series of red (rouge) sorghums exist in the region that is used to dye fabrics. I did not get the specific phenologic characteristics of the medicinal varieties nor the ones fed to horses.

Other agronomic constraints that were mentioned were root feeding insects that attack both rice and sorghum. I asked for a description of the pest and was told that those in the room had not seen it, but farmers told them about it. They also mentioned weeds as being a problem. They indicated that research needs to be conducted on planting geometry because currently farmers are planting their décrue fields with plant spacings of 2 m or greater. I believe that this carries over from the dryland fields where wider spacings may increase yields in dry years. Our work from Lake Faguibine last year showed yield increases when sorghum was planted at narrower spacings (0.6 vs 1.0 m).

The group stated that they hoped that this was not the last meeting on this subject and that we would continue to include them in our planning as well as share our results. I indicated that by attending this meeting, I considered them to be part of the project and that they would be included in all future activities.

March 10- 11

While back in Tombouctou, we stopped by the Ministry of Agriculture office for the region. We met with Director Mohamed Ibrahim. We wanted to update him on our work around Lake Faguibine. He was very interested in our progress and mentioned Mali will soon have a wheat initiative starting in 2009 (similar to the rice program that was started last year near Mopti). He was very interested in the wheat activities at the Dire station. He was also excited to learn that Kansas State has an integrated wheat program from breeding to flour production and marketing.
We next stopped by the USAID office in Tombouctou and met Ahmadou Diakite. He is working in the Goundam area on improving vegetable production. We talked with him about our need to hire a field technician or someone to assist in the Goundam area for the summer. He indicated that he is in the Goundam area often and could assist in identifying such a person.

Processing Technology
Dr. Bruce Hamaker

Summary of Activities for Mali Processing Project

A visit of entrepreneur processing enterprise sites in Mopti, Bandiagara, and Gao was made by Mamadou Diouf (consultant) and Yara Koureisi (IER project leader) in mid-December, 2008, and a report and planning meeting followed in Bamako with Bruce Hamaker (PI, Purdue University) present. A visit was made to the USAID Mali Mission to discuss progress and plans with Mary Lou Carlson and Jean Harman.

The following activities were conducted in the first quarter of 2009.

Activity 1: Survey on the transformation of cereals in localities of establishment of the units (Mopti/Gao region)

- Person in charge of the supervision: Yara Koréissi
- The questionnaire was developed and adopted in early January, followed by training of investigators in Mopti and Gao and implementation of the survey in late January.

- **Status: s**ynthesis and results will be presented at the May 26-29 Processing Workshop to be held in Mopti.

Activity 2: Equipment of the units and the UTC of LTA/IER:

- Person in charge in charge of the supervision: Mamadou Diouf
- Partner entrepreneurs are required to build sanitary units (in most cases, separate buildings) to house the new equipment.
- Contracts will be signed prior to final setup of the equipment for a “payback” agreement for a significant percentage of the equipment cost.
- Facilitate the supply of millet and sorghum by the means of the contractualization in collaboration with the "Marketing Production" project.
- Food processing equipment ordered for gifting to the IER to support the Food Processing Technology activities in Mali, February 2009
  - Grinding stone mills: 7
  - Diesel motors ZH 100 (3)
  - Hammer mills (3)
  - Hammer mills without motors (3)
  - Motorized disc decorticators (dehullers) (3)
  - Disc decorticators (dehullers) without motors (4)
  - Batch of small equipment and equipments of manufacture such as: work tables (station of conditioning of the finished products), balances, crockery basins, buckets, vats, shovels for grains and flour, brushes, manual sieves
  - Canon SX 110 digital camera
  - HP SmartBuy 6730b laptop computer

Status: Equipment from suppliers ECM in Theis, Senegal and ETS Moustapha Cisse in Bamako will be shipped in mid to late April. Mamadou Diouf will be at the sites to coordinate installation of equipment.

Activity 3: Training of the recipients

Person in charge of the supervision: Mamadou Diouf

First workshop – to be held May 26-29, Mopti

- Topic: Primary education of technologies of processing of high quality, competitive millet and sorghum products, the fundamentals of quality management and packaging, and contracting farmers for high quality grains.
- Participants: Four (4) responsible persons per unit, one (1) for the control of the machines and two (2) at least involved with the traditional operations of the processing units; and other invited guests
- Place: Mopti (buildings of the IER) and Sévaré (in one or two of the units of the recipients)
- Trainers: Mamadou Diouf, Yara Koréissi, Djibril Dramé, Dr. Ouendeba Botorou

A second workshop will be planned for late summer

- Topic: Marketing and management of a unit of local cereal transformation
- Participants: Three (3) responsible persons per unit
- Place: Gao (to be specified)

Training
Dr. Jess Lowenberg-DeBoer

A subcontract for the training component has been awarded to Purdue University. Coordinator of the training program is Jess Lowenberg-DeBoer, Director of International Programs in Agriculture. IER has identified eight students, five academic and three short term. The academic students will consist of two in Agricultural Economics with John Sanders at Purdue University, one in Food Science under Bruce Hamaker at Purdue University and two in Agronomy at Kansas State University under Vara Prasad and Scott Staggenborg. The three short term trainees will consist of one each in Agricultural Economics at Purdue University, plant breeding at Purdue University and Agronomy at Kansas State University. The academic students are scheduled to begin their English language training at Purdue June 1, 2009. Dr. Lowenberg-DeBoer has made two trips to Mali to coordinate the training.

Training budget

Item	Initial yr. 2007-2008	Year 1 2008-2009	Year 2 2009-2010	Year 3 2010-2011	Year 4 2011-2012	Total (US$)
Training (Academic)		203,920	203,920	203,919	203,919	815,678
Training (Short term)	4,109	31,846	36,983	51,365	51,365	175,669
Total						

Request from IER for the Training Component

A need for highly competent technically qualified scientists in sorghum and millet food processing, agronomy (soil science and production practices), animal nutrition and agricultural economics exists in Mali. In collaboration with IER, INTSORMIL proposes the following long (academic) and short term training plan to further build institutional capacity within IER.

	Long term training (academic)			
	Candidates	**Mentor**	**Fields of study**	**Gender**
	Aly Ahamadou	Sanders	Agricultural Economics	M
	Mamadou Dembele	Sanders	Agricultural Economics	M
	Fatimata Cisse	Hamaker	Food Science	F
	Bandiougou Diawara	Prasad/Staggenborg	Agronomy	M
	Djeneba Dembele	Prasad/Staggenborg	Agronomy/GIS	F

Short term training areas*	**Location**	**Period**
• **Agronomy**		
Procedures for conducting on station and on farm agronomic experiments and technology transfer strategies	USA Kansas State University	**TBD**
• **Plant Breeding**		
Train farmers in seed production including hybrid seeds Awareness of crop losses by pests during storage	USA Purdue University	**TBD**
• **Agricultural Economics**		
Basic concepts for the production-marketing project Value chain analysis Data analysis	USA Purdue University	**TBD**

*Short term training plans will begin as soon as the academic students have arrived and started their English Language Training.

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