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

**Quarterly Report
April 1, – June 30, 2010**

**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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Production-Marketing



Décrue sorghum



Training



Processing

Introduction

The U.N. Conference on Trade and Development (UNCTAD) in a report stated that “technology and innovation must be targeted at the needs of Africa's millions of smallholder farmers and reflect varying climate conditions, rather than being simply copied from advances in Asia and Latin America.”

WASHINGTON, D.C. - APRIL 24, 2010 - At a high-level nutrition roundtable today co-hosted by Canada, Japan, the United States, through the U.S. Agency for International Development (USAID), and the World Bank, USAID Administrator Dr. Rajiv Shah announced the 20 focus countries of the U.S. Government's Feed the Future, initiative that targets the causes of hunger and aims to reduce poverty, hunger, and undernutrition. Based on this global burden of undernutrition and other criteria that examined the prevalence and dynamics of poverty, country commitment, and opportunities for agriculture-led growth, the 20 Feed the Future focus countries are: Ethiopia, Ghana, Kenya, Liberia, Mali, Malawi, Mozambique, Rwanda, Senegal, Tanzania, Uganda, and Zambia in Africa; Bangladesh, Cambodia, Nepal, Tajikistan in Asia; and Guatemala, Haiti, Honduras, and, Nicaragua in Latin America. Feed the Future will build upon strong existing foundations to make improvements in global health, poverty reduction, and the overall development of our focus countries.

This quarterly report presents progress in promoting food security in Mali via the USAID/Mali Mission supported Cooperative Agreement with INTSORMIL “**Transfer of Sorghum, Millet Production, Processing and Marketing Technologies in Mali**.” It is significant to note that this project has the same targets as the Feed the Future initiative: to reduce poverty, hunger and undernutrition through agriculture-led growth. This action is being done by meeting the following objectives.

“Sub-Saharan Africa
needs a Green
Revolution investing in
agricultural technology”

Speech by UNCTAD
Secretary-General Supachai
Panitchpakdi
May 19, 2010

Objectives

- Facilitate adoption of production and marketing technologies to improve the incomes of sorghum and millet producers
- Facilitate the development of markets for food use for millet and sorghum and as a poultry feed for sorghum
- Develop stronger farmers' groups and enhance their marketing power
- Extend mechanized food processing technologies to entrepreneurs and processor groups
- Introduce improved agronomic practices into décrue farming systems in northern Mali.

This report details the activities and progress achieved during the period April 1 – June 30, 2010 (including the June 21-24, 2010 Partner's Meeting in Bamako) under the Cooperative Agreement # 688-A-00-007-00043-00. The report covers progress in the **Production-Marketing, Food Processing, Décrue Sorghum** and **Training** components.

Executive Summary

INTSORMIL was represented at the USAID Partner's Meeting June 22-24 in Bamako by Short Heinrichs from the ME, Mamourou Diourte, Project Coordinator, Yara Koreissi representing the Food Processing team, Botorou Ouendeba representing the Production-Marketing team and Abdoul Wahab Toure representing the décrue team.

Production-Marketing

With the collaboration of IICEM, AMEDD, IER, and BNDA the Production-Marketing project of INTSORMIL will have approximately 1,800 ha in Grinkan (improved sorghum cultivar) with moderate inorganic fertilizer and improved agronomic practices in the greater Koutiala region in the summer of 2010. With Global 2000, DRA and IER we will have 500 ha in Toroniou in the Segou region. Both projects represent the movement up from pilot projects to bank financing. These pilot projects before the scaling up were giving 1.5 to 2 tons/ha of sorghum and 1.5 to 1.9 tons/ha of millet over several years for the best farmers following project recommendations. The Production-Marketing project also includes marketing assistance (a five point program for the farmers' associations to increase the prices received and reduce input costs), increased contacts and sales to the millet food processors (a rapidly growing sector dominated by female entrepreneurs), and the development of new farmers' associations into marketing cooperatives in each of the collaborating villages. Note that our farmers' associations do all the functions of "commerchants." They gather small quantities, they store, they search for the best product and input markets and they substantially increase the prices received by their farmer members (20 to 50%).

Besides this scaling up operation we have our regular pilot project in the greater Mopti region with 350 ha in Toroniou millet and other new technologies in the summer of 2010. Here we are also engaged with IICEM in collaborating with local farmers' associations to construct storage facilities so the farmers' associations can avoid the post harvest price collapse traditionally plaguing staple crops. There are similar pilot projects with 160 ha of Seguifa (sorghum) in Kolokani collaborating with DRA and IER and another 100 ha in the greater Segou region (Faso Jigi is the local NGO). Special provisions are now being implemented to further increase the involvement of women.

Jeanne Coulibaly, Purdue PhD. student is now conducting the field research for her thesis, "*Increasing Womens' Welfare in Malian Rural Households with Agricultural Technologies*." She is currently in Mali and can be contacted at <jcouliba@purdue.edu>. Her PhD. prospectus is partially reprinted below in the Production-Marketing section.

Food Processing

Enterprise development in the Mopti-Gao Region- Accomplishments include 1) Market survey completed, 2) Seven partners identified, 3) Working with women processors and their associations, 4) Mechanization of entrepreneurial units with contributions made by partners for payback, 5) Building constructed with partner contribution, 6) Dehuller and 2 mills installed and optimized, 7) Workshops conducted to train entrepreneurs in technology based improvements, Linkages with Production-Marketing component, IICEM (Market evaluation and strategies to finance entrepreneurs) and NGOs (CRS, Afrique Verte and others) established) and September 2010 workshop planned. **Development of technology support, optimization and incubation center at IER Sotuba for Bamako area urban processors-** Equipment for the center is being purchased and we are developing plans to assist IER in construction of a building to house the incubation center.

Décrue Sorghum

Research is being conducted to develop a recommended package of practices for each site. The final package will include a combination of cultivar and crop/nutrient management practices. **Cultivar selection-** For the first time sorghum cultivars have been extensively tested in the northern décrue region. Thirty three cultivars were tested in farmers' fields and a few cultivars with superior agronomic characteristics (yield etc.) were selected for demonstrations. **Cropping practices-** Optimum planting

density and planting dates have been identified. **On farm demonstrations-** To reach a wider area and more farmers with technology optimum cropping practices are being transferred to farmers this cropping season via demonstrations conducted with the support of partners DRA, Tombouctou; DRA, Mopti; CONFIGES, Gao and AFRICARE, Goundam.

Long Term Training (Academic)

Fatimata Cisse was admitted to Purdue's Food Science Graduate Program in January 2010 and is now conducting her research and taking courses. **Bandiougou Diawara** was admitted to Kansas State's Agronomy Graduate Program in June 2010. He is taking courses this summer and starting his research here in the US. **Sory Diallo** was identified as a replacement for Ms. Djeneba Dembele, who withdrew from the program due to the birth of her child. His admission to KSU Graduate School/Department of Agronomy is scheduled for August 2010. **Aly Ahamadou and Mamadou Dembele** were both admitted in January 2010 to Purdue as post-baccalaureate students for the Spring 2010 semester since they had not reached the required TOEFL scores for graduate school admittance. They are continuing the English program this summer and have applied for entrance into the Ag Economics program at West Texas A&M for the Fall 2010 semester.

Short Term Training

One short term training has been arranged for this summer. Abocar Oumar Touré will come to Purdue August 1 to start his plant breeding training with Mitch Tuinstra. He has been entered into the TraiNet system and the vetting process has begun. The planned program dates are August 1 to September 30, 2010.

Project Components

Management Entity

USAID Mali Mission Partner's Meeting June 22-24, 2010

INTSORMIL was represented at the Partner's meeting by the Management Entity (E. Heinrichs), IER Coordinator (M. Diourte)), Production-Marketing (J. Sanders, B. Ouendeba and N. Yaro Diarisso), Processing (B. Hamaker and Yara Koreissi), Décrué Sorghum (V. Prasad. A. Wahab Toure) and Training (J. Lowenberg De-Boer). A Power Point presentation at the meeting covering all components of the project has been posted on the INTSORMIL website < <http://intsormil.org/>> under "ME Presentations" entitled <[2009 USAID Mali Mission Associate Award Partner's Meeting](#)>. All project components found the meeting extremely profitable as new collaboration was established which will significantly increase the impact of the project. The current collaborative relationships are described in the component reports that follow.

INTSORMIL poster displayed at the Partner's Meeting, Bamako June 22-24, 2010



TRANSFER OF SORGHUM, MILLET PRODUCTION, PROCESSING AND MARKETING TECHNOLOGIES IN MALI

Sorghum, Millet and Other Grains Collaborative Research Support Program (INTSORMIL CRSP)



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Coordonnateur de Projet INTSORMIL
Chef Programme Sorgho
IER CRRA Sotuba
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The objective of the project is to strengthen the Sorghum and Millet Farmers' associations in Sikasso/Koutiala, Ségou, Koulikoro/Dioloa, Kolokani, Mopti and Kayes and to develop strong ties between the farmers' organizations and the food/feed processors in Bamako, Mopti and Gao.

The ongoing activities of the project are based on the four components of the project which are:

- (1) Production-Marketing;
- (2) Processing;
- (3) Decrue Sorghum;
- (4) Training.

Production – Marketing

Table 1. Malian Area in New Technology for the 2007-2009 Crop Years

Crop	2007	2008	2009	Village Site
Sorghum	48	50	69	Kaniko
Sorghum	--	50	150	Garasso
Sorghum	48	100	160	Dioloa
Sorghum	56	100	100	Kafara
Sorghum	--	--	50	Zanzoni
Sorghum	--	50	110	Kolokani
Millet	150	150	150	Tingoni
Millet	--	--	60	Bankass/Pissa
Millet	--	--	60	Douenza/Wallo
Sorghum	--	--	75	Diankourte Camara
Total	302	500	984	

Source: Unpublished data from the field trips visiting the farmers' associations in the various regions.

Table 2. New Areas in Production-Marketing Project and in Associated Projects with ICEM for 2010 and Areas in these Same Regions in 2009

	New (ha)	Old (ha)	Total (ha)
Koutiala			
ICEM-AMEDD	2500		2500
P-M Project		270	270
Tingoni			
ICEM-Sas 2000	500		500
P-M Project		110	110
Ségou			
Faso Jigi			
P-M Project	100		100
Mopti			
P-M Project	300	120	420
DRA			
Kolokani			
P-M Project	60	110	170
DRA			
Kayes			
P-M Project	195	75	270
DRA			
Total	3655	685	4340

Two improved sorghum varieties: let Natchama (ZTba) widely disseminated in the Dioloa area and right Grinkan (GTba) widely disseminated in the Koutiala area - Photo M. Diouré, 2009



Goal and Objectives of Millet/Sorghum Processing Project

Goal

- Expand markets for millet/sorghum through high and consistent quality market-competitive processed products

Objectives

- Enterprise development
- Link with Production-Marketing project to contract farmers for grain supplies

Mopti-Gao region – Introduce and train in technology-based improvements to entrepreneur processors

Bamako area – Set up technology support and incubation center for urban processors

CONTRIBUTORS

Mamourou Diouré, Project Coordinator ; John Sanders, Botorou Ouendeba, Niaba Temé, Bruce Hamaker, Yara Koreissi, Mamadou Diouf, Vana Prasad, Abou Wahab Touré, Scott Staggensborg, Abou O. Touré, Abdoulaye G. Diallo

Project Thrusts

Enterprise development in Mopti-Gao region

- Currently work with women processors and their associations
- Mechanization of units with contributions made by partners and contracts for payback
- Technical and market development training

Process optimization and incubation center set up at IER/Sotuba for Bamako area processors

Mopti/Gao Project Status Current Activities

Status

- Market survey completed
- 6 partners identified (women processor associations)
- Building constructed – partner contribution
- Dehuller and 2 mills installed and optimized
- Equipment and process 4 day workshop; further training
- March entrepreneur workshop

Current activities

- Processing and marketing activities
- Fall workshop on couscous processing

Linkages

Production – Marketing component

- Contracting with farmer groups
- Clean and quality grain

ICEM

- Market evaluation
- Strategies to finance Bamako entrepreneurs

NGOs

- Catholic Relief Services
- Afrique Verte
- Other



Decrue sorghum



ACTIVITIES

- Expanding selected cultivars by farmers in the decrue area of Northern Mali. (2010)
- Testing cultural practices with selected cultivars by farmers around the lakes in the Northern Mali.

PARTNERS

- ✓ DRA de Tombouctou
- ✓ DRA de Mopti
- ✓ CONFIGES – GAO
- ✓ AFRICAIRE Goundam
- ✓ RCGOP – Tombouctou
- ✓ Nouveaux horizons – Gao
- ✓ ACAS – Kidal

Training

For the training component of the project, five students from IER are expected to receive MSc degrees from U.S. universities. Three IER scientists will receive short term training at Purdue and Kansas State University.

Conclusion

According to John Sanders, sorghum and millet are no longer only low income food staples. There are important expanding markets for processing them (millet food products and poultry feed rations). New varieties available from national research activities respond well to inorganic fertilizer. Higher input use on sorghum and millet, combined with better marketing and institutional evolution of farmers' associations, leads to high outputs and profitability. The yield increases from the combined improved practices consistently increased incomes while maintaining household food security. Moreover, several components of the technology package and the marketing strategies reduce the risk of higher input use.

Mali/USAJD Mission Partner's Meeting

Strategic Brainstorming- Scaling Up

June 22-24, 2010



IER INTSORMIL Team
(l to r)

Niaba Teme, sorghum/millet
breeder
Production-Marketing

Mamourou Diourte
Coordinator

Yara Koreissi
Processing

Abdoul Wahab Toure
Décrue sorghum



Mamourou Diourte in
brainstorming session



Abdoul Wahab Toure (Decrue), Jean Francois Guay (IICEM) and Botorou Ouendeba (Production-Marketkng) (l to r) in brainstorming session.



Breakout group ranking value chain priorities:

- ◆ Potatoes
- ◆ Shallots/onions
- ◆ Tomatoes
- ◆ Mangoes
- ◆ Tiger nuts (pois sucre)
- ◆ Tourism
- ◆ Cattle
- ◆ Small ruminants
- ◆ Poultry
- ◆ Fisheries
- ◆ Seeds
- ◆ Rice
- ◆ Corn
- ◆ Millet/sorghum
- ◆ Soy
- ◆ Fonio

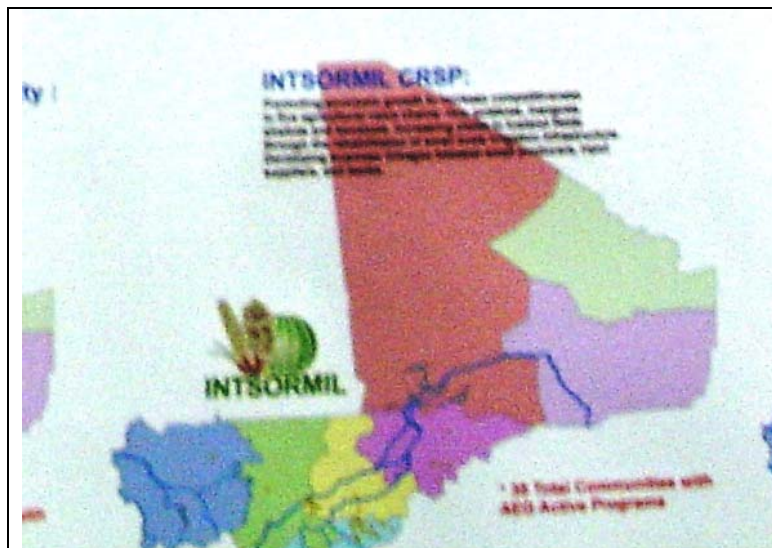


Fred Weltzien, ICRISAT sorghum /millet breeder (L) and Yara Koreissi , IER/INTSORMIL food processing specialist (R) discussing collaborative activities.

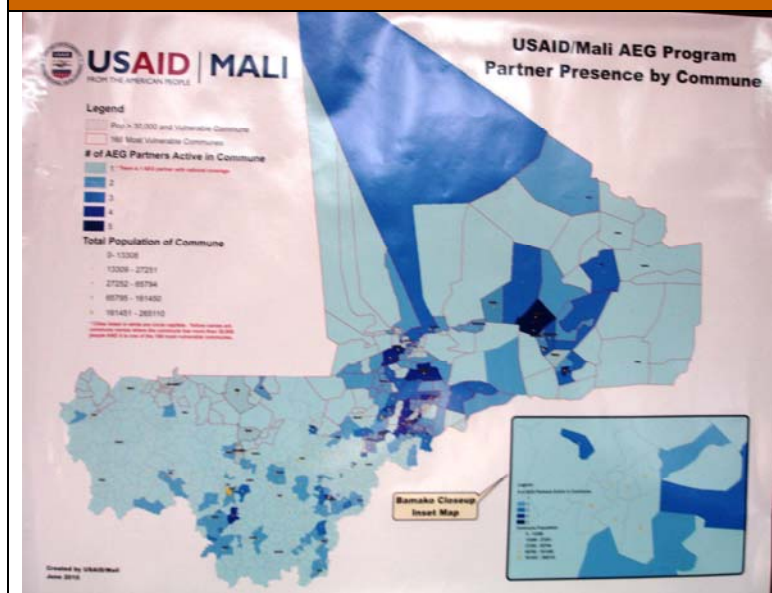


All USAID/Mali AEG Activities by Community (large map, left upper).

Malian communities with AEG activities broken down by partner (small maps per partner). INTSORMIL is second from right on bottom row (see logo).



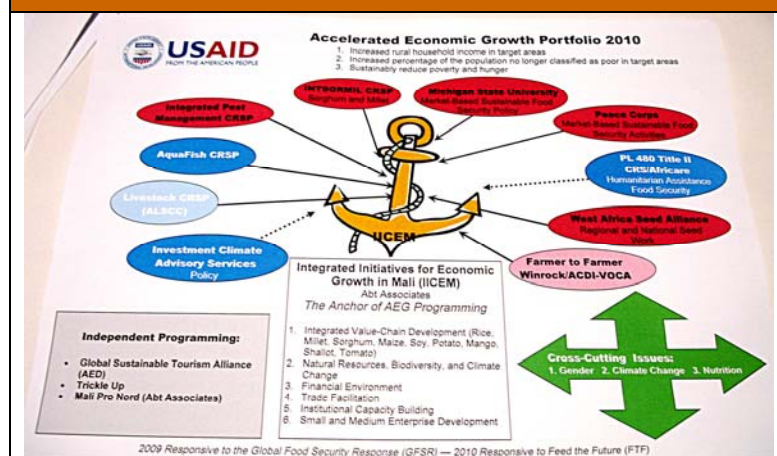
Malian communities with AEG /INTSORMIL activities.



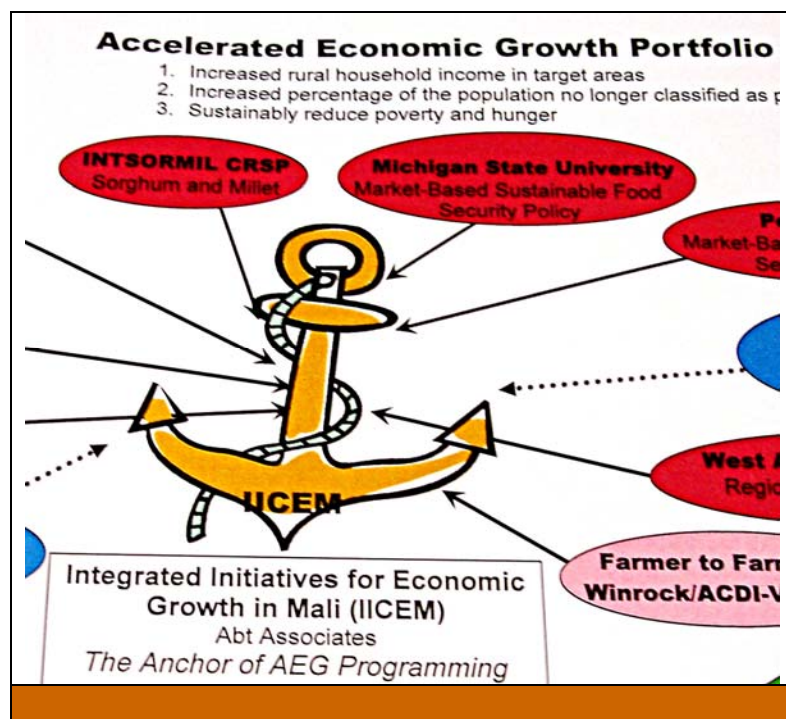
USAID/Mali AEG program-partner presence by commune



All USAID/Mali activities by community



Accelerated Economic Growth (AEG) Portfolios 2010. IICEM is the anchor of AEG programming. Sorghum and millet are included in initiative 1: Integrated value-chain development (rice, millet, sorghum, maize, soy, potato, mango, shallot and tomato).



INTSORMIL CRSP in the Accelerated Economic Growth (AEG) portfolio

Production – Marketing Activities

John Sanders, Purdue University

Increasing the Incomes of Malian Sorghum and Millet Producers

May 26, 2010

John H. Sanders

Botorou Ouendeba

Niaba Teme

For the past six years the Production-Marketing project under the INTSORMIL program has been focused on getting new sorghum and millet technologies onto farmers' fields. In the summer of 2010, assuming the proposed bank financing comes through, there will be 4,340 ha involved in six major sites with approximately that number of farmers involved. There is a mistaken conception that sorghum and millet are subsistence crops and that farmers either will not use improved inputs or they cannot make money with improved inputs on these crops. Conventional wisdom is to avoid purchased inputs on sorghum and millet because they are subsistence crops. Unfortunately, low inputs result in low outputs. Moreover, soil fertility constraints are pervasive in Mali especially where these two cereals are the primary food source.

Increased inorganic fertilization is a prerequisite to any strategy to increase these crop yields. This fertilization is combined with improved fertility responsive new cultivars, better agronomic practices, and the introduction of a water harvesting technique.¹ The Production-Marketing project of INTSORMIL has shown in Mali that sorghum and millet are not only responsive to inorganic fertilizer but also that this intensification can be highly profitable to farmers especially when combined with improved marketing practices and the development of farmers' organizations. Banks and farmers are increasingly willing to use bank credit to finance these input purchases for sorghum and millet production.

The basic premise of this program was that substantial new technologies exist for these crops. These technologies include new cultivars, moderate inorganic fertilization, and improved agronomic practices. What has been lacking has been a concern with and strategy to respond to the three principal price collapses reducing the profitability of these basic staples. Prices collapse at harvest as farmer are pressed to make a series of expenditures at that time. Prices collapse in good and sometimes even normal years as there is just so much of the staples that people can eat so new markets to put floors under staple prices or to provide value added are needed. Finally, governments often intervene in bad rainfall years when prices start going up with food aid or subsidized food imports. Putting short run consumer interests over those of producers can have a long run deleterious effect on farmers' incentives to use inputs and to make investments in their agricultural activities. So with our marketing strategies we operate on as many of these price collapses as possible. The consequence is that we increase the profitability of farmers' investments in increased input use. Not using enough inorganic fertilizer is similar

¹ The introduction of ridges, tied ridges or better land preparation conserves the available water, which comes often in intense storms. Increased water availability improves the response to fertilization and reduces its risk.

to telling poor people that they should eat less. Plant nutrients are essential to any strategy to increase yields.

We now have substantial experience in introducing the combination of new technologies, marketing strategies and farmers' associations that evolve into marketing cooperatives. When the marketing strategies are introduced with the new technologies, they give farmers a price premium to pay for the higher input use required for the inorganic fertilizer, seeds and "bache" (plastic or tarp put on the ground to keep the cereal clean during threshing and thereby obtain a price premium from food processors). Moreover, the higher yields also help to pay for higher input use. Farmers following recommendations double to triple yields and get prices 20 to 50% higher than prices other farmers receive at harvest time (see our evaluation bulletins for 2005-2008). We should be able to do much even better on the price side in the future as more farmers follow the different components of the marketing strategies.

To implement the project we meet with farmers' groups in specific sites considered to be good producers of sorghum or millet. We attempt to get 50 ha in each village group with approximately one farmer/ha. Through the farmers' groups farmers receive fertilizer and improved seeds and financing for the water harvesting technique. Farmers are required to reimburse the farmers' group with grain at the harvest price. With this grain repayment and any additional grain individual farmers want the association to sell for them the farmers' group follows the program recommendations of selling later in the season. These funds then go into a bank account to create a rotating fund for the farmers' group to continue input purchases the next year. The farmers' groups by buying and selling in quantity also have increased bargaining power. This results in a greater discount for fertilizer purchase and an increased price premium for selling the grain staple.

For the progress in developing and expanding this program see Tables 1 and 2 below.

Table 1. Malian Area in New Technology for the 2007-2009 Crop Years

Crop	2007	2008	2009	Village Site
Sorghum	48	50	69	Kaniko
Sorghum	--	50	150	Garasso
Sorghum	48	100	160	Dioila
Sorghum	56	100	100	Kafara
Sorghum	--	--	50	Zanzoni
Sorghum	--	50	110	Kolokani
Millet	150	150	150	Tingoni
Millet	--	--	60	Bankass/Pissa
Millet	--	--	60	Douenza/Wallo
Sorghum	--	--	75	Diankounte Camara
Total	302	500	984	

Source: Unpublished data from the field trips visiting the farmers' associations in the various regions.

Table 2. New areas in the Production-Marketing Project and in associated projects with IICEM for 2010 and areas in these same regions in 2009

	New (ha)	Old (ha) ²	Total (ha)
Koutiala			
IICEM-AMEDD	2500		2500
P-M Project		270	270
Tingoni			
IICEM-Sas.2000	500		500
P-M Project		110	110
Faso-Jigi-Segou			
P-M Project	100		100
Mopti			
P-M Project	300	120	420
DRA			
Kolokani			
P-M Project	60	110	170
DRA			
Kayes			
P-M Project	195	75	270
DRA			
Total	3655	685	4340

Besides avoiding sales at harvest another important component for insuring profitability is the development of new markets. For millet this is the rapidly increasing processed food market in the urban areas. Millet farmers in the Production-Marketing project target their sales to these food processors. These millet farmers thresh on tarps ("bache") or with mechanical threshers and thereby reduce the 13% impurities (food processors' estimates) of grain sold on the markets (Toure, A. et al., p. 13) In turn the

² Note that a fundamental component of the Production-Marketing project is to provide input credits that have to be repaid to the farmers' cooperative in kind at harvest. The farmers' coop holds on to the cereals until the post harvest price recovery. Then they are sold and these funds become a rotating fund to provide these credits in subsequent years. So we expect the old areas to continue the program so they are included here.

millet farmers demand a price premium of around 20 FCFA/kg for their clean grain. Clean grain is essential for establishing product quality and protecting the machines of the millet food processing industry.

For sorghum there is a secondary market for good and normal rainfall years. In these years food buyers of millet and sorghum can buy all their cereal requirements. Then the excess sorghum competes with maize as a feed for the rapidly expanding intensive broiler and egg producers. Non-tannin³ sorghum has 97% of the feed efficiency of maize (Joe Hancock, poultry nutritionist, communication). Therefore, at prices less than 97% of the maize price as during 2008 in Mali poultry producers should substitute sorghum for maize in the ration. This secondary market puts a price floor for sorghum when otherwise the excess cereals would lead to a price collapse.

The project is also using its ties to INTSORMIL to provide technical expertise to the food and feed processing sectors. Moreover, we facilitate the contacts between these companies and the farmers' groups with which we are involved. This negotiation process takes time to develop because the processors are used to dealing with individual farmers and the farmers' organizations now have more bargaining power. The food processors often resisted paying an adequate price premium to cover the increased value of the grain. But over time this price premium has been increasing.⁴

In conclusion sorghum and millet are no longer only low income food staples. There are important expanding markets for processing them (millet food products and poultry feed rations). New varieties available from national research activities respond well to inorganic fertilizer. Higher input use on sorghum and millet, combined with better marketing and institutional evolution of farmers' associations, leads to high outputs and profitability. The yield increases from the combined improved practices consistently increased incomes while maintaining household food security. Moreover, several components of the technology package and the marketing strategies reduce the risk of higher input use.

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Coulbaly, Jeanne, 2010. *Evaluation of Sorghum and Millet Technology and Marketing Strategy Introduction, 2008-09*, INTSORMIL Bulletin No 10, Department of Agricultural Economics, Purdue University, West Lafayette, IN. forthcoming.

³ Most of the traditional and all of the improved sorghum cultivars are low or non-tannin in Mali (Abdoulaye et al, 2006, pp. 8,9). Nevertheless, buyers of sorghum for the cereal in the ration can avoid the mixing with tannin cultivars in the open market sales by buying from the farmers' associations in the project.

⁴ For calculation of the increased value of the grain or the maximum food processors see Abdoulaye et al, 2007.

Toure, Aminata, T. Abdoulaye, J.H.Sanders, and B.Ouendeba,2007. *Transformation Commerciale du Mil et du Sorgho au Mali*,INTSORMIL Bulletin No 7, Department of Agricultural Economics, Purdue University, West Lafayette, IN, 38 pages



Farmer seed producers of Grinkan (sorghum cultivar) for planting in 2010 with the Director of the NGO, AMEDD at a field day, summer of 2009.



Head of farmers' association in Tingoni with Toroniou millet cultivar.

Progress report- Early Crop Season 2010
Based on a trip report by Botorou Ouendeba and Niaba Teme
19 June- 12 July, 2010

This is a report on the trip of B. Ouendeba and N. Teme throughout Mali during the period June 19-July 12. This is based on the reports of both Ouendeba and Niaba and extended conversations with Sanders during the trip. The report is composed of accomplishments, plans for the rest of 2010 and identified problems that we need to work more on. We focus on the three principal regions for our activities in 2010, Koutiala, Segou, and Mopti.

Regions

Koutiala. With the dramatic success of Grinkan in Garasso in the last two years, a field day was held in 2009 and the decision was made that it was time with IICEM backing to look for a substantial scaling up. Input financing was discussed with IICEM and we emphasized that we preferred not to have loans with more than 15% interest and with repayment periods several months after the harvest so that farmers were not forced to sell their sorghum at the lowest price point immediately after harvest. Then we met with two banks in Koutiala. BNDA was willing to provide credit for 10 months at 15% annual rates. IICEM agreed to guarantee the loans. Initially AMEDD estimated that 2500 ha would be involved through farmers' associations but BNDA wanted to check farmers' credit histories. Due to a misunderstanding with AMEDD personnel coordinating the activities, the BNDA still had not released the money at the time of this field visit. Ouendeba, Niaba and Bougouna, the Director of AMEDD, then visited the regional director of BNDA, who repeated what he told the AMEDD technicians. BNDA would provide vouchers (not cash) directly to the farmers' associations, with which they could buy the fertilizer from the dealers. The fertilizer price would include transportation. This is a much better arrangement than releasing money to either AMEDD or the farmers' associations. The farmers' association representatives immediately began picking up the vouchers in the BNDA branches. The latest estimates of area (ha) is 1836 ha and 1,639 farmers but this is undoubtedly too high for the recipients of the credit.⁵ The Production-Marketing project will seek to verify in August how many farmers' associations were able to obtain the vouchers and when the fertilizers arrived.

Two of the principal objectives of Production-Marketing are a rapid scaling up and turning input financing over to banks once we have demonstrated the profitability of the production and marketing practices in the region. So we have a good start in 2010 on this scaling up and making the bank contacts. Unfortunately, the system did not work well in 2010 but the BNDA lending scheme is excellent and we just have to make it operate more smoothly and earlier.⁶

Greater Tingoni, Segou region. Similar to Grinkan in Garasso for sorghum has been Toroniou for millet in Tingoni. Millet is produced in more difficult conditions so best farmer yields are lower (1.5 to 1.9 tons/ha as compared with 2 to 2.5 tons/ha for Grinkan) Nevertheless, millet yields more than double traditional farmer yields and the combined production practices are highly profitable especially when combined with better marketing practices.

Sasakawa Global 2000 had done substantial organizational activities in identifying 8 new farmers' associations with 50 to 100 ha in each and a total of 500 ha. Farmers in the greater Tingoni region had been asking for the last three years for an extension of the program. As in Koutiala there was a last

⁵ Note that the seed had already been distributed but without the fungicide.

⁶ Since the BNDA and IICEM developed a good lending scheme, it is unfortunate that the coordination activities between the farmers' associations and the BNDA were not handled in a timely manner. In 2011 this process needs to be initiated much earlier.

minute crisis. Kondo Jigima was not one of the banks receiving loan guarantees from IICEM.⁷ So at the last minute no financing was provided. Ouendeba and Niaba helped Dr. Abou Berthe of Global 2000 resolve this problem. Then Global 2000 immediately contacted the fertilizer distributor, Amadou Ongoiba, and that process of getting fertilizer to the farms has been accomplished.

Mopti region. Various regions of concentrated millet production are still in the pilot project stage. We will have 300 new ha in 2010 and continue with the 100 ha from last year. We are including here the modification for the participation of women pointed out in the field interviews of Jeanne Coulibaly in the fall of 2009. We had been introducing this project 50 ha at a time. Then we began introducing 50 ha for men and 10 for women. We asked that participants produce on 1 ha or ½. This was much more land than women had access to in their private plots. Now we are asking that the women form associations working with the men but divide up the land according to the land area that the women have direct control of, usually .1 to .2 ha in their private plots. We will again evaluate how this is working during this crop season.

The Mopti region now has strong support from the regional agriculture director (DRA) in Mopti and he traveled to the sites with Ouendeba and Niaba. All the inputs were provided on time and the farmers have been planting the improved millet (Toroniou) package in most sites when they were visited.

In the marketing strategy the principal price problem that we first focus on avoiding is the harvest price collapse. So farmers' associations need to have local storage facilities to be capable of waiting until prices recover for the price recovery. We are collaborating with IICEM in facilitating the construction of local storage facilities. In all five sites the farmers' associations were organizing to provide the labor and IICEM has begun their evaluation for supplementary financing (doors, windows, roof, floor) for the storage facilities.

The second component of the marketing strategy is value added by producing a millet with a uniform cultivar and cleaner from not threshing on the ground. The next step with this scaling up of millet production is to strengthen the contacts between these associations and the millet food processors. By producing a uniform and cleaner millet (getting threshing off the ground) farmers are able to get a value added price premium from the food processors. Food processors are agreed that a clean, uniform grain supply is critical for them. Food processors do not always agree that they have to pay for this higher quality product. But the farmers' associations enable a wider evaluation of markets and give market power by selling in larger quantities. Bamako producers are paying a price premium of 10 to 20 CFA/kg. In Ouasso (Mopti region), farmers are selling their millet at 165FCFA/kg (Oumar Guindo, the DRA field Technician in Ouasso). Guindo reports that their millet is getting a better price because it is cleaner and more uniform compared to the millet on the market.

Kolokani and Segou (with Faso Jigi). We are expanding the activities in Kolokani by 60 ha and initiating activities with the NGO Faso Jigi of 100 ha. In both cases the new sorghum cultivar in the technology marketing package is Seguifa. We were late with the fertilizer but fortunately Seguifa needs to be planted late. Farmers have now all received their inputs. Kolokani is an example of excellent collaboration with a strong local DRA. As in Mopti we are coordinating with IICEM to obtain support for improved storage facilities.

Faso Jigi, a large farmers' organization, has good access historically to bank loans for essentially consumption purposes. So by demonstrating the importance of the combined package we seek to convert these loans to production loans tied to program implementation.

Kayes. Our plans were to increase the area here by 195 ha. We already have had the last two years 75 ha in Diankante Camara. Unfortunately, with all the focus on scaling up in the two prime areas of Koutiala and Segou we have had to put off this extension until 2011.⁸

⁷ This issue became even more complicated as Kondo Jigima later stated that they just needed a MOU from IICEM rather than a loan guarantee. In 2011 we need to begin working with the NGO or DRA on making all the bank arrangements before April 1 so that fertilizer is available to the farmers by May 1.

⁸ IICEM has begun negotiations with DRA to support the monitoring, input delivery and extension. But we still need to mount our pilot projects in the Kayes region to demonstrate the technology, marketing, and institutional effects before moving to the scaling up operation.

Plans for the rest of the 2010 crop year:

During 2010 we anticipate three more trips to Mali. The first beginning August 5 will be to orient the farmers and to visit the fields especially in the three main zones. Since Koutiala and greater Tingoni now are part of our large scale scaling up activity, we need to make sure that there is good program understanding as well as checking for early field problems. Replanting, thinning and weeding are issues then. But also, a very important thing is to begin discussing marketing especially for the engagements with the millet processors and the importance of clean millet. Millet farmers also need to insist on a value added price differential for a uniform variety, clean millet. We need to make sure that the farmers will do the threshing on canvas or plastic or with a threshing machine. Moreover, when they first harvest, they should not put the heads on the ground.

We plan to organize in October a workshop for representatives of these new farmers' associations and the millet food processors of Bamako. In the past these workshops have been very useful for both and have led to more bargaining and interaction. Presently, most of the millet food processors understand the importance of paying a price premium to encourage an increased supply of higher value millet.

The second trip in October will be to see the crops shortly before harvest and to have a better evaluation of performance and farmer feedback at this critical time. Also the workshop for the farmers' associations of the greater Tingoni region and the millet food processors will be held at this time. We will also evaluate other markets for sorghum especially the new USDA activity to provide food aid from local production.

The third trip in December is to continue work on the marketing and to begin planning with IICEM, the banks and the collaborating extension organizations the scaling up activities for 2011. Given the long delays in bank certification of borrowers and providing bank financing we will start this process earlier.

Progress and Challenges

Marketing of sorghum. Marketing innovations and contacts with processors are working well for millet in Tingoni. We will need to extend this to a much wider area in 2010 but this is a straight forward objective as we have already the contacts with the millet food processors and have had workshops before for them.

In poor rainfall years and even normal rainfall years sorghum also benefits from these contacts as there is substitution of sorghum for food processing when there is an insufficient supply of millet. However, in good rainfall years cereal prices collapse so we need to develop alternative markets to serve as price floors.⁹ The intensive poultry sector is expanding rapidly and cereals are approximately 50% of the ration. Non-tannin¹⁰ sorghum has 95 to 97% of the feed efficiency of maize (Joe Hancock, poultry nutritionist, communication). Therefore, at prices less than 95% of the maize price as during 2008 poultry producers should substitute sorghum for maize in the ration. This secondary market puts a price floor for sorghum when otherwise the excess cereals would lead to a price collapse.

With our poultry nutrition specialist we will continue the workshops for intensive poultry producers. The workshops emphasize the substitution potential of sorghum for maize in the ration. Joe Hancock, the INTSORMIL poultry ration specialist, has also been helping Malian chicken producers by providing information on low cost methods to respond to the excessive heat problem.

Besides workshops we will facilitate the contacts between the farmers' associations and the chicken producers. A union of farmers' associations in the greater Koutiala region could negotiate with the association of chicken producers in these good rainfall years when sorghum is cheaper than maize.

⁹ This is similar to a program to expand fresh tomato production. If this is done on a big scale, a factory to produce canned tomatoes or juice then provides a price floor after the fresh market is saturated and prices decline.

¹⁰ Most of the traditional and all of the improved sorghum cultivars are low or non-tannin in Mali (Abdoulaye et al, 2006, pp. 8,9). Nevertheless, buyers of sorghum for the cereal in the ration can avoid the mixing with tannin cultivars in the open market sales by buying from the farmers' associations in the project.

Improved seed production. We were disappointed with reports on poor germination rates for Grinkan on some farms in the greater Koutiala region. Niaba has suggested that we will have to produce seed in drier regions and perhaps with irrigation to avoid the late season rain effect.¹¹

In developed countries seed is generally produced in irrigated conditions. So we need to evaluate better the germination results and investigate the costs of producing seed under irrigation. Clearly, this will raise seed costs. But farmers are already appreciating the better cultivars and increasingly will be prepared to pay for higher quality seed. This is also an important step in getting ready to introduce hybrids. We will be collaborating with WASA on this seed quality production reevaluating our strategy during 2010. Present planning is to use seed from best farmer local production but this is not a good long term solution

Better new cultivars. We still think that Seguifa is too prone to mold-headbug attack. Therefore, we would like adapted Guinea-Caudatum crosses for the regions of Segou and Kolikani and the greater Kayes region where we have been introducing Seguifa. Similarly Toronoiu is an old selection from farmers' cultivars. Farmers like it and there has been good response to inputs but new millet cultivars need to be identified and regionally tested in both the greater Tingoni and Mopti regions. We will be interacting with IER breeders on these new cultivar requirements.

Project size. Our principal 2010 activity has been supporting the scaling up activity. We had to cut back on our pilot project activity in Kayes to focus on extension with other agency collaboration in Koutiala and Segou. Now with this continued scaling up we need to further increase our involvement in marketing studies, marketing contacts, and instruction to the farmers' associations on marketing and efficient economic functioning of cooperatives. We also need to expand the field research and implementation activities to increase the impact on women farmers that Jeanne Coulibaly has been providing since the fall.

Mission au Mali, 25 Juin – 1 Juillet, 2010

B. Ouendeba and Niaba Teme

1. Région de Mopti (du 25-28 Juin 2010)

Cercle de Douanza

Wallo et Mougou, les deux sites de Douanza ont reçu leurs semences et engrais pour les 120 nouveaux hectares, le 4 juin 2010 (au total 120 sacs de DAP et 120 sacs d'urée) et la répartition de ces intrants a été faite entre les producteurs impliqués dans le programme. Cas spécifique de Wallo : Pour les 60 anciens ha de 2009, les engrais n'ont pas été achetés et le mil est encore stocké dans le magasin de la coopérative. Le Directeur régional de l'agriculture de Mopti, Mr Maiga, s'est engagé à négocier un bon prix pour l'achat des engrais si l'argent est disponible. Nous avons expressément demandé aux producteurs de Wallo de vendre leur mil dans la semaine qui commence le 27 juin pour pouvoir

¹¹There were also two seed sources in 2010 and those with triple bagging of the seed are expected to have had better germination. We are checking on that now.

s'approvisionner en engrais afin d'éviter tout retard dans le respect du calendrier cultural. A la date du passage de la mission, les parcelles du programme n'avaient pas été piquetées.

Cercles de Bankass et Koro

Le 27 juin, les pluies étaient abondantes dans toute la région et tous les producteurs étaient au champ en train de labourer et de semer. Néanmoins la participation aux rencontres était bonne. On constate une forte utilisation de la culture attelée (bœufs, ânes et chameaux). Quand les paysans sèment sans avoir fait de labour, ils font le semis directement sur les anciens billons de la saison précédente.

Kanikombole-Bankass (50 ha)

Pour le piquetage, 50 ha attribués aux homes avaient été délimités à la date du 27 Juin. Nous avons appris que sur le plan culturel, les hommes cultivent toujours les terres riches parce que ce sont eux qui assurent disent ils, la sécurité alimentaire dans les ménages. Ceci explique pourquoi toutes les parcelles des hommes sont situées autour des cases de Kanikombole; les 10 ha restants situés un peu plus loin seront attribués aux femmes. L'agent de suivi s'engage à terminer le piquetage au plus tard fin juin. Le nombre d'hommes concernés est de 82 hommes sur 50 ha et les femmes sont au nombre de 28 réparties sur 10 ha

Intrants: les engrais (60 sacs de DAP, 60 sacs d'urée), semences (480 kg de toroniou) et fongicides (60 sachets) ont été bien reçus mais seules semences traitées ont été distribuées aux producteurs pour éviter des abus pour les engrais. Ces derniers seront mis à la disposition des paysans au moment de leur application. Le responsable de la direction régionale de l'agriculture, Mr Soungalo, a donné les prix exacts des intrants. Chaque hectare de mil revient à: 2400 fcfa pour les semences + 19.000 f (1 sac de DAP) + 15.000 f (1 sac d'urée) + 500 f (1 sachet de fongicide) + 1000 f (transport) = 37,900 fcfa à rembourser après le battage.

Il faut noter qu'à la date de visite, 5 paysans avaient déjà labouré et semé leurs parcelles de toroniou.

Après avoir eu toutes les informations sur la préparation et le déroulement de la campagne, l'équipe du projet a rappelé les objectifs du programme Production-Marketing. Les producteurs ont demandé plus d'information sur les remboursements des intrants après la récolte du mil.

Le prix du mil sur le marché est compris entre 135 et 140 fcfa en ce mois de Juin.

Kountogoro-Koro (60 ha)

Tous les paysans étaient dans les champs mais nous avons pu avoir à la rencontre le président de la coopérative et plusieurs producteurs qui ont arrêté leurs travaux champêtres. Comme dans le village de kanikombole à bankass, les intrants sont arrivés à temps et ont été tous distribués aux producteurs. Tous les 60 ha ont été délimités par l'agent de l'agriculture de Koro. Pour la distribution des superficies, 50 hommes ont reçu 50 ha et 10 ha ont été repartis entre 40 femmes. Le 27 juin, l'agent de l'agriculture a fait une démonstration de semis des champs du projet (épandage de fumier et d'engrais DAP, labour puis semis). Le remboursement des intrants qui s'élève à 37.900 fcfa par hectare a été communiqué aux paysans. Pendant les discussions les paysans ont demandé si on pouvait associer le niébé à la culture du mil. J'ai rappelé l'un des objectifs du projet à savoir transférer des technologies éprouvées pour augmenter la production d'une culture pure de mil sans association.

Table 1. Villages, superficies financées par le projet en 2010, nombre de femmes et d'hommes et contact dans la région de Mopti

Région	Village	Superficie des hommes	Nombre des hommes	Superficie des femmes	Nombre des femmes	contacts
Mopti	Wallo-douanza	50	50	10	40	Oumar G. 79095738
Mopti	Mougui 2 douanza	50	50	10	40	Nouhou G. 63602005
Mopti	Kountogoro-Koro	50	50	10	40	Maiga : 79368476 Elhaj : 65702746
Mopti	Tere-Koro	50	50	10	40	Ester 79203171
Mopti	Kanikombole-Bankass	50	82	10	28	Yacouba 66014920 Aniesa 79353084
	Total	250	282	50	188	

Ce qui a été retenu dans tous les villages :

- Production de mil en culture pure (pas d'association)
- Engrais utilisés par hectare: 50 kg de DAP et 50 kg d'urée
- Encadrement technique des producteurs par les agents des services de l'agriculture
- Production de semences toroniou : 2 ha/site
- Remboursements des intrants : 37.900 fcfa/ha en 2011
- Mission d'IICEM dans tous les villages pour discuter de la construction éventuelle de magasin
- A Koro l'agriculture a de bons rapports avec P4P-PAM pour l'achat de grain après la campagne agricole (projection de 2011 : 150 fcfa/kg de grain de mil)

Cercle de KOUTIALA (du 28 juin au 01 Juillet)

Les villages de Kiffosso, Omarbougou, Ziena, et Douguan ont été visités en compagnie du Directeur de l'ONG AMEDD. Malgré les travaux champêtres, la mobilisation des paysans pour assister à nos réunions a été importante. Dans chaque village, nous avons rappelé les objectifs du programme d'extension de la culture de Grinkan. Nous avons également partagé avec ces paysans les inquiétudes que nous avons en ce qui concerne les engrais qui n'étaient pas encore livrés. Les négociations avec la banque BNDA a été le principal facteur de blocage et nous avons promis de nous y atteler et de les tenir informer dans les 3 jours qui suivaient.

Tous les villages (1835.5 ha pour 1639 paysans) impliqués dans la production de Grinkan en 2010 dans la région de Koutiala, ont reçu les semences nécessaires ; il faut cependant noter que les fongicides n'ont pas été envoyés avec les semences. Ceux qui ont déjà semé l'ont fait sans traiter leurs semences. Il est important de noter que quelques paysans ayant déjà semé ont relevé des poquets manquants ce qui nous a un peu inquiétés. Nous avons visité plusieurs champs de Grinkan et dans certains champs il n'y avait pas de poquets manquants surtout dans les champs semés avec suffisamment d'humidité sur les billons. Nous avons instruit les paysans à faire un repiquage de tous les poquets manquants puisqu'il y a suffisamment de plants après démarrage. Un resemis ne serait pas efficace puisque les plants sont déjà grands. Les paysans ont voulu savoir un peu plus sur les méthodes d'application de l'engrais. Nous leur avons recommandé : 1) d'épandre le fumier et le DAP et faire les billons ; 2) semer directement sur les billons le même jour pour que le sol ne soit sec. Le billonnage doit se faire sur la superficie que le paysan peut semer le même jour ; 3) l'urée sera appliqué après le premier sarclage et le démarrage ; l'urée appliqué au niveau des poquets doit être enfoui. Les paysans ont aussi voulu s'assurer que la variété

Grinkan n'est pas un organisme génétiquement modifié (OGM) ; d'amples informations ont été fournies pour leur prouver que cette variété n'est pas un OGM.

Pour comprendre ce qui se passe avec la BNDA, nous avons tenu 2 réunions au siège de AMEDD en présence de Bougouna pour la seconde rencontre. Pour l'équipe de AMEDD, le staff de la banque manque de professionnalisme car il y avait trop d'hésitations sur les pièces à fournir pour la constitution des dossiers de crédit. Sur la base des informations reçues de AMEDD, nous avons proposé la rédaction d'une correspondance adressée à la BNDA pour lui indiquer qu'elle sera entièrement responsable si l'opération de crédit pour achat d'engrais venait d'échouer. C'est muni de cette lettre que nous nous sommes transportés avec Bougouna dans le bureau du Directeur de la banque à Koutiala. Ce dernier nous a bien reçus avec le professionnalisme d'un banquier. Sa première phrase a été : 'les écrits sont toujours destinés à culpabiliser l'autre partie et que lui il préfère passer à l'action au lieu des nombreux écrits qui n'aboutissent nulle part' ; après avoir entendu la version de la banque, nous avons conclu que le staff de AMEDD qui conduisait les négociations était responsable des retards accusés dans la signature des bons de commande nécessaires à l'octroi des engrais par les paysans. c'est au cours de cette rencontre que la banque a pris l'engagement de traiter tous les dossiers des Organisations Paysannes en 2 jours si les responsables des OP peuvent venir chercher leurs bons de commandes dès le lundi matin 05 Juillet. La banque a demandé à ne plus avoir à faire avec les représentants de AMEDD qui étaient impliqués dans les négociations initiales. C'est très réconforté, que nous avons quitté le Jeudi 01 Juillet, Koutiala pour Ségou.

2. Région Ségou 05-09 Juillet

Collaboration avec **Faso Jigi**. Les sites de Sokoibougou et de Katiena vont mettre en œuvre la production de séguifa sur 100 ha. Tous les 2 sites ont reçu les semences et les fongicides pour ensemercer les 100 ha du programme. Les champs n'ont pas encore été délimités. Suite aux discussions avec Faso jigi, un engagement ferme a été pris pour faire les délimitations et apporter les engrais au cours de la semaine du 05-09 juillet. Plusieurs paysans ont déjà fini les semis des champs de mil situés un peu plus loin des villages. Le sorgho doit être semé à proximité des villages quand les engrais seront disponibles.

Nous avons constaté avec beaucoup de plaisir que Faso Jigi, avec un appui éventuel de IICEM, est en train de vouloir mettre en œuvre un programme similaire au notre pour la production de 600 ha de toroniou (mil) et de 400 ha de seguifa (sorgho). Mais à la date du 01 Juillet, il n'y avait pas encore de semences et d'engrais pour l'opération et il n'y a toujours pas de contrat entre IICEM et Faso Jigi. Je doute fort que les intrants soient au niveau des organisations paysannes a temps pour une bonne exécution des activités. C'est pourquoi la mission a attiré l'attention des responsables de Faso Jigi pour la mise en œuvre rapide de notre programme (100 ha) puisque les semences, engrais et fonds de suivi sont en place pour démarrer la campagne agricole.

SG 2000 et DRA Ségou doivent lancer en 2010, un programme de production de 500 ha de toroniou avec 8 Organisations Paysannes (OP), dans la région de Baraouli (Ségou). A la date du 02 Juillet, les paysans n'ont reçu que les semences et les fongicides. Depuis presque 1 mois, les OP ont signé et déposé leurs dossiers de prêt auprès de Kondo Jigima (institution de microfinance) bien représentée dans la région. Il faut noter que Kondo Jigima ne fait pas partie des institutions où IICEM a fait un dépôt de fonds pour garantir des prêts aux producteurs de mil et sorgho entre autres. Les semis de mil ont débuté dans la zone (certains plus de 15 jours) et tout retard dans l'approvisionnement en engrais risque de mettre en danger l'opération de toroniou. A la rencontre de Baraouli, nous étions avec Dr Berthe Abou, directeur de SG 2000, Mr Diawara, directeur régional de l'agriculture Ségou, et les représentants des OP et agents de suivi de ces OP. Les paysans ont réitéré leur inquiétude à cause du retard dans la mise en place des engrais. L'option de tout faire pour la réussite de l'opération a été retenue car il sera

difficile d'avoir un protocole d'accord entre IICEM et Kondo Jigima pour libérer les fonds prévus même dans un délai de 4 semaines.

Le lundi 05 Juillet, à Bamako, une réunion a regroupé le directeur de SG 2000, les membres de la mission et Mr Amadou Oungoiba, un agro-dealer fournisseur d'engrais. L'objet de la rencontre est de voir comment mettre à la disposition des producteurs de mil, les engrais (500 sacs de DAP et 500 sacs d'uree) dans les meilleurs délais. Le mil n'ayant pas droit aux engrais subventionnés, Mr Oungoiba a proposé après de longues négociations, les prix suivants des engrais rendus à Baraouli (Ségou) : 18.500 fcfa pour 1 sac de DAP et 16.500 fcfa 1 sac d'urée, ce qui reviendrait à 35.000 fcfa pour 1 ha de toroniou. Ces quantités seront livrées au plus tard le vendredi 09 Juillet. Le cout total des engrais s'élève à 35.000 f/ha x 500 ha = 17.500.000 f. Comme indiqué par John Sanders, le projet production et marketing ne peut pas contribuer pour plus de \$34,000 soit 17.680.000 fcfa à un taux de 520 f pour \$1. Le directeur de SG 2000 s'est engagé à couvrir les frais de suivi des activités et toutes les dispositions seront prises pour la production de grain de qualité car les transformatrices de Bamako ont toujours été les meilleurs clientes des paysans dans cette zone de Tingoni.

Table 2. Activités du projet marketing et activités collaboratives avec AMEDD, Faso Jigi et SG 2000 / DRA

Region	Production et marketing	Programme collaboratif/ extension	Mise en œuvre	Contact
Koutiala (grinkan)	-	1840 ha	AMEDD	Bougouna sogoba Bsogoba67@yahoo.fr
Segou (seguifa)	100 ha (new)	-	Faso Jigi	Abdoulaye sissouma A_sissouma@yahoo.fr
Segou (toroniou)	150 ha (old) Tingoni	500 ha	SG 2000	Berthe abou bertheabsaa@gmail.com

Discussion on Sorghum Cultivar Requirements for the Production-Marketing Project

One of the objectives of on-farm technology diffusion is to give feedback to researchers on what works. In 2010 we will be in our 7th year of putting technologies on farms. During most of that time we have been involved in three countries with a more recent concentration on a substantial expansion in Mali. Our basic operating philosophy is that you can not get sustained and significant yield increases without moderate to high use of inorganic fertilizer combined with varieties that respond well to inorganic fertilizer.¹² To pay for this higher fertilization it is necessary to confront the basic problems of all staples in developing countries, ie 1) At harvest times prices collapse because farmers need to make a series of expenditures and have limited access to storage; 2) In good and even normal years prices collapse after those with sufficient incomes buy all the staples they can consume; 3) Governments in developing countries become concerned about staple prices for urban consumers when prices increase rapidly in poor rainfall years and governments often intervene to drive these prices down.

By developing marketing strategies to respond to these sources of food staple price problems we insure that farmers can pay for the increased expenditures on inorganic fertilizer and higher quality seeds and still make money. Besides the technologies and marketing strategies we also develop farmers' associations, which then become marketing cooperatives engaged in assembly, storage and product selling for higher prices for their members and buying and distributing inputs in quantity to reduce their costs.

In the introduction process we have learned a series of things about the cultivars responding best in these improved environments. The new cultivars should not be tall and should not lodge with increased fertilization. Farmers recognize that the grain has a much higher value than the forage and that the shorter, squatter plants put more of their energy into grain production and less into leaves and stems. This is the basic physiology research of the '50s, which became the center piece of international center development of the Green Revolution for wheat and rice. The economics part was the falling inorganic fertilizer price since the First World War enabled a much higher fertilization and therefore put a large premium on the development of shorter, squatter cultivars.

Many have confused drought escape with drought resistance and argued for introducing earlier and earlier cultivars. Since drought has many forms and with improved practices including water retention techniques we are responding to some of the drought risk we do not want early cultivars because then they have less time to respond to the higher input levels employed. In summary, so far we look for intermediate height and season length cultivars.

Now for some specific adaptation to Mali. Caudatums have much higher yield potential than Guineas because of the densely packed heads. Caudatums are predominant in the US. In Mali late rains have chronically produced a combination mold-headbug problem.¹³ INTSORMIL tried unsuccessfully to look for resistances in Caudatums to get around this mold-headbug problem. Most Malian sorghums are Guineas, which have more open heads and thus dry sooner and are more difficult for the headbug to multiply but yield substantially less than Caudatums. So what works best in Mali for avoiding the mold-headbug complex, but also substantially increasing yields, are the crosses between Guineas and Caudatums. We are definitely not interested in tall Guineas as they lodge and yield poorly with increased fertilization.

Some pictures are included of two different combinations of Guinea and Caudatum both developed by Acar Toure of IER, Mali. Niatitiama has been very successful in Kafara but the seed quality issue has still not been resolved. Grinkan has been an outstanding success in the cotton area of Koutiala

¹² Water retention techniques are also included to increase the returns and to reduce the risks of inorganic fertilizers.

¹³ Also developing early Caudatums for drought escape aggravated the mold-headbug problem. Our present field recommendation is to plant these early materials, such as Seguifa late, thereby negating the desired effect of earliness in overcoming late season drought but avoiding the headbug-mold problem.

and we will be attempting to substantially increase the area in Grinkan in 2010. It is too early for hybrids in most sorghum regions as farmers still need to be convinced of the need to pay higher prices for improved cultivars and to buy annually but the next step in the regions with the successful introduction of these improved Caudatum-Guinea crosses will be the introduction of hybrids.



The new sorghum cultivar (Niatitiama. Guinea v. Caudatum cross-intermediate height), Summer 2008 in Kafara.

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Farmer and AMEDD NGO Agent with Grinkan, summer 2008



Production-Marketing Project Collaboration with Sasakawa Global 2000 In Farm Level Activities in the Segou Region, 2010 Crop Year

Introduction

The key components of the Production-Marketing project in the crop year of 2010 are the significant expansions of crop area in the two pilot regions with the most success. In the Koutiala region the Grinkan sorghum cultivar has consistently given yields of 2 to 3 tons over the last three years for farmers following recommendations. The national development bank has become involved with the help of IICEM and AMEDD and will be providing credit to farmers' associations in the greater Koutiala regions.

The other region of success has been in Tingoni outside Segou with Toroniou, a millet cultivar. Here best farmer yields have been in the 1.5 to 1.9 ton/ha range and there has been a price premium from the millet food processors available making this moderate yield improvement even more profitable. The objective here has also been to phase out our direct financial involvement for input credit and to get bank involvement. Global 2000 has shown a high level of commitment to this project and has organized 8 new farmers' associations with between 50 and 100 members in each. Seed was provided and farmers were organized by Sasakawa and the farmers' associations were waiting for the bank loans. One of the prime facilitators in getting bank involvement has been the willingness of IICEM to support our project by providing loan guarantees. For some reason one of the negotiating technicians approached the wrong bank without the loan guarantee provision and at the last moment the bank has done nothing. To maintain momentum in these farmers' groups we are paying for the fertilizer and Sasakawa 2000 is paying for the other components of our normal farm level organization, ie the seeds, monitoring and the "bache" (canvas on which the threshing is done to maintain clean grain).

Work plan

The Production-Marketing project with Global 2000 and the DRA of the Segou region will collaborate in program expansion onto approximately 500 ha in the greater Segou region. This program includes new technologies (improved seeds, moderate inorganic fertilization, a water harvesting technique and improved agronomy), the introduction of improved marketing techniques, and the development of farmers' associations into marketing cooperatives. The contribution of the Production-Marketing project has been in the development and implementation of this model or pilot project in collaboration with IER, Global 2000, and the DRA of the Segou region. We will continue to support this expansion in the summer of 2010 with field visits to the farmers' associations, the farms and the collaborating agencies. In 2011 we expect to substantially expand this area and to include a bank with a loan guarantee from IICEM so that bank financing is assured.

Women's Participation in the IER-INTSORMIL/ USAID-Mali Mission Production-Marketing Project

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**INCREASING WOMENS' WELFARE IN MALIAN RURAL
HOUSEHOLDS WITH AGRICULTURAL TECHNOLOGIES**

Ph D Prospectus
by
Jeanne Coulibaly

**Department of Agricultural Economics
Purdue University, West Lafayette, IN**

Chair:
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June, 2010

Problem statement

The improvement in the well-being of individual household members has been the center of interest of many development policies (von Braun and Webb 1989, Agarwal 1997, Evers and Walters 2000). Numerous empirical studies recognize that development policies that do not take into account rural women's contributions and responsibilities in agricultural productivity result often in counterproductive effects. In particular, many attempts to introduce new agricultural technologies have not produced their expected effects because the role of women in crop production did not receive much emphasis (Alderman et al 1997). Thus, there is an increasing interest in understanding how technological change affects the allocation of resources and the distribution of income within the household in order to better shape development policies.

In Mali, the past decade has been characterized by a decline in the importance of cotton as a cash crop. There has been a downward trend in the world cotton price in the 21st Century due to the introduction of transgenic cotton, BT cotton, along with the reduction of the system of guaranteed cotton price by the parastatal compagny (Droy 2008) as well as the competition from synthetics. These declining cotton prices have led to a decrease of farmers' income and have encouraged farmers to diversify away from cotton through an increase in the area and the inputs allocated to the production of cereals. Some of the fertilizers provided as credit for cotton are presently being diverted to the cereals. Malian households are progressively substituting cereals such as maize, and sorghum for the production of cotton in the cotton producing areas. In 2007, the reduction of cotton areas resulted in a dramatic fall of production of more than 40 % (OECD 2008).

In order to improve farmers' income, development efforts are being made to introduce new technologies of cereals particularly sorghum and millet. These technologies consist of new high-yielding cultivars, moderate levels of fertilizer and improved agronomic practices. Some economic studies revealed that these innovations have potential to increase significantly household incomes (Vitale et al. 2007, Baquedano and Sanders 2009). These studies have taken the household as a unit and implicitly assumed that an increase in household income will make all household members better off. A pitfall is that they did not look at the within household effect of these new technologies, particularly the impact on women's disposable income and welfare. As many empirical studies revealed, evaluating the effects of new economic incentives in the household without examining the intra-household resource allocation may end up in misleading policies (von Braun and Webb 1989, Due and Gladwin 1991, Lawrence et al. 1999).

A large body of literature argues that women may not obtain higher incomes from adoption of agricultural technologies on the communal family land because of the additional labor requirements thereby reducing their labor available for their main source of income "women's private plots." (Kumar 1987, Gladwin and Mc Millan 1989, Lilja and Sanders 1998). In this case the positive effects from technological change on the communal land on women's income are reduced or eliminated by the decrease in labor availability for their private plots and the resulting decrease in private plot income.

However, a complete welfare analysis would also have to consider the welfare benefits to women from the increased household expenditures made possible by the technological change.

Thus, the problem of this dissertation is whether women benefit from the new income streams generated by the shift to new cereal technologies and associated marketing strategies. The main goals are to measure the impact of new technologies on the household income and investigate the intra-household's income distribution focusing on the effect on women's welfare. The other purpose of this study is to analyze strategies that can increase women's bargaining power or otherwise help them to benefit from the new agricultural technologies.



Jeanne Coulibaly, Purdue PhD student (L) and Niaba Teme, IER sorghum breeder (R) in a discussion with farmers of Douentza Village, Mopti Region

Justification

The impact of new technologies on women's welfare has been a central issue in the development literature. New intensive agricultural technologies with higher labor requirement often have been hypothesized to leave women's worse off despite the increased in household's income. When a new technology is introduced, there is a displacement of women's labor from their individual fields, i.e private plots¹⁴ to the household collective land i.e communal plot¹⁵ in order to respond to the higher demand of labor. The resulting effect is a rise in the household income generated on the communal land with the household head controlling this increased income. The share of the additional income accruing to women or compensation in wages for women's increased labor is the outcome of negotiation between spouses and depends on their relative bargaining power according to bargaining concepts.

Previous research has examined the implications of new economic opportunities and women's bargaining power on their well-being, but there is little empirical application that focuses on the net effect of agricultural technology change on women's welfare. Lilja et al. (1996) used econometric techniques to demonstrate that with the introduction of cotton technology, women who perceive their right to refuse to work when they are not satisfied with the payments received, have a 28 % higher compensation in their wage than those who do not. In addition, this study found that women's income¹⁶ declined with introduction of new technology because the decline in their private plot's income was not compensated by the increased income received from their work on the communal plot.

However, this study did not provide empirical evidence regarding the net impact of technological change on women's welfare. Indeed, a decline in women's income following the introduction of new technology does not mean a decline in welfare. The effect on welfare also will depend on how the increased income from the new technology is spent by the family head in the household. In addition to the communal wage, women's welfare can also be influenced by increased expenditures on consumption or investment goods. So, even though the net income earned by women decreases as a result of the adoption of agricultural technology, they can still be made better off. Thus, detailed investigations need to be carried out on the pattern of the household expenditures to examine whether increased discretionary income due to the introduction of new technology increases women's well-being.

Numerous research studies have investigated the rural household decision making process in order to capture the intra household resource allocation and understand the gender response of households to new income streams. Hence, an evolution of household decision making models has occurred over the past years to explain household behavior in agrarian societies, and investigate gender

¹⁴ Private plots are used by individual household members for their own personal needs. Women generally use these private plots to produce vegetables and spices for sales for their financial needs. Part of these produces can be used for family consumption. The IER-INTSORMIL project provides input credits for cereals for women and men.

¹⁵ The role of the communal land is to generate cash crop income and family food consumption.

¹⁶ A decline in women's income following the introduction of new technology does not mean a decline in welfare. The effect on welfare also will depend on how the increased income from the new technology is spent by the family head in the household.

interaction in resources allocation as well as in redistribution of profit from economic opportunities. These theories have evolved from exploitation and altruism to bargaining.

The exploitation theory assumes the presence of an authoritative family head who makes decisions not necessarily for the collective good. Family members follow his lead because he is responsible for providing subsistence consumption for the household. All household members feel the need to sacrifice and work together to insure subsistence. The existence of few economic resources and the collective desire to attain subsistence reduces conflicts. As new income streams become more available, if the household head still continues to be the only or principal beneficiary of these increased income streams, then there is often conflict within the household.

The altruism theory developed by Becker (1981) from neoclassical economics assumes that economic agents are identical by representing the household as a single decision unit. Preferences of household members are aggregated into a household joint utility function which is maximized over a pooled income and time constraint. In contrast to the exploitative theory where the household head makes dictatorial decisions, the altruistic family head behaves as a benevolent dictator and makes consensual decisions on how best to allocate resources within the family maximizing group welfare. Becker's theory as well as other neoclassical economists led to this unitary model of household decision-making. The unitary model implicitly considers that the identity or gender of the individual earning income should not matter in the demand for goods after controlling for total expenditures (Hoddinott et al. 1997).

A growing number of studies have challenged this neoclassical representation of the household decision making because of the pooling income assumption and the failure to incorporate explicitly the process by which resources are distributed within the household. Much informal evidence in developing countries against the income pooling assumption indicate that household members have diverse preferences and household demand for goods and leisure depends on the identity of the individual controlling the income (see for example Schlutz 1990, Thomas 1997, and Hopkins et al. 1994). This is especially important in the context of sub-Saharan Africa where the household includes large extended families with often conflicting interests. In this case, modeling the household decision making in a single utility function is not expected to reflect the dynamic of interactions existing within a household. All these concerns have led to the collective approaches of intrahousehold allocation.

Collective theory departs from the altruism hypothesis by taking into account the household interactions for resource allocation and income distribution. The collective approach incorporates the preference heterogeneity of individual family members in assessing the total well-being of the household. It is perceived to be a more realistic representation of the process of decision making within the household compared to the exploitation and altruism theories. The collective theory is in line with the New Institutional Economics or transaction cost approach of Williamson (1975) extended by Pollak (1985) that views the family as an institution and governance structure with individual interactions and rejects the assumption of identical preferences. The process of interaction for the allocation of household goods is performed within a game theory framework and gives rise to the use of bargaining models.

Bargaining problems are included in the class of household decision making developed by Sen (1990). There is a cooperation-conflict relationship in the household similar to the one in a firm. All household members know they need to collaborate to survive but there is conflict over the income streams especially as new technologies increase income. Thus, the decision making process with the bargaining theory is analogous to the one of a firm where conflicts are resolved through negotiation. Nash Bargaining models of cooperation and non-cooperation in resource allocation and distribution within the family have been developed by respectively Bourguignon and Chiappori (1992), Manser and Brown (1980) as well as Mc Elroy and Horney (1981). The difference between these models is that cooperative models retain the hypothesis of income pooling whereas non-cooperative models assume separate spheres of resources control. Also, as opposed to the cooperative models, non-cooperative models of household decision making do not necessarily result in Pareto efficient intrahousehold resource allocation. Recently, these intrafamily complex interactions have been captured by a mix of cooperative and non-cooperative models. These models allow some decisions to be made unilaterally while others are made jointly.

Carter and Katz (1997) took the lead in developing a modeling procedure embracing the cooperative and non-cooperative resource allocation process. Their model called the “conjugal contract model” depicts the household economy with individuals having independent preferences and resource availability but allowing many forms of interdependence among household members. It also incorporates theoretically the influence of the patriarchal structure of the traditional society on the threat point of the bargaining agents. The threat point is defined as the next best alternative available to the marital partners if they were to separate or break cooperation. The conjugal contract is made through the transfer of women’s labor time to men who in return transfer income to women. In this model, there is a symmetric treatment of the exchange of labor and income between husband and wife, that means, the rent accruing after bargaining is only influenced by the individuals’ threat points.

The symmetry assumption implies that both agents have equal bargaining power (utility at their threat point) so the profit obtained from bargaining is divided equally among them (see figure 1 in appendices where the equilibrium lies at equal distance between their threat points A and B). The specification of the threat point differs across bargaining models. Some authors (Mc Elroy and Horney 1981) assume that the threat is the well-being of the spouses in the event of divorce. Other researchers (Lundberg and Pollak 1993) define it as the spouse’s well-being in a non-cooperative equilibrium within marriage.

Most bargaining models to our knowledge in the development literature follow Carter and Katz’s modeling procedure and assume symmetry in the negotiations between bargainers. However, this approach has been questioned by Warner and Campbell (2000) because of its lack of explicit asymmetry in the transfer of resources between husband and wife. These authors argued that the man is in a more powerful position during this exchange of labor and income and therefore Carter and Katz’s model should formally show the greater power of the male in the intrahousehold resource negotiation.

Thus, they use a Stackelberg oligopoly “leader/follower” approach that relaxes the symmetric treatment of the bargaining between conflicting parties. The household head makes all critical decision and the wife reacts if she is not satisfied with the decisions.

This unequal bargaining power between principal and agents in the labour market has often been captured in the literature of industrial organization by using an asymmetric Nash bargaining model. The concept was developed by Svejnar (1980, 1986) to address criticism about the symmetric Nash model. The asymmetric Nash model assumes that the bargaining outcome is influenced not only by some endogenous factors (threat points) but also by some exogenous elements that Svejnar called “fear of disagreement” or “cost of disagreement” in order to be more reflective of the prevailing institutional environment. In the Nash asymmetric model, the gains accruing to the conflicting parties depend on their relative bargaining power. So, the Nash asymmetric model maximizes a weighted product of the conflicting parties’ utilities and the bargaining net profit is shared in proportion of the conflicting parties’ degree of relative bargaining power (see figure 2). This research will not test the theories of decision making but will choose the bargaining theory as the one that could best capture the process of income distribution within the household and women’s labor allocation on the communal plot.

Research studies claimed that policies that affect the endowments and income of individual household members will also influence the outcomes of household decisions. In 2009, the IER-INTSORMIL project in Mali has started to encourage women’s participation in the Production-Marketing project by promoting their access to land, and adoption of improved technologies. Thus, an examination of the extent to which policies strategies proposed by the project increases women’s welfare deserves attention.

According to the theory of induced institutional innovations, new institutions arise as a result of new income streams from technological change (Hayami and Ruttan 1985, Ruttan 1997). This argument has been supported by the pressure of population on land in Western Europe in the Middle Ages which raised the value of land and induced a change in the institutions that govern property rights (Bardhan 1989).

In Mali, some changes that seem to be consistent with the theory of induced innovation are taking place. Female workgroups that used to perform community oriented services are changing their structure to be more profit oriented. These gender work teams contract informally their labor to some agricultural activities mostly during peak agricultural seasons and ask for some cash payment instead of performing those services for free or for wages which can then be used to pay for community function as it occurred in the past. Another institutional evolution is the shift from extended to nuclear family, which is especially common in East Africa.

Study Objectives

1. Estimate the impact of new agricultural technology and marketing strategies on the household’s income

2. Evaluate the impact of new technologies and marketing strategies upon income distribution within the household focusing on the effect on women's welfare
3. Evaluate the effect of induced institutional change from the introduction of new technology on women's welfare and also identify policy alternatives to increase the welfare of women.

Study Areas

The areas of focus for this research are the regions of Sikasso and Segou located in the Sudanian zone of Mali. In those regions, the districts targeted are Koutiala for the region of Sikasso and Tingoni for the region of Segou. These districts have been very successful since 2007 with the adoption of sorghum and millet technological packages proposed by the IER-INTSORMIL project. The main crop produced in Koutiala is cotton while watermelon, cowpeas and millet are chiefly grown in Tingoni. In Koutiala, the current traditional technologies used for cotton and maize employ improved cultivars, inorganic fertilizer and chemicals for the control of insects. Other crops used limited amount of inorganic fertilizer. In both districts, women traditional crops include cowpea, peanuts and vegetables mainly okra. The coarse grains are traditionally used for the family consumption but with the introduction of new technologies through the IER-INTSORMIL project, sorghum and millet are becoming cash crops like cotton and watermelon.

In southern Mali, particularly in the district of Koutiala, the subsistence farming system has changed in the seventies with the introduction of cotton with new technologies. In the 1980s, substantial income gains were made with cotton that moved the traditional system to a cash economy. Since 2000, cotton revenue and production have been set back by a series of factors that led to a large reduction in the household's income from cotton. Thus, before the present introduction of new cereal technologies, the reductions of income have pushed family members to more concern with basic subsistence and to maintaining what they have come to regard as necessary household expenditures. We expect that with the increased incomes from the new technologies the conflict over the increased income streams will renew.

In the district of Tingoni, the subsistence system became more commercially oriented during the past few years with the introduction of watermelon and cowpeas as cash crops to diversify the existing sources of income. So, before the adoption of new technologies for millet, watermelon and cowpeas were the main sources of cash revenue generated in the household.

The effect of new technology on the household income will be evaluated by introducing yield improving inputs and a new marketing strategy on the communal land. Since 2007, households have adopted new technological and marketing innovations under the IER-INTSORMIL project in order to increase their income. The technology packages are high-yield inputs composed of moderate levels of fertilizer, improved seeds of sorghum "Grinkan" in Koutiala and millet "Toroniou" in Tingoni. The marketing

strategies consist of storing the grain at harvest and selling the stock when prices are recovering. We will also look at the credit constraint associated with the introduction of new technologies. With the use of higher level of agricultural inputs, households can be credit constrained. The availability of credit from lending institutions may therefore benefit farmers, make their production more profitable and promote technology adoption.

In this farming economy, the household head controls the family labor allocated to those plots by defining the amount of time spent by adult household members including women. They are compensated for their work by receiving a daily subsistence allowance in cereals. This subsistence allowance can be supplemented with some gifts especially for women or cash payments depending on the size of the profit. The necessary household expenditures are also paid by the family head. In larger farms, the family head can also hire outside labor especially during the peak labor season such as weeding and harvesting. Household members can work on their private fields after meeting their work obligation on the communal plots. Women are the main managers of their private plots and control the income generated from these fields. At certain times of the year women can also find off-farm work.

Data Collection

Data will be collected through household survey in two of the project's most successful villages which are Koutiala and Tingoni. Data will be collected for the situation with and without technological change as the intensive technologies have not been applied on all cropping parcels of farmers' exploitations. Data will target yields of the main agricultural crops per quality of land, harvest and post harvest prices for these crops, quantity and cost of inputs used as well as storage costs. Household consumption and expenditures will be gathered as well.

Information regarding off-farm wages, transaction costs (distance to the market, travel costs), bonus or incentives paid to household members on farm at harvest, labor allocated across cropping seasons on the communal, private plot and the off farm employment, socio-economic characteristics of household members will be reported.

Already existing data collected by Baquedano and Sanders (2009) and those reported in the annual Intersoil-IER bulletins will also be used. Some secondary data on time series yields and prices for the crop commodities investigated in areas under study will be collected from the Famine Early Warning System (FEWS) in Bamako (Mali). These data will be useful in analyzing the distribution of the state of nature for yields and prices.

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Appendices

Table 1. Total women time allocation in economic activities (hours/day)

	Women	Men
a. Crop production	3.90	4.91
b. Household chores	3.49	0.34
c. Artisanry	0	0.13
d. Livestock husbandry	0.09	0.44
e. Marketing	0.80	1.56
f. Social activities	1.03	0.23
Total labor used for farm activities (a+d)	3.99	5.35
Total labor used for off farm activities (e+f)	1.83	1.79
Total hours of work (a → e)	8.28	7.38

Source: Lilja, 1995

Table 2. Average return to women's labor

Activities	Wage (in FCFA/day)	Wage (in US dollar/day)
Communal work	51.5	0.11
Private plot	886.83	1.85
Work group team	80.34	0.17
Off-farm	68.92	0.14

Source: Adjusted from Lilja (1995) by considering the inflation rate (3%)

Source of Exchange rate in 2009 (Ouanda corporation): 1 US \$=478.74 F CFA

Table 3. Expected yield on traditional and new technologies

Technologies	Expected Yield (kg/ha)
Traditional technologies	
cotton	1275
maize	1473
Sorghum	1136
Millet	827
Peanut	418
Cowpea	1057
Improved technologies	
Improved Cotton	1505
Bt Cotton	1543
Improved sorghum	1619

Source: Baquedano 2009, INTSORMIL Bulletin 2008

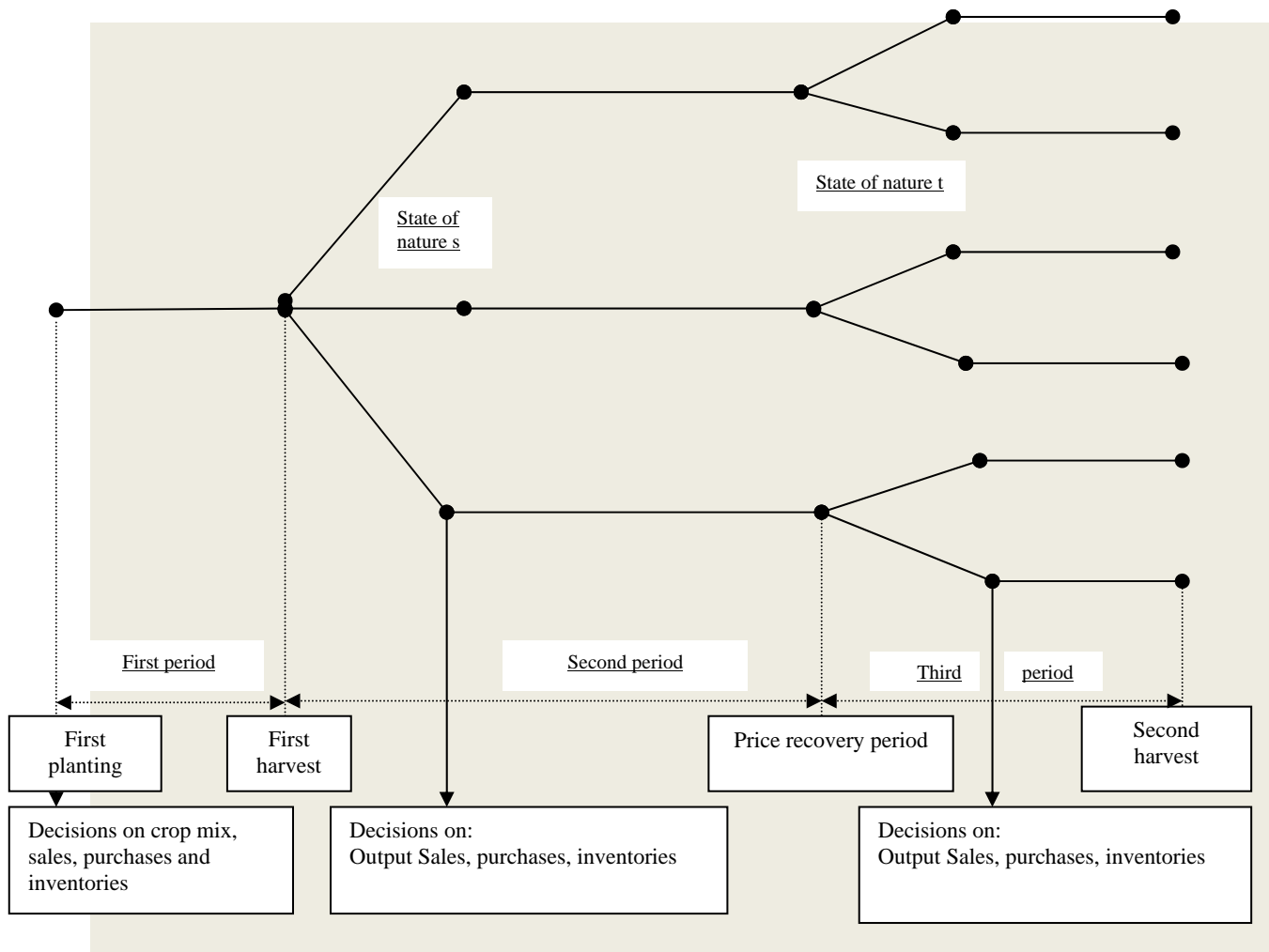


Figure 1: Diagram on farmers' decisions in Mali

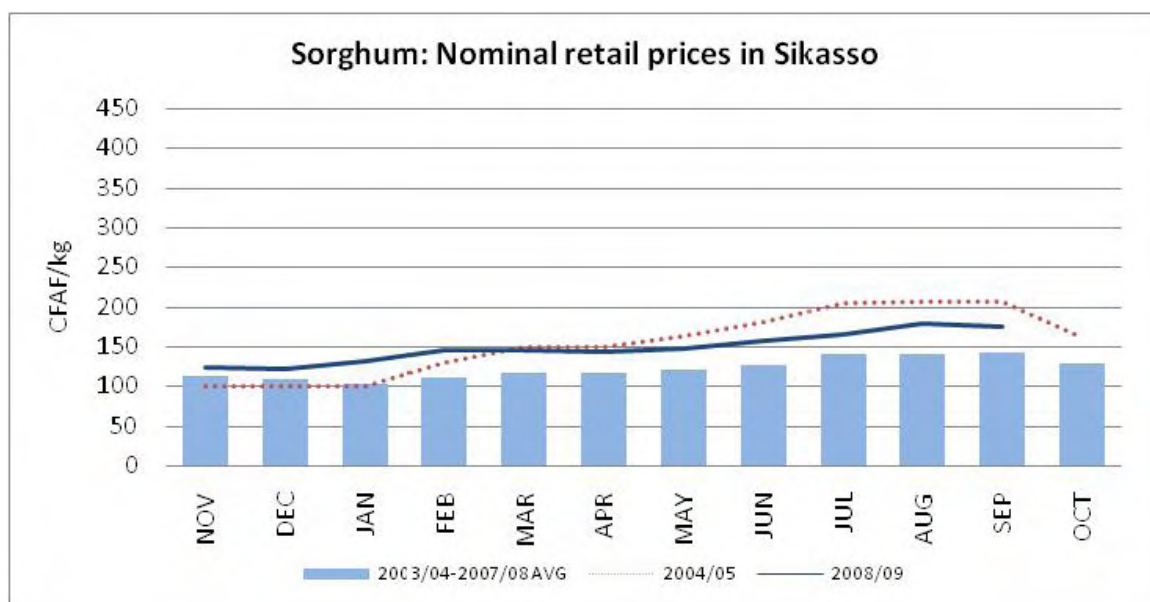


Figure : Monthly price variation for sorghum in Sikasso for years 2003/04 and 2008/09
Source: Famine Early Warning Sytems Network (FEWS.Net/Mali)

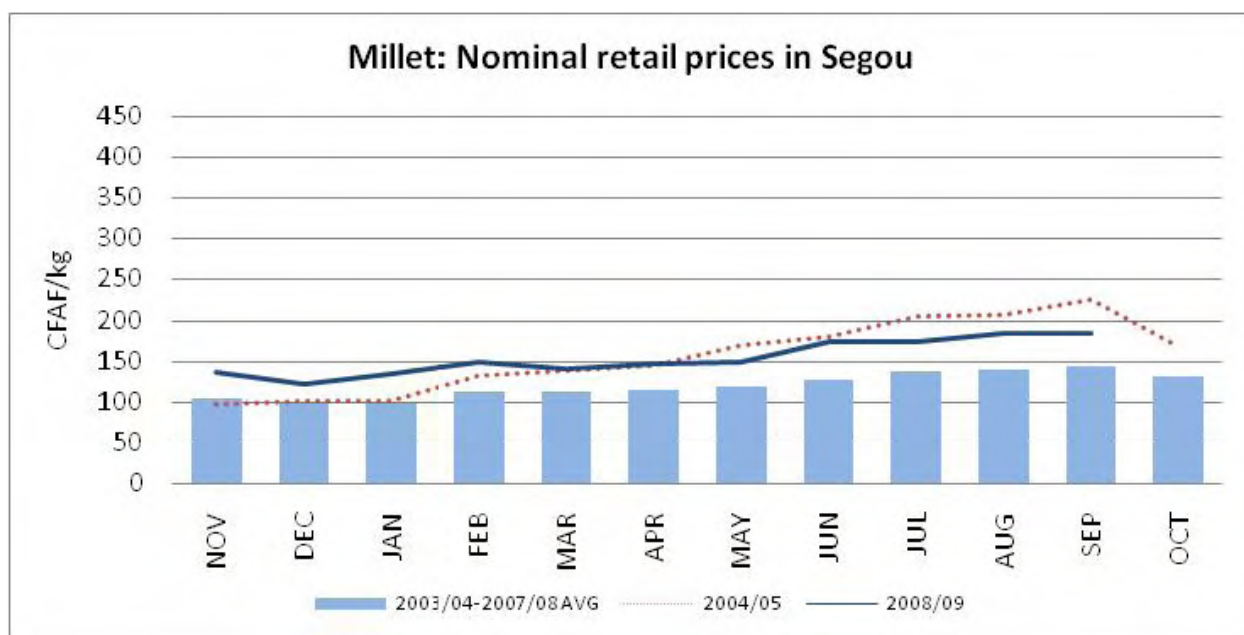


Figure: Monthly price variation for Millet in Segou for years 2003/04 and 2008/09
Source: Famine Early Warning Sytems Network (FEWS.Net/Mali)

Food Processing Technology Activities

Bruce Hamaker, Purdue University

The overall goal of the cereal **processing technology and training** component of the project is to establish a successful model of entrepreneurial sorghum/millet processing to competitive marketed food products. Year 2 activities focus on organization of the project, strengthening the IER Food Technology unit, establishing entrepreneurial incubator units and training of processors in the incubator units. The processing team consisted of Bruce Hamaker, Project Leader (Purdue University), Yara Koréissi, Host Country Coordinator (IER, Sotuba) and Mamadou Diouf, Consultant (ITA, retired).

Goal and Objectives of Millet/Sorghum Processing Project

Goal

Expand markets for millet/sorghum through **high and consistent quality market-competitive processed products**

Objectives

- Enterprise development
 - ◆ Mopti-Gao region - Introduce and train in technology-based improvements to entrepreneur processors
 - ◆ Bamako area – Set up technology support and incubation center for urban processors
- Link with Production-Marketing project to contract farmers for grain supplies
- Target markets – local, urban, regional

The Team

IER/LTA

- ◆ Yara Kouressi – food scientist/nutritionist, Ph.D. candidate, Wageningen University (photo right)
- ◆ Seydou Malle – food technologist
- ◆ Sidi Kone – food technologist
- ◆ Mme Traore – food technologist
- ◆ 2 new technologists to be located in Bamako and Mopti/Sevare



Cereal Processing Expert

Mamadou Diouf, formerly with l'Institut de Technologie Alimentaire/Dakar and PROCELOS-CILSS/Ouagadougou (photo right)



Principal Investigator- Bruce Hamaker, Purdue with entrepreneurs at workshop

Potential Markets

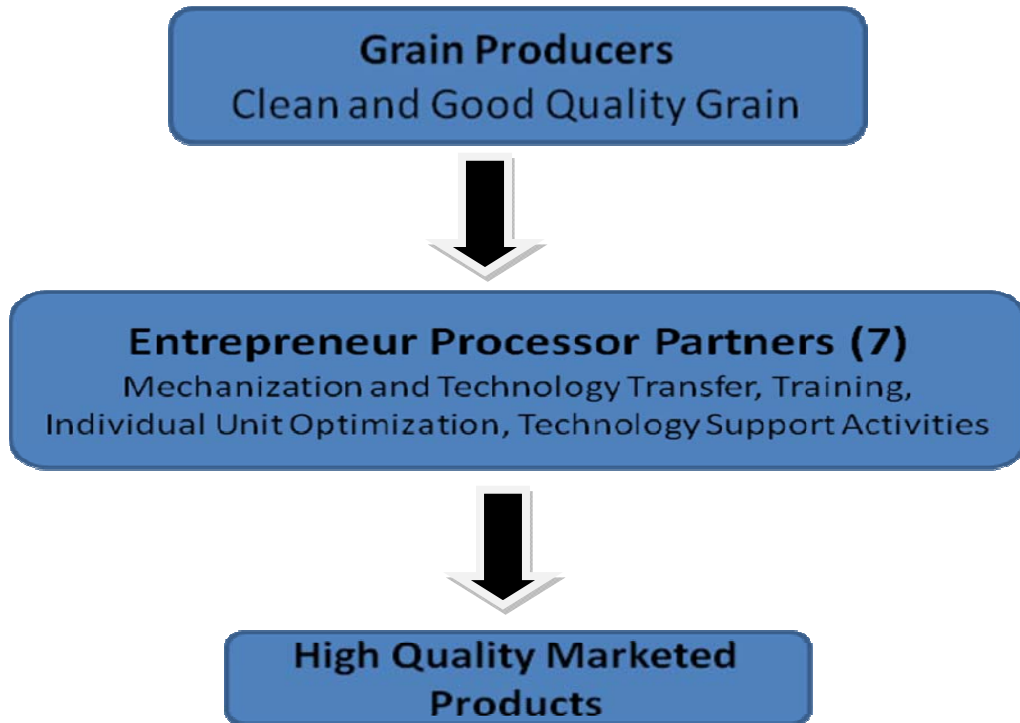
- Local – Mopti/Gao
- Urban
 - ◆ High quality ingredients from Mopti/Gao
 - ◆ Higher level final products



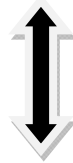
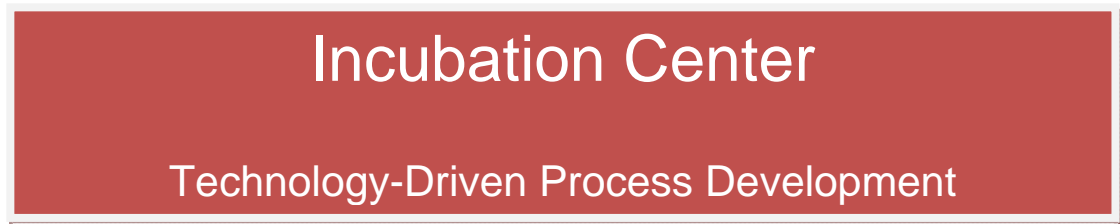
Two Project Thrusts

- Enterprise development in Mopti-Gao region
 - ◆ Currently work with women processors and their associations
 - ◆ Mechanization of units with contributions made by partners and contracts for payback
 - ◆ Technical and market development training
- Process optimization and incubation center set up at IER/Sotuba for Bamako area processors

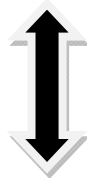
Entrepreneur Processor Development Mopti/Gao/Bandiagara



'Bad quality grain in, bad product out'



Equipment Usage, Market Testing



IER/Sotuba Incubation Center

Status and Current Activities

Status

- Three meetings with Bamako area processor association (FENATRA)
- Temporary building designated and dehuller and 2 mills installed. Need larger building to accommodate additional equipment.
- Optimization studies completed and transferred to Mopti/Gao

Current

- New equipment installed in Center for 2nd level products
- Training workshop in the Fall
- Market testing by entrepreneurs



Linkages

Production – Marketing component (Sanders, Botorou)

- ❖ Contracting with farmer groups
- ❖ Clean and quality grain

IICEM

- ❖ Market evaluation
- ❖ Strategies to finance Bamako entrepreneurs

NGO's

- ❖ CRS
- ❖ Others

Décrue Sorghum Activities

Scott Staggenborg and Vara Prasad, Kansas State University

Introduction

The **décrue sorghum** activities are conducted in collaboration with the sorghum program scientists from IER, Sotuba and are conducted in the Bintagoungou and Goundam area. The goal is to identify agronomic practices that lead to increased yields and increased quality of post water recession grown sorghum. The project is being coordinated by Abdoul Wahab Toure, IER Agronomist. Wahab is being assisted by two Institut Rural de Katibougou students who are located at the décrue sites and are conducting their theses based on the project results. Activities conducted by IER scientists will include and testing to identify most suitable cultivars for the region, testing of various cultural practices (cultivars, planting techniques, fertilizer regimes, pest management strategies and transfer of suitable technologies identified to farmers.

Global Objective

To generate improved agronomic techniques along with appropriate décrue sorghum cultivars to sustain food production and foster economic improvement of northern Mali

Specific Objectives

1. To determine farmers' perceptions and knowledge about current management practices and farmers' needs and preferences and at the same time to collect the sorghum cultivars grown in the area.
2. To conduct experiments on integrated soil, water, nutrient and décrue sorghum management strategies for improved productivity.
3. To diffuse the generated improved techniques.

2010 Season Research Protocols

1. TESTING CULTURAL PRACTICES ON SORGHUM IN THE DECRUE SYSTEM

I OBJECTIVES:

1.1 Global objective:

To assess on décrue sorghum, research findings (recommended cultural practices) on rainfed sorghum.

1.2 Specific objectives:

- To assess adaptability of 3 cultivars selected from previous experiment
- To assess sorghum response to fertilizer in the décrue system

-To assess integrated plant, pest and soil management technology on decrue sorghum.

II MATERIALS AND METHODS:

2.1 Experimental design

A split-plot is being used with 3 blocks per site. Varieties are being used as the main plots and cultural practices as sub-plots. Three sites are being used: Bintagoungou in the Faguibine lake and Goundam in the T    lake.

Main plots (varieties)

V1 : Saba S   

V2 : Saba Tienda

V3 : Niaticama

Sub-plots :Cultural practices (CP)

PC1: 1m x 1 m, no thinning.

PC2: 0.80 m x 0.60 m 3 plants per hill

PC3: 0.80 m x 0.60 m 3 plants per hill +
the use of Furadan for soil treatment and 'Apron Star' for seed treatment.

PC4: PC3 + 1.5 g of Diammonium phosphate (DAP) per hill.

PC5 PC3 + 3.0 g of Diammonium phosphate (DAP) per hill.

2.2 Data collection:

Soil was sampled in both Bintagoungou and Goundam sites at 0-20 cm and 20-40 cm layers, on the basis of one sample per layer per replication. Fifteen samples will be available on site basis (3 replication), for soil analysis: texture, organic matter, pH, total and available P, sum of exchangeable cations (Na, Ca, K and Mg).

Spatial occupation by the crops was appreciated in each treatment on: a) the basis of actual number of germinated hills per ha; b) the ratio of actual to planned number of hills on % basis. Number of hills, stems, panicles as well as panicles and grain weight were recorded at harvest.

2.3 Data analysis:

Data will be analysed using Statistical Analysis System. Analysis of variance will be used to test treatments effect. Ppds will, be used pre-planned comparison, involving farmer's practice and one of the cultural practices suggested by research.

2. TESTING INTERACTIVE EFFECT OF SOIL AND SEED TREATMENT ON SORGHUM PLANT POPULATION AND GRAIN YIELD IN THE DECRUE SYSTEM

I OBJECTIVES:

1.1 Global objective

To assess on decrue sorghum, research findings (recommended cultural practices) on rainfed sorghum.

1.2 Specific objectives:

-To assess the contribution of soil treatment, seed treatment and their interaction on plant population as well as and grain yield of sorghum in the decrue system.

II MATERIALS AND METHODS:

2.1 Experimental design:

The trial is being conducted in Bintagoungou (Hameye farm), Bougoumaïra and Goundam as a split-plot. Soil treatments are being used as main plots and combinations of plant population and seed treatments as sub-plots. Two blocks were used per site.

Main plots (Soil treatments)

Soil treated with Furadan

Soil not treated

Sub-plots: (Combinaison of plant population and seed treatment)

DP1 = 1m x 1m (No thinning);

DP2 = 0.75 m x 0.50 m 3 plants per hill (75 000 plants per ha);

DP3 = 0.75 m x 0.25 m 3 plants per hill (150 000 plants per ha)

DP4 = DP3 + seed treatment

DP5 = DP4 + seed treatment

2.2 Data collection:

Spatial occupation by the crops will be appreciated on the basis of actual number of germinated hills per ha. Germination will be appreciated by the ratio of actual to planned number of hills (expressed in %). Number of hills, of stems, of panicles as well as panicle and grain weight will be recorded at harvest.

2.3 Data analysis:

Data will be analysed using Statistical Analysis System. Analysis of variance will be used to test treatments effect. Ppds will be used for pre-planned comparison, involving one of the selected varieties in one hand and the check one in another. Multi sites analysis will be used to assess varieties x sites interaction.

3. DIAGNOSIS IN THE 'DECRUE SYSTEM' OF NORTHERN MALI OF SOIL NUTRIENT DEFICIENCIES FOR SORGHUM

I OBJECTIVES:

1.1 Global objective

To develop a fertilization strategy based on scientific knowledge of soil parameters and the farmers's production objectives.

1.2 Specific objectives:

-To determine soil nutrient deficiencies in the decrue system of northern Mali.
-To better understand relationship between soil and plant parameters in order to build a fertilization strategy for a decrue cropping systems.

II MATERIALS AND METHODS:

Nutrients availability in soils of the 'decrue system' are being assessed using sorghum response to the following fertilizers treatments.

- 1 NPKS
- 2 NPKS (-P)
- 3 NPKS (-N)
- 4 NPKS (-S)
- 5 NPKS (-K)
- 6 No fertilizer

NOTA BEMA: 1) Number of rows reduced from 6 to 3 in Télé lake (Goundam); in Faguibine lake (BTG) 6 rows were maintained.

2) Rows length = 6 m ; Between rows = 0.75 m; within rows = 0.50 m.

In addition, diagnosis in soil nutrient deficiencies will be expanded to Mopti region and Tombouctou region (lake HORO). Nine farmers with 3 per fringe (high, intermediate, and low) are concerned in both regions with **the participation of Regional Direction of Agriculture.**

Data collection:

Data will be recorded on : a) plant parameters (sorghum grain, stems and biomass yield) and soil parameters (Texture, pH, organic matter, P available, Ca, Mg and Na).

4. TESTING SELECTED VARIETIES BY FARMERS OUTSIDE THE FAGUIBINE LAKE

I OBJECTIVES:

1.1 Global objective:

To assess on decrue sorghum, research findings (recommended cultural practices) on rainfed sorghum.

1.2 Specific objectives:

-To assess adaptability and performance of 3 cultivars selected from previous research.

II MATERIALS AND METHODS:

Randomized complete block design is being used to compare to a check one, three selected cultivars from experiments conducted in 2008 and 2009: Saba Sôtô, Saba Tienda and Niaticama. The study is being conducted in Mopti, Gao, and Tombouctou regions with six blocks per region. Within each region, farmers are being used as blocks. Data are being collected on germinated and harvested hills, days to flowering, and grain weight.

Décrue Research and Technology Transfer (Demonstrations) Workplan 2010

The 2010 Work plan will consist of two parts, one associated with the proposed research and the other associated with the demonstration efforts.

Research

The research projects will consist of two components. The first will be work conducted in the décrue areas of Lake Faguibine and the Mopti area. The work in the Mopti area will also be connected to some of the demonstration activities.

1. Plant Geometry Study

The objectives of these studies are to continue to refine our understanding of the effects of plant density on sorghum yields. Results from 2008 and 2009 suggest that higher plant densities result in higher yields. The 2009 results were not-significant across the treatments established, but definite trends exist.

The treatments for 2010 are:

1. 1m x 1m hill spacing with no thinning – current farmer practice
2. 0.5m x 0.75m hill spacing with 2 plants per hill
3. 0.5m x 0.75m hill spacing with 3 plants per hill
4. 0.5m x 0.25m hill spacing with 2 plants per hill

Three to four replications and repeated on 2 to 3 farmer fields in Lake Faguibine

2. Seed Protection Study

This study will also be a continuance of previous research. The objective of this study is to determine if seed treatments or planting time fertilizer will influence yields compared with current farmer practices.

The treatments for 2010 are:

1. PC1: 1m x 1m hill spacing without seed treatment or fertilizer – current farmer practice
2. PC2: 0.5m x 0.75m hill spacing with 2 plants per hill
3. PC3: PC2 + seed treatment for insects
4. PC4: PC3 + 5 kg DAP per ha
5. PC5: PC3 + 10 kg DAP per ha

Three to four replications and repeated on 2 to 3 farmer fields in Lake Faguibine

3. Soil Fertility Study

The objectives of this study are to determine the effects of individual plant nutrients. This will be accomplished by comparing a complete fertilizer treatment to those with nutrients removed.

The treatments for 2010 are:

1. No fertilizer control
2. N-P-K-S fertilizer mixture
3. N-P-K fertilizer mixture
4. N-P-S fertilizer mixture
5. N-K-S fertilizer mixture
6. P-K-S fertilizer mixture

Three to four replications and repeated on 2 to 3 farmer fields in Lake Faguibine

This study will also be placed on 1 to 2 farmer fields in the Mopti region.

4. Cultivar Screening Study

One of the issues that we have become aware of is that some cultivars that are quite productive in Sotuba Station are not well adapted to northern latitudes. In fact, one of the breeders indicated during the 2009 field trip that they have had cultivars that were introduced into the north that did not even flower due to photoperiod sensitivity. Cultivar selection is something that is always mentioned by farmers and others in the region, therefore a method to screen a wide range of cultivars in a lower risk (from drought, livestock feeding, etc) scenario in the north is needed. We propose to plant two replications of 30 to 40 cultivars at the Gao and Dire IER stations. These would be planted in March similar to the same dates used in the *décrue* field studies. Early season irrigation (March) and irrigation(s) during the dry period in the spring prior to the rains will emulate the *décrue* environment somewhat. The plots will be rainfed once the rainy season begins. Measurements taken by the resident IER staff will be: anthesis date, maturity date and grain yields. This project will be overseen by Mr. Diallo and Aly Soumare's staff at Gao and Dire stations. The projected cost of this activity is 2,500,000 cfa or \$6,000

2010 Proposed Décrue Sorghum Cultivar Demonstration Protocol for Activities Conducted by NGOs

A recent meeting in Mopti (Feb 2010) was organized to engage IER extension personnel and NGO personnel regarding potential demonstration plots in the north of Mali. The objective of these activities will be two fold. One is to collect additional data regarding the décrue systems in the Gao, Kidal, Tombouktu, and Mopti areas. These data will focus on cultivar performance in décrue systems. Three common cultivars will be included in each plot with the participant encouraged to include one to three local cultivars for both comparison and screening purposes. Deliverables will include maturity ratings (anthesis and physiological maturity) and farmer contacts throughout the growing season. All participating NGOs will be offered 450,000 cfa per plot or about \$1,000 per plot.

Objective: To obtain high quality and reliable data on the performance of cultivars in the North of Mali.

Proposed Sites: Farmer's fields up to their discretion.

Proposed Treatments: Three common cultivars as selected by Abdoul Wahab Toure based on results from 2008 and 2009 Décrue research and three or more additional local varieties.

Proposed Conditions: Plots would be planted on farmer's fields up to the NGO's discretion. The plots must be replicated at least three times if adequate seed is available.

Proposed Measurements/Deliverables:

- ❖ Stand ratings two weeks after planting.
- ❖ Bloom notes – relative maturity of cultivars. Requires one to two visits near flowering period.
- ❖ Harvest data – heads per plot/area harvested
- ❖ Harvest data – Harvest panicles and take fresh weights and allowed to dry in the sun for several days and take dry weight.
- ❖ Seed saved for future use as planting seed (optional).
- ❖ Number of farmers contacted through field visits and demonstration trainings/field days.
- ❖ Farmer perceptions of cultivars (if possible)

Data will be reported to Abdoul Wahab Toure, who will function as project coordinator in Mali.




Proposed Amount: 450,000 cfa per location

Funds will be dispersed directly from INTSORMIL to the respective organization on behalf of the individual.

Décrue sorghum demonstrations conducted by NGOs in 2010 crop season.





NGO	Demonstration Activity
DRA Mopti (1 trial)	Testing varieties Nutrient deficiency trials
DRA Tombouctou (2 trials)	Testing varieties Nutrient deficiency trials
CONFIGES (3 trials)	Testing varieties
AFRICARE (4 trials)	Testing varieties

Décrue Sorghum Activities

<i>Décrue Sorghum Activities</i>	
<p>Transfer of Sorghum, Millet Production, Processing and Marketing Technologies in Mali</p> <p>Component: Décrue Sorghum</p> <p>Mali:</p> <p>Abdoul W.Toure (Agronomist) Niabe Teme (Breeder) A.G. Diallo (Breeder) M. Diourte (Pathologist)</p> <p>L. Keita (Technician) Students: O. Sango, M. Sanogo and I. Toure</p> <p>United States:</p> <p>Vara Prasad (Physiologist) S. Staggenborg (Agronomist) S. Heinrichs (Entomologist)</p> <p>    </p>	<p>The Team</p>

<p style="text-align: center;">Decrue Team</p>  <p style="text-align: center; font-size: small;">NGOs, IER staff from Gao-Dire Station, IER Sotuba Station, and IER Extension from Mopti meeting in Ségou, 2 February 2010 to develop the décrue sorghum workplan.</p>	
<p style="text-align: center;">Overall Goal and Hypothesis</p> <p>Overall goal will be to generate and transfer improved agronomic techniques with appropriate décrue sorghum cultivars to improve food production and foster economic improvement of northern Mali.</p> <p>Our research hypothesis is selection of improved cultivars suitable for Décrue cultivation and improving input (fertilizer and pesticides) and crop (planting date, density and orientation) management will improve productivity of this region</p> <p>Package of practices will include a combination of cultivar and crop/nutrient management practices.</p>	<p style="text-align: center;">Goal</p>

<p style="text-align: center;">Decrue Sorghum: Challenges</p> <ol style="list-style-type: none"> 1. Soil should be inundated long enough to absorb enough water to sustain initial growth of the plant. 2. It should be planted at elevations high enough to let plant reach maturity in the interval between the beginning of rains and the arrival of the floods. 3. Sorghum generally needs about 150 d to mature, which restricts its planting in low elevations. 4. Some farmers transplant from high elevations – if he is confident that the flood will not destroy crop before harvest. 5. If recession is too rapid, farmer will not have time to prepare the seedbed before soil dries below the optimum moisture. 6. Speed of recession will limit the area of planting by farmers 7. Uncertainty of strength of flood and date of arrival is important. 	<p style="text-align: center;">Challenges</p>
<p style="text-align: center;">Decrue Sorghum: Constraints</p> <ol style="list-style-type: none"> 1. Lack of knowledge about cultivars available or suitable for decrue. 2. Lack of knowledge about best management practices. 3. No data available on possible impact of nutrients (fertilizers). 4. The growth systems (roots and shoots) of decrue sorghum cultivars is not known. 5. Impact of moisture (water levels) on growth, productivity and yield is not documented or known. 6. Impact of improved management (i.e. use of inorganic or organic fertilizer / irrigation in some regions during dry periods) not understood. 7. Interaction of fertilizer and water levels not understood and needs investigation. 8. Few tested cultivars well suited for decrue production. 	<p style="text-align: center;">Constraints</p>

<p style="text-align: center;">Specific Objectives</p> <ol style="list-style-type: none"> 1. Understand farmers perceptions on current crop management practices, preferences and needs. 2. Document and collect the various cultivars that are being grown in décrue sorghum. 3. To conduct research on soil, water and nutrient management in decrue sorghum to improve productivity. Planting techniques; Fertilizer Management; and Pest Management (weeds, diseases and pests) 4. To transfer the generated technologies to producers 	<p>Objectives</p>
<p style="text-align: center;">Décrue Sorghum: Planted in Receding Lake or River Water</p> <div style="display: flex; flex-wrap: wrap;">     </div>	<p>The environment</p>

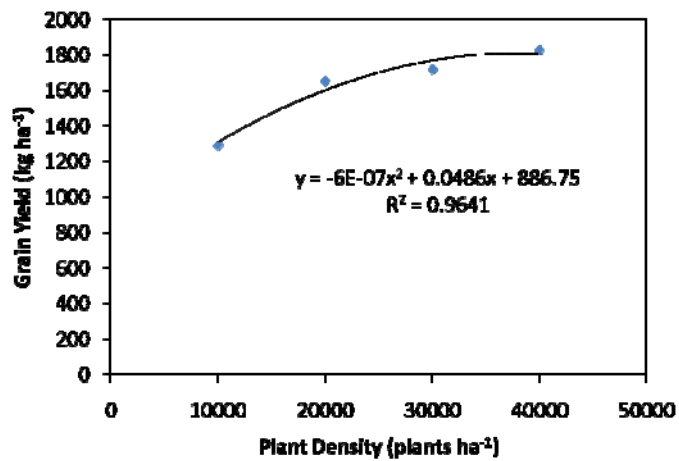
Cultivar Preferences and Performance



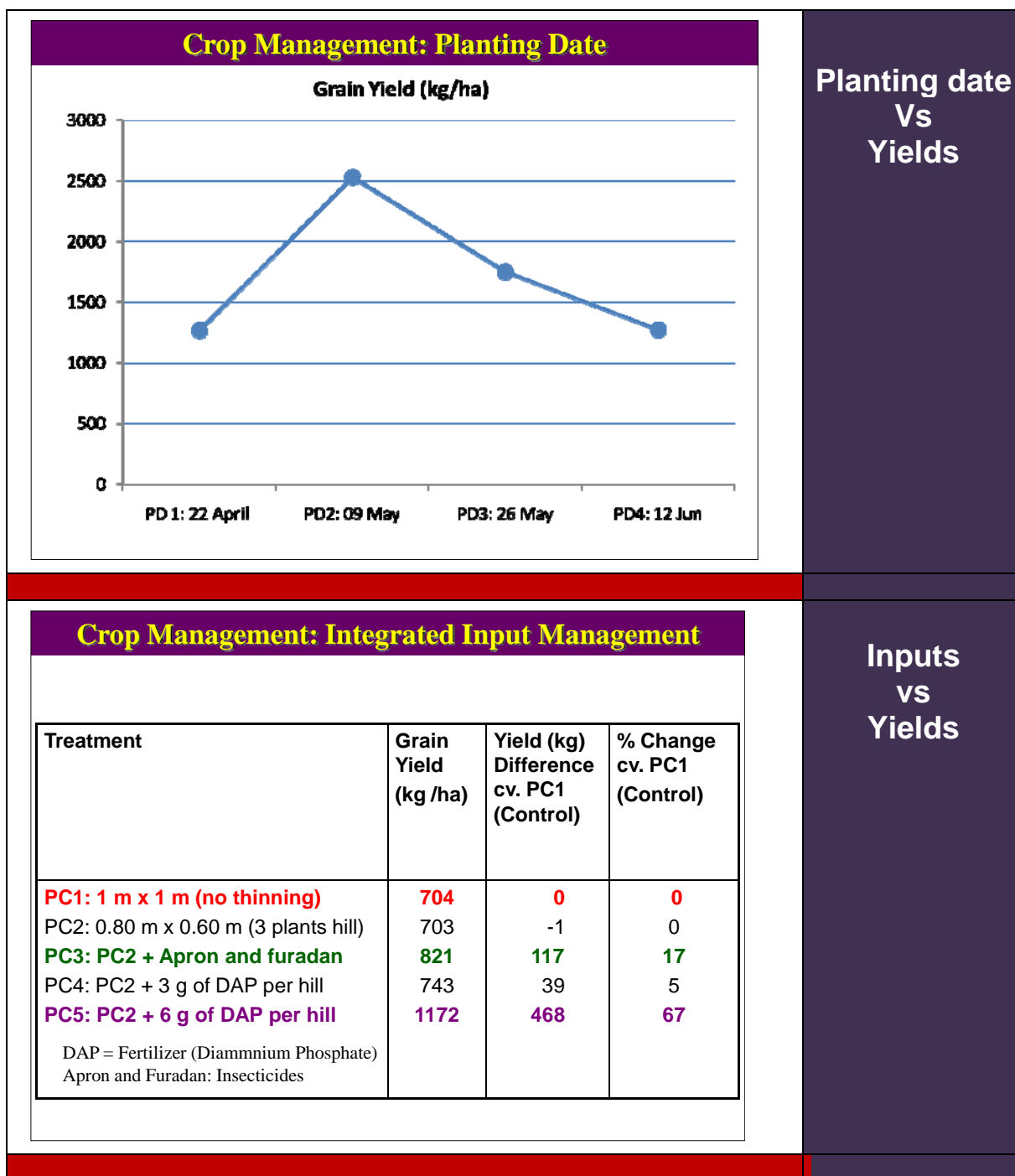
Mamadou Abba YATTARA, a collaborative farmer with IER, elated about new variety "Niatichama"

Cultivar
selection

Crop Management: Plant Density



Density
Vs
Yields



Decrue – Tour - 2009



High
yielding
décrue
cultivar

Training at Kansas State

Vara, Sory, Scott, Bandiougou, Alassane



Bandiougou and Sory filling pots with soil



Sory and Bandiougou helping other students in greenhouse



Sory and Bandiougou in greenhouse with sorghum plants



The décrue
team of
Staggenborg
and Prasad
provide
academic
(M.Sc.)
training in
sorghum
agronomy at
Kansas State
University

Training Activities

Jess Lowenberg-DeBoer, Purdue University

Long Term Training (Academic)

Fatimata Cisse was admitted to Purdue's Food Science Graduate Program in January 2010. She has completed her first semester at Purdue and did well – all A's and B's. She will start some research work here in the US this summer and will take two classes. Since she is not able to start her research in Mali this summer, she has requested and we are awaiting USAID approval for her husband to visit for one month late this summer.

Bandiougou Diawara was admitted to Kansas State's Agronomy Graduate Program in June 2010. From January to May, 2010 he was enrolled in Kansas State's English Language Program (ELP). He successfully completed the Spring ELP course—allowing his full admittance to their Graduate School. He is taking courses this summer and starting his research here in the US.

Sory Diallo was identified as a replacement for Ms. Djeneba Dembele, who withdrew from the program due to the birth of her child. Sory arrived in the US January 2010 and started his English language training at Kansas State through their English Language Program. He did well in his first semester of English and will continue ELP through the summer. His admission to KSU Graduate School/Department of Agronomy is scheduled for August 2010.

Aly Ahamadou and Mamadou Dembele were both admitted in January 2010 to Purdue as post-baccalaureate students for the Spring 2010 semester since they had not reached the required TOEFL scores for graduate school admittance. They are continuing the English program this summer and they will apply for entrance into the Ag Economics program at West Texas A&M for the Fall semester.

Short Term Training

One short term training has been arranged for this summer. Abocar Oumar Touré will come to Purdue August 1 to start his plant breeding training with Mitch Tuinstra. He has been entered into the TraiNet system and the vetting process has begun. The planned program dates are August 1 to September 30, 2010.

The production trainee, Abdoul Wahab Touré, will wait until summer/fall of 2011 to come to Kansas State for his short term training. The decision to delay until 2011 was made to best accommodate his Decrue research in Mali and production season timing in the US. The third proposed short term training is in agricultural economics/marketing and the candidate initially proposed is no longer available. John Sanders is discussing the best way to handle this proposed training with Drs. Bino Teme and Mamourou Diourte.

Report submitted by:

E. A. "Short" Heinrichs

Assistant Director

INTSORMIL

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402-472-6011

File: Mali Bi-Quarterly report April 1 to June 30, 2010