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

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by

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

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Table of Contents

Introduction

Production-Marketing

Decrue sorghum

INTSORMIL

Processing

Training

"Processing and Marketing Technologies in Mali" Project

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.**

Acronyms and Abbreviations

ACRONYM	DESCRIPTION
AMEDD	**Association Malienne d'Eveil au Developpement**
BNDA	**Banque Nationale de développement Agricole Mali**
CONFIGES	**NGO/ Gao**
CRRA	**Centre regional de Recherche Agronomique**
DRA	**Division de la Recherche Agronomique**
FCFA	**Franc CFA**
Ha	**Hectare**
IER	**Institut d'Economie Rurale**
IICEM	**Integrated Initiatives for Economic Growth In Mali**
LTA	**Laboratoire d'Tecnologie Alimentaire (IER)**
MOU	**Memorandum of Understanding**
MT	**Metric tonne**
NGO	**Non Governmental Organization**
RCGOP	**NGO/ Tomboctou**
WFP	**World Food Program**
WTAMU	**West Texas A&M University**

Executive Summary of Achievements

Management Entity

A publicity campaign was initiated with the goal of promoting the project to more rapidly transfer sorghum and millet production, marketing and food processing technologies to farmers and entrepreneurial food processors. The campaign includes signage at project sites, t-shirts and hats with appropriate logos for collaborators, radio TV spots and submission of USAID Success Stories to the Mali Mission. A 20 minute movie on the IER/INTSORMIL collaboration has been produced and shown on local TV. The movie will be translated to English and placed as four 5 minute chapters on the INTSORMIL website with links to YouTube.

Production-Marketing

AN INTSORMIL Production-Marketing team visit to three principal activity sites to review results from the 2010 campaign indicated increased millet yields and profits in comparison to non-project crops. **Most farmers were elated with the yields of one to two tons of millet/ha compared to the regional average of around 400 kg/ha** and thus are eager to participate in planning for the expansion of project sites in 2011.

We are extending with SAA collaboration the project area in 2011 by another 500 ha and with the revolving fund again providing inputs to the 500 ha planted last year. In 2011 all inputs paid for the 500 ha of last year with these profits and another 250 ha with the profits from the sale of the millet. Because of the superior quality of the grain the millet was sold for **140 CFA/kg** to PAM, the agency for food relief, when the market price was **115 CFA/kg**. Note that the BNDA is entering to finance the inputs for another 250 ha making a total of 1,000 ha in the Segou region. Another partner selling the inputs is Arc de Ciel. They provided the fertilizer last year and will again this year and 1,000 sacks of DAP and 1,000 sacks of Urea will be purchased from them for this program in 2011. Note that a remaining constraint for our Pilot Project is to develop a strategy to increase local **bank involvement** in input finance at the start of the crop season so that the responsibility for input financing now provided by INTSORML can be transferred to local banks for sustainability of the project.

A second constraint is the **need for storage facilities**. In the INTSORMIL marketing strategy for Mali the principal price problem that we first focus on avoiding is the harvest price collapse. To avoid the price collapse farmers' associations need to have local storage facilities to be capable of waiting until prices recover for the price recovery. INTSORMIL scientists have assessed the need for more adequate grain storage facilities in Mali. We are collaborating with USAID/IICEM in facilitating the construction of local storage facilities. In all sites the farmers' associations have been organized to provide the labor and USAID/IICEM has begun their evaluation for supplementary financing for their storage facilities

Food Processing

An important facet of the Food Processing project has been the development of a center at IER in Sotuba that has in place the same processing equipment that has been introduced to our partner entrepreneurs in the Mopti/Gao region of Mali. The center will facilitate transfer of processing technologies to the entrepreneur processing sector **1) through training workshops**, **2) access to processing equipment and testing of products in the marketplace**, and **3) assisting entrepreneurs** through technical support to gain funds for mechanization of their processing enterprises. The dedication ceremony for the new center is scheduled in June 2011 and will coincide with a training workshop for Bamako-area cereal processors as well as our Mopti/Gao entrepreneur beneficiaries.

A study was recently conducted through INTSORMIL by the Food Processing Component (Purdue Hamaker Project) to examine thick sorghum/millet consumption related to preference and satiation in the Sikasso, Segou and Mopti regions of Mali. This is part of a larger study to understand the effect of thick porridges, and delayed glucose delivery to the body, on satiety and overall food consumption. The exciting conclusions from the study are that **thick porridges (tô) are generally eaten more frequently in the villages and are consumed in a thicker consistency and are very satiating** (thicker porridges correlated with lower hunger scores at 2 and 4 hours post-consumption). We believe that this finding could be used in a promotional campaign to encourage urban populations to consume more sorghum/millet tô – something on the order of ***"eat sorghum and millet – they are healthy satiating foods (not 'poor' foods)".*** Particularly in this time of high prices for grain imports, we believe this could be helpful. If one million families ate one more meal a week of sorghum/millet tô (using about 1 kg of flour for the meal), that is about 50,000 metric tonnes of grain a year, which is more than the total wheat imports into Mali in 2008.

Décrue Sorghum in Northern Mali

1. Expanding the Use of Well Adapted Varieties Identified in the Décrue System
Local varieties (Saba Soto, and Saba Tienda) were identified for their yield performance and adaptability, while an introduced variety (Niatichama) was identified for its grain quality despite its low yield stability. Cultivars Saba Soto and Saba Tienda had high yields in 2008 and 2009 and were selected for testing on expanded area in 2010 by more farmers in Faguibine Lake region.

2. Testing New Sorghum Lines Under Simulated Irrigation at On-Station (IER) Conditions
The demonstration plots showed superior adaptability of varieties Saba Soto and Saba Tienda when compared to Niatichama in the décrue production systems in northern regions of Mali. There is a need to test more genotypes for yield stability and grain quality in this region

3. Soil Nutrient Deficiency Studies in Décrue Production System
With the continuous and frequent inundation of soil with water from the lakes effective soil nutrition is critical for increasing grain yield of sorghum in the décrue production system. In addition, farmers do not now apply nutrients. The response of sorghum to fertilizer depends upon the soil type and location. In poor soils such as those in Tonka the crop responds to nutrients. Maximum decreases in grain yield were observed when N or P were deficient. Further detailed studies at multi-locations with different soil types and textures along with measurement of soil nutrient and plant nutrient uptake are being conducted and will lead to appropriate fertilizer management practices for the décrue production system.

4. Pest Management
Birds were a major biotic constraint in the Gao Region trials in 2010. Yield losses were >99% on several sorghum cultivars.

Training

Long Term Training (Academic)

Fatimata Cisse continues to perform very well in her degree program at Purdue in Food Science. She will spend approximately 8 weeks in Mali this summer doing her field research. **Bandiougou Diawara** and **Sory Diallo** are both pursuing master's in Agronomy at Kansas State. **Bandiougou Diawara** is progressing well in his graduate studies. He completed his first season of field studies and is currently analyzing the data. In addition, he is conducting literature review on cold tolerance in sorghum. He will be repeating his field experiments in summer 2011. **Sory** enrolled in two courses this semester (spring 2011). He is performing well in both the courses. In addition, he started his thesis research. His research will focus on evaluating the sorghum germplasm collection for abiotic stress tolerance (cold stress, salinity stress, drought and temperature stress). **Aly Ahamadou and Mamadou Dembele** are enrolled in Level III (top class) of West Texas A&M University's English as a Second Language (ESL) program. Both are working hard and making good progress. At this time, we expect them to complete ESLI this term and be ready for graduate study beginning this summer. Upon successful ESLI completion they will be conditionally accepted into the graduate program to pursue their non-thesis master's in agricultural economics. They plan to take two graduate level agricultural business and economics courses in summer 2011. Their non-thesis program should take 18 months with an anticipated completion date of December 31, 2012. ***We will be requesting a no cost extension to allow them to finish their degrees.***

Short term training

Yara Koreisso Dembele, from the Food Processing project at IER Sotuba attended the 9th African Nutrition Leadership Program in South Africa, which built capacity in leadership, communication, and advocacy skills in the area of food and nutrition science. Dembele will apply her improved skillset in the INTSORMIL Technology Transfer Project, which aims to expand markets for millet/sorghum and other grains through the promotion of high quality and market-competitive processed products. **Abdoul Wahab Toure** is planning to do his short term training at Kansas State this summer where he will work with Drs. Prasad and Staggenborg in Agronomy.

Progress

Production – Marketing Activities

John Sanders, Purdue University and Botorou Ouendeba

Trip Report to Sites of Production-Marketing, March 19-April 2, 201

Our trip objective was to visit our three principal sites in preparation for our activities in the summer of 2011. The three sites are the sorghum activity in Koutiala in which we have been working with AMEDD (an NGO focusing on the Koutiala region), the millet zones of the Mopti region with DRA (regional office of the national extension service in the Mopti region), and the millet zone of Segou with SAA-DRA (an NGO formerly Global 2000 working all over Africa on the introduction of food crop technologies and the regional office in Segou of the national extension service).

On Monday we met with IICEM to coordinate our activities. They informed us that they are just working in Koutiala and Mopti in 2011 and have ceased new construction of storage due to a freeze on their pipeline funds. They also informed us that they would be working with AIID (another NGO working in Koutiala) rather than AMEDD. We agreed to meet with AIID and with the IICEM regional representative in Koutiala. We also agreed to buy certified Toroniou seed for their Mopti program. Jean Francois mentioned goals of 2,500 ha in Koutiala (Grinkan sorghum) and 2,000 ha (Toroniou millet) in the Mopti region.

The regional program directors of IICEM are in the process of signing up farmers in the two regions, Koutiala and Mopti. With these lists they will approach the BNDA in both regions. Lending for individual farmers' associations would then be available through vouchers to buy fertilizer. Since the fertilizer needs to be available on the farms in May, there is very little time to accomplish all the organization and travel required in the two regions. Nevertheless, this IICEM program seems like a systematic process to get the initial input credits and to organize farmers' associations for bank loans. The IICEM program and our pilot project field work will be aided this year by the extension of the inorganic fertilizer subsidy to millet and sorghum.

Then we traveled to Koutiala and met with AMEDD. We had funded AMEDD to acquire Grinkan seed for the 2011 planting. But we had insisted on germination trials after the poor germination experience of 2010 with Grinkan. Germination rates were around 60% in 2010. This poor germination has been attributed to insects but with the PICs triple sacks insects would have been controlled. Hence, late rains in 2009 and mold must have been the important factors. In 2010 late rains were heavy and pervasive. Germination tests by AMEDD in 2011 ranged from 0 to 20%. So in the pilot program in Koutiala we are calling off our

diffusion activities for this crop year and will be engaged in seed production of Grinkan during the summer of 2011. This is probably fortuitous since for some time we have been wanting to focus more on seed production to improve quality especially eliminating the off types from farmer based seed production. We also will be testing a limited number of new millet cultivars in 2011 as Toroniou is a very old selection from the Dogon region of Mopti (identified and promoted by Oumar Niangado when he was the Director at the Cinzana agricultural research station of IER).

We have also advised AIID that even with germination rates as high as 60%, it would be better to wait a season and produce very good seed in 2011 for an expanded program in 2012. Nothing can be as disillusioning for farmers in a new production program as poor seed and having to spend substantial time replanting. Farmers will be taking loans for inorganic fertilizer and be asked to do many other labor intensive operations. We need to be sure that the seed is excellent. We will be producing seed on three different sites and Niaba Teme will be handling the organization of this program. Niabe is also arranging presently for Toroniou millet seed for 2011 for our pilot project in Mopti and for 1,000 ha in the Mopti region for the IICEM project.1 The seed will be kept in the PICs sacks. In Mopti as in other regions the critical input is still the inorganic fertilizer in these low soil fertility zones so getting the bank lending to the farmers' associations on time for them to buy the fertilizer in May will be critical.

We were very happy with the Wollo farmers' organization (Mopti region). They turned down an offer for 12,000/sack for their clean millet and counter offered 17,000. They later sold for 16,500.It is great to see farmers getting independence and confidence to negotiate. With the triple sacks the risk is largely eliminated from holding their grain longer so they are learning that they do not have to respond to the first bid. Wollo farmers have built storage but already it is insufficient space. Also we have the issue here for the second year in a role that the President of the farmers' association held the money from the grain sales rather than opening a bank account. The Wollo farmers' association was told that they have to open a bank account to continue the program. They have now opened a bank account. Once farmers' associations hold bank accounts it becomes easier for them to get bank loans for their members.

In the Kountogoro site that the Minister of Agriculture visited in the fall of 2010 farmers were very happy with the millet yields. 2010 was the second good rainfall year. Farmers estimated traditional millet yields at 400 kg/ha and their yields of one to two tons/ha. These yield estimates of two tons are probably too high but we will be evaluating yield performance with further field interviewing and reviewing the crop cut data. 2
The big yield gains for millet are when the farmers combine the inorganic fertilizer with the organic fertilizer on their better lands. Meanwhile the farmers' associations continue to make gains on improving their marketing by storing and selling later, getting the millet off

1 We were disappointed to learn that in the Mopti region the PICs sacks bought for the farmers' associations in 2010 were never delivered and are still sitting in the IICEM office.

2 . Unfortunately, the crop cut estimates are not very reliable. When several crop cut estimates together are exactly the same or yields are over 2 tons/ha for millet both conditions are suspect.

the ground to sell a cleaner millet, and convincing the farmers' associations to bargain for a better price. In the Mopti region the storage facilities generally are too small so we need help them expand these storage facilities.

In the new sites of Begne and also Tere there were also inadequate storage facilities so this lack of storage is emerging as a principal constraint for the farmers' associations in the Mopti region. Yields were low in Tere apparently from famers not following well the recommendations so we are only expanding by 20 ha with half for women. In Konniekamole there was less than 50% repayment by the men and 100% by the women so we will increase the area of the women in 2011 (by 20 ha) with no increase for the men. Their storage facilities are also inadequate and badly used.

Also we need to emphasize to the farmers' associations that we have had two good rainfall years in 2009 and 2010 and we need to keep reminding farmers about the importance of water retention measures to use better the available rain in case of an adverse rainfall year. Organic matter helps here also.

There will be 320 new ha in the our new technology-marketing project in the Mopti region during 2011. There are already 420 ha in the program operating with the revolving funds. The IICEM program was expanded to 3,000 ha here.

In the Segou region SAA expanded the area in our new millet technologies and associated program by 494 ha (330 farmers) in 2010. We financed the fertilizer inputs which were then to be repaid to the farmers' associations as a revolving fund. IICEM financed the supervision costs and other SAA expenses. In 2010 IICEM cut out their support but SAA also has programs from Agra and the Gates program (Hope).

The missing element in our pilot project approach is obtaining input financing from the beginning of the project. So we asked SAA to bring together the regional BNDA bank representative and the fertilizer dealer to discuss how they could become involved in the program. The BNDA representative was willing to finance the fertilizer purchase for half of the new area. His guarantee was the involvement of SAA and the ability of the farmers' associations to finance the fertilizer purchase for original 500 ha and 250 new ha with the profits made in 2010 from selling their millet at 140 CFA/ kg (to PAM when the market price was 115). Repayment rates were generally good. 137 tons were sold and 63 tons were in storage in late March.

Mme Deme, a prominent millet food processor in Bamako, continues to be an important buyer of millet in the Segou region and has bought 85 tons of millet this year from Tingoni this crop year. The cereal grain quality still needs to be improved and we will be looking into that this summer. But the contrast between the region known for a dirty millet and our prime site, Tingoni, known now for a clean millet, is striking and we need to extend the Tingoni practices to the 994 ha here in millet production added in 2010 and 2011.
In a region with mean yields of 700 ha the estimated mean yields for program participants in Segou were 1.2 tons/ha. There were numerous problems in 2010 including the fertilizers arriving late, insufficient agronomical instruction, and some flooding. So we should have

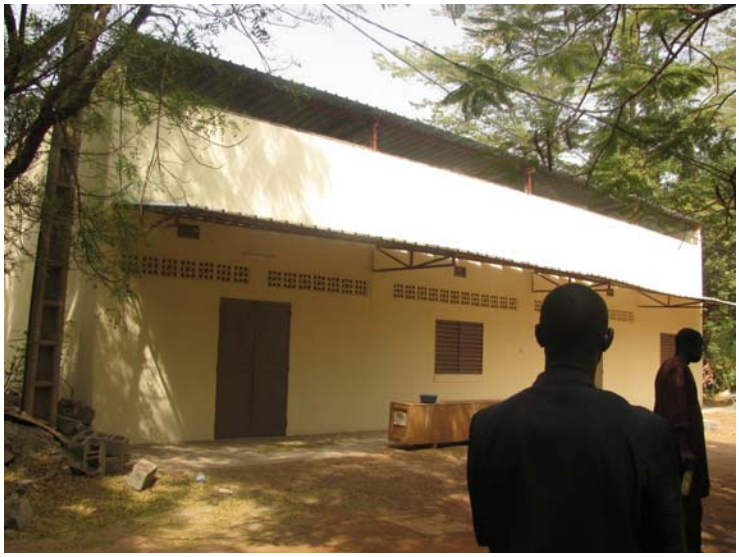
even higher yields here as farmers imitate the best farmers, who were following well the recommendations.

In Boajie the largest site in the Segou region in terms of area and farmer participants, there was poor repayment and some heated discussion on the need for repayment. Farmers complained about the delay in being able to use the screens for cleaning and putting the millet in storage. Reimbursement was 75% and they sold to PAM at 140 CFA/kg in February. Note that we held a workshop for these farmers' groups and the processors in the fall and the concept of searching for and insisting on a good price for a clean millet seems to be understood now.

Food Processing

Bruce Hamaker, Purdue; Yara Koreissi, IER/LTA/Mali; Mamadou Diouff, Consultant

An important facet of the processing project has been the development of a center at IER in Sotuba that has in place the same processing equipment that has been introduced to our partner entrepreneurs in the Mopti/Gao region of Mali. This unit functions to work out and improve food processing technologies and transfer improvements to entrepreneurs. In this way, processors can be made competitive with consistent quality products produced. Another part of the project, however is to work additionally with cereal processors in Bamako and other urban centers to bring new and appropriate mechanized cereal processing technologies for high quality processed products for the larger goal of expanding markets for millet and sorghum. To this end, in the first quarter of 2011, an enlarged and dedicated "IER Incubation Centre" was constructed and nearly completed at the IER Sotuba Station on the outskirts of Bamako. This facility which is a significant expansion of a smaller building will house primary and secondary processing equipment identified to process millet and sorghum to a variety of competitive quality products for the marketplace. These will include, but not be limited to a variety of milled products (high quality flours, semolina, grits) and precooked agglomerated products (couscous, degue, mone). The center will facilitate transfer of processing technologies to the entrepreneur processing sector 1) through **training workshops**, 2) **access to processing equipment and testing of products in the marketplace**, and 3) **assisting entrepreneurs** through technical support to gain funds for mechanization of their processing enterprises. The processing center will also function, as it has done previously for milling activities, as a unit to fine-tune and improve processing technologies to better fit Malian needs, and will provide a longer-term technical support function to cereal processors to improve their competitiveness. The opening ceremony for the new center is scheduled in June 2011 and will coincide with a training workshop for Bamako-area cereal processors as well as our Mopti/Gao entrepreneur beneficiaries.



New "Incubation Center" at IER, Sotuba, Mali in the final stages of construction.

Décrue Sorghum Activities

Scott Staggenborg and Vara Prasad, Kansas State University and Abdoul Wahab Toure, IER, Mali

1. Expanding the Use of Well Adapted Varieties Identified in the Décrue System

Local varieties (Saba Soto, and Saba Tienda) were identified for their yield performance and adaptability, while an introduced variety (Niatichama) was identified for its grain quality despite its low yield stability. All the varieties were among cultivars initially selected by farmers in 2008, based on their preferences. Yield performance was observed in all of them in 2008 but with less stability in Niatichama in 2009. Cultivars Saba Soto and Saba Tienda had high yields in 2008 and 2009 and were selected for testing on expanded area in 2010 by more farmers in Faguibine lake region.

Goal and Objectives:

The goal of this experiment was to identify high yielding stable cultivars in the region and expand its use by farmers in the décrue production systems in northern Mali.

The specific objectives were (a) to test in expanded area of the décrue system, adaptability of sorghum varieties selected from previous years in northern regions of Tombouctou, Gao and Mopti; and (b) to record quantitative data on farmers perceptions and points of view on the selected varieties through farmers participatory approaches.

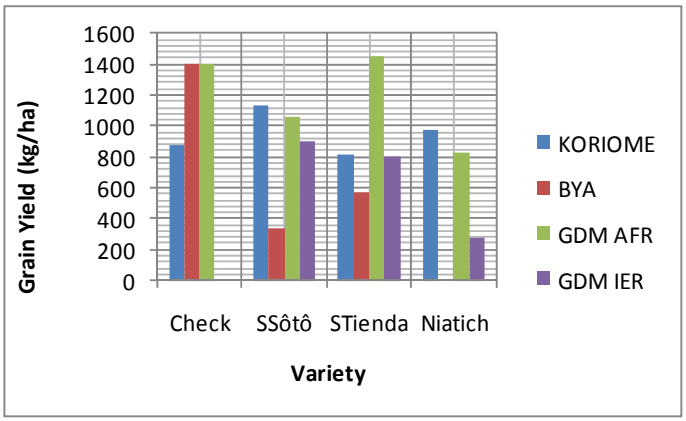


Fig. 1. Grain yield of four varieties at four different locations.

Materials and Methods:

Four varieties (local check, Saba Soto, and Saba Tienda, and Niatichama) were planted in a randomized complete block design with 6 replications. Each variety was assigned to 6 row plot of 6 m long and 4.5 m wide. Spacing was 0.75 m between rows and 0.50 m between plants. After emergence plants were thinned to 2-3 per plants per hill. No inorganic fertilizer was added. Time to flowering was recorded. At physiological maturity data on panicle and grain yield was recorded from two central rows. Farmers choice was recorded based on standard scoring method. 1st best (16 grade), 2nd best (12 grade), 3rd best (8 grade) and last (0 grade). Fifty farmers per location were used in the survey of perceptions. The data was analyzed using PROC GLM procedures in SAS. Varieties and location were used as class variables, and means were tested and separated using LSD to determine significance of location, varieties and interaction of location and varieties.

Results and Discussion:

There were significant effects of location, variety and interaction between location and variety (Fig. 1).

- In Koriomé: Saba Sôtô was the highest yielding variety, followed by Niatichama, local check and Saba Tienda.
- In Bya: Local check was the highest yielding variety, followed by Saba Tienda, Saba Sôto. Niatichama which did not flower.
- In Goundam (AFR): Saba Tienda was highest yielding variety followed by local check, Saba Sôtô, and Niatichama. There was infestation of pest on Niatichama.
- In Goundam (IER): Saba Sôtô was highest yielder, followed by Saba Tienda and Niatichama.

Farmers scores for the variety and grain yield at different locations showed differences in preferences. Data shows that farmers preferences is not always positively correlated with grain yield. This suggest the need for breeders to take into consideration the farmers preferences. Farmer's preferences for variety Saba Sôtô, Saba Tienda and check in Koriome (Fig. 2) were due to early maturity. Niatichama was reported in 2009 as a late cultivar with less stability although its grain quality was good.

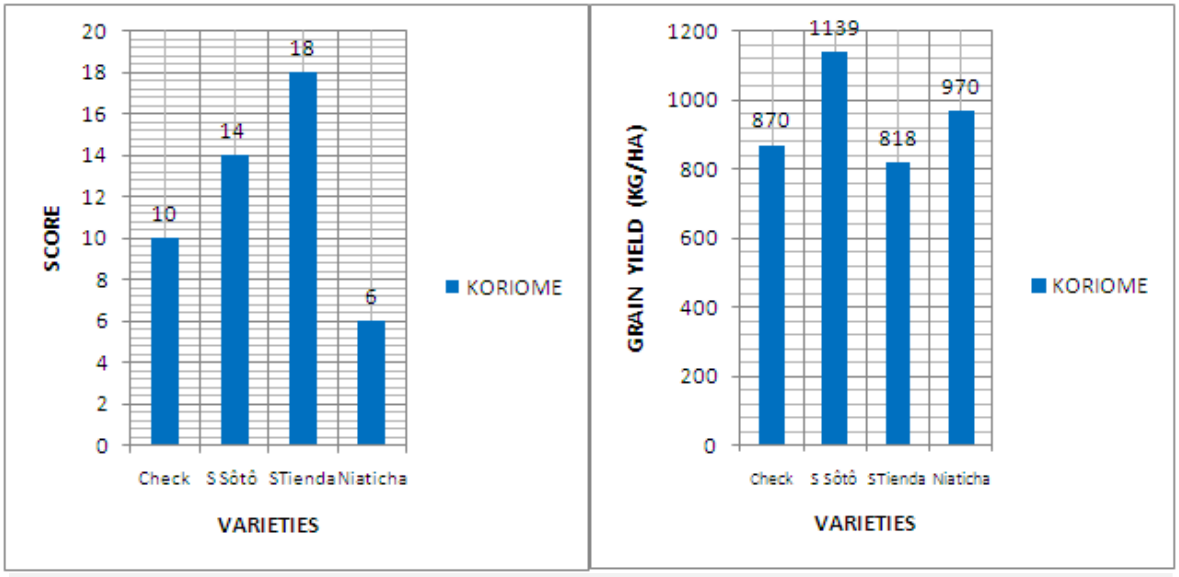


Fig. 2. Farmers scores and grain yield of different varieties at Koriome (Tombouctou Region) during cropping season on 2010.

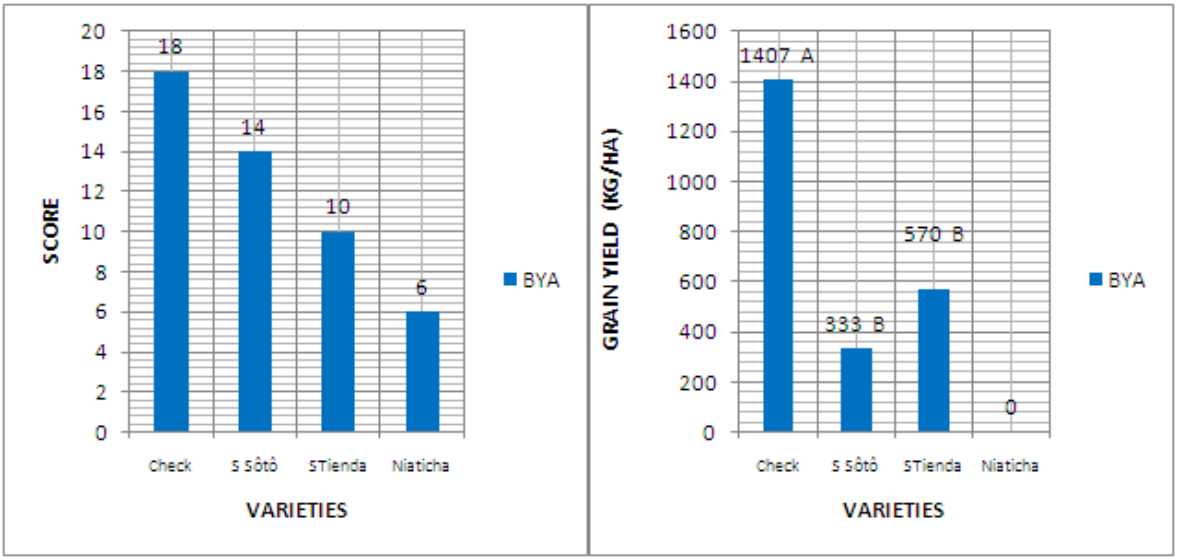


Fig. 3. Farmers scores and grain yield of different varieties at Bya (Gao Region) during cropping season on 2010.

In Bya, farmers scored the local variety superior followed by others as it yielded better than other (Fig. 3). Niatichama received lowest scores as it did not flower and produce any yield.

In GDM -AFR, variety Saba Tienda produced highest yield followed by local check, Saba Soto, while Niatichama had the lowest yields (Fig. 4). Despite the lowest yield Niatichama was preferred by women farmers (Fig. 4), while Saba Tienda was preferred by male farmers.

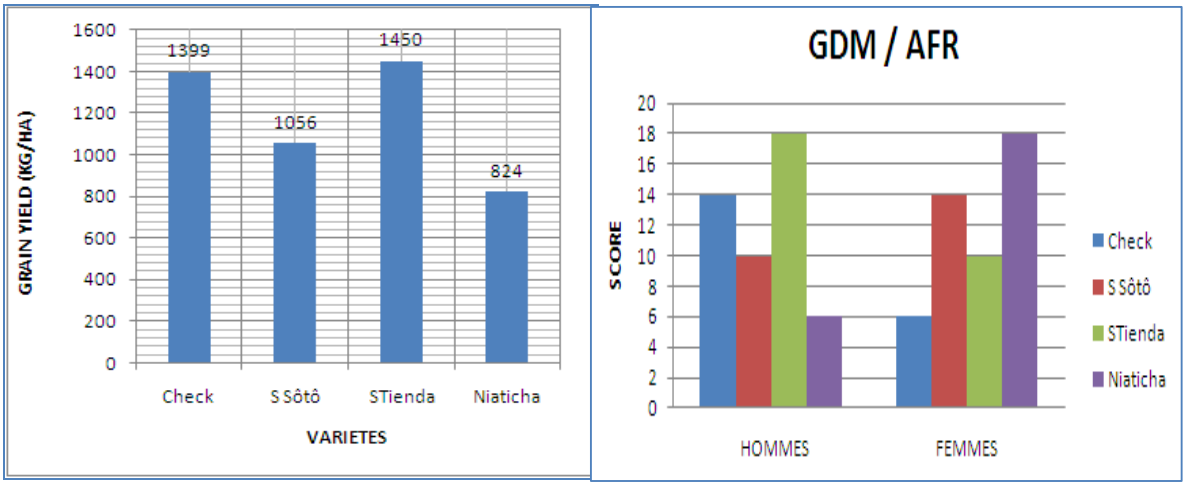


Fig. 4. Farmers scores and grain yield of different varieties in the decrue system of Goundam (Africare), Tele Lake (Tombouctou Region) during cropping season on 2010.

Conclusions: The demonstration plots showed superior adaptability of varieties Saba Soto and Saba Tienda when compared to Niatichama in the décrue production systems in northern regions of Mali. There is a need to test more genotypes for yield stability and grain quality in this region.

2. Testing New Sorghum Lines Under Simulated Irrigation at On-Station (IER) Conditions

Results from last year suggest strong Genotype by Environment interaction for grain yield. Thus, there is need to screen or evaluate more genotypes at multiple location to identify most suitable genotype for décrue region. Screening of genotypes as initiated at on-station (Gao and Dire) research facilities of IER.

Goal and Objectives:

The goal of these experiments was to identify new potential sorghum lines for décrue production systems. Specific objective was to screen sorghum lines for grain yield and stability.

IER Gao Station:

Materials and Methods:

Thirty five sorghum lines (29 new lines and 6 existing, as shown in Table 1) selected from the National Program and farmers fields were planted in Gao research station. Planting date was 05 May 2010. The experimental design was a randomized complete block design with two replications. Each variety was assigned to 2 row plot of 6 m long and 1.5 m wide. Spacing was 0.75 m between rows and 0.50 m between plants. After emergence plants were thinned to 2-3 per plants per hill. Data on vigor at emergence (scores), days to flowering was collected. At maturity data on plant height and grain yield was measured. Data was analyzed using PROC GLM procedures in SAS. Means were tested and separated using LSD.

Table 1. List of lines and their traits when grown in Gao during 2010 season.

S.No	Genotype	Vigor Scores	Days to Flowering	Plant Height (m)	Grain Yield (kg/ha)*
1	08-BE-F5P-2	3	158	3.025	19.25
2	08-BE-F5P-4	2	125	1.4	44.32
3	08-BE-F5P-51	4	143	1.49	19.25
4	08-CZ-F5P-29	4	126	2.325	19.25
5	08-CZ-F5P-43	4	129	3.2	12.45
6	08-FA-F5T-13	3	163	3.3	29.16
7	08-FA-F5T-24	4	133	3.25	21.29
8	08-FA-F5T-6-2	4	155	1.975	38.21
9	08-KE-F5T-25	3	163	3.275	39.81
10	08-KE-F5T-27	3	134	3.275	33.74
11	08-KE-F5T-32	3	146	2.925	32.13
12	08-KE-F5T-34	2	145	3.05	6.7
13	08-KE-F5T-38	4	138	1.625	10.9
14	08-KI-F5T-37	4	128	3.55	8.76
15	09-KO-F5DT-107	3	163	3.2	19.25
16	09-KO-F5DT-47	2	155	3.275	0.92
17	09-KO-F5DT-55	3	153	3.55	14.19
18	09-KO-F5DT-63	2	164	3.115	10.47
19	09-KO-F5DT-79	3	128	3.445	19.61
20	09-KO-F5DT-81	3	127	3.375	9.69

21	F2-78	2	145	1.65	35.61
22	DARREL KEN	2	145	3.275	19.25
23	NIETA	3	172	3.65	28.19
24	CSM 388	3	133	3.6	19.23
25	ZALABLABE	3	148	2.135	19.25
26	ZARRA	3	162	3.325	14.26
27	KENEKEBA	4	160	3.765	15.55
28	97-SB-F5DT-150	3	128	1.65	22.65
29	Saba Soto (23)	2	118	3.2	8.9
30	Saba Tienda(28)	3	96	1.85	11.08
31	SEGUETANA	3	165	3.925	19.03
32	TAFDIT 1	3	157	2.15	14.59
33	TAFDIT 2	3	160	2.075	2.18
34	BORELGOUDRO	3	159	2.35	17.3
Mean		2.75	144	2.83	19.3
LSD			4.87**	0.89**	NS

*Extremely severe bird damage.

Results and Discussion:

There was genetic variability in phenology (time to flowering) which ranged from 96 d to 172 d (Table 1). The average time to flower was 144 d. There was a wide distribution for days to flowering (Fig. 5). About 9% of genotypes were shorter (90-120 d), and other durations ranges were about 20% (Fig. 5). Plant height varied from 1.6 m to 3.7 m (Table 1). ***There was heavy infestation of birds*** **and yields were very low.** Thus, the yield levels are not depictive of the yield potential of the genotypes.

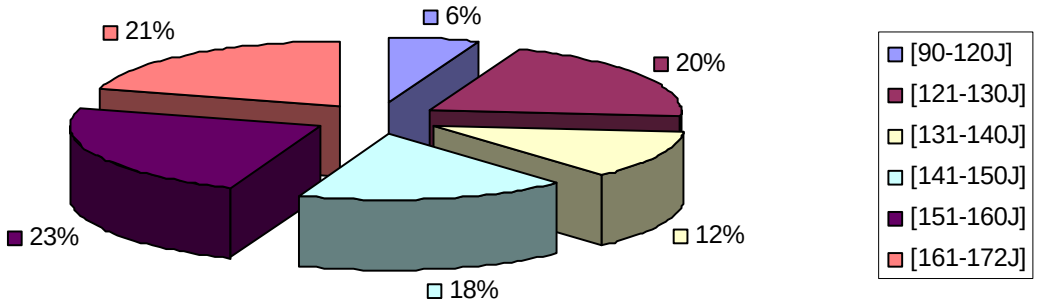


Fig. 5. Distribution if new genotypes into various duration classes on the basis of days to flowering.

IER Dire Station:

Materials and Methods:

Forty two sorghum genotypes (as shown in Table 2) selected from the National Program and farmers fields were planted in Dire research station. There were two planting dates (20 April and 5 June, 2010).

The experimental design was a split plot design with two replications. Main plot was planting dates and sub-plots were genotypes. Each sub-plot comprised of 2 rows of 5 m long. Spacing was 0.75 m between rows and 0.50 m between plants. Data on panicle emergence (50% panicle emergence) and grain yield was collected. Sensitivity index for day length was estimated using the formula: k = (days to flowering for planting date 1 minus days to flowering for planting date 2) / (number of days between planting date 1 and planting date 2). Values of k will be between 0 and 1. Data was analyzed using PROC GLM procedures in SAS. Means were tested and separated using LSD.

Results and Discussion:

There was genetic variability in phenology (time to panicle emergence) which ranged from 96 d to 184 d after planting in April planting date; and from 88 to 143 in June planting date (Table 2). The average duration was 161 days (April planting) and 124 (June planting). There was also wide variability in sensitivity index for photoperiod (ranged from 0.13 to 1.00). There was differences in grain yield among different genotypes across both planting dates. In general, on average across all genotypes, later planting dates produced slightly higher yields.

Table 2. Genotype and their traits in Dire during 2010 season. The highlighted lines are suggested for further testing.

S.No	Genotype	Days to 50% Panicle Emerg. (Date 1)	Days to 50% Panicle Emerg. (Date 2)	Photoperiod Sensitivity	Grain Yield (kg/ha) Date 1	Grain Yield (kg/ha) Date 2	Average
1	08-BE-F5P-2	178	143	0.78	848	688	768
2	08-BE-F5P-4	171	126	1	756	905	831
3	08-CZ-F5P-29	156	126	0.67	405	600	503
4	**08-CZ-F5P-43**	**146**	**118**	**0.62**	**883**	**1031**	**957**
5	08-BE-F5P-51	*	118	*	538	729	633
6	09-KO-F5DT-63	172	132	0.89	786	775	780
7	09-KO-F5DT-79	151	111	0.89	610	850	730
8	09-KO-F5DT-107	177	132	1	578	806	692
9	09-KO-F5DT-81	163	123	0.89	665	871	768
10	09-KO-F5DT-55	171	126	1	623	635	629
11	09-KO-F5DT-47	177	126	1.13	357	346	351
12	08-FA-F5T-13	177	137	0.89	543	715	629
13	08-KE-F5T-32	177	132	1	648	660	654
14	08-KE-F5T-27	163	132	0.69	396	407	402
15	08-FA-F5T-24	163	132	0.69	462	417	439
16	08-KE-F5T-25	182	139	0.96	316	362	339
17	**08-FA-F5T-6-2**	**171**	**132**	**0.87**	**1298**	**1550**	**1424**

18	08-KE-F5T-38	177	139	0.84	508	623	566
19	08-KI-F5T-37	171	118	1.18	451	554	503
20	08-KE-F5T-34	171	143	0.62	442	488	465
21	ZARRA	178	132	1.02	495	460	477
22	**DARREL KEN**	**156**	**132**	**0.53**	**855**	**1084**	**970**
23	SEGUETANA	177	137	0.89	442	488	465
24	CSM 388	163	118	1	492	538	515
25	NIETA	184	*	*	300	277	288
26	F2-78	171	126	1	752	1061	906
27	KENEKEBA	177	137	0.89	880	731	805
28	00-SB-F5DT-18(18)	171	126	1	711	951	831
29	**05-CZ-F5P-67-1**	**163**	**126**	**0.82**	**986**	**1306**	**1146**
30	08-SB-DU-119	163	118	1	467	765	616
31	**08-SB-DU-127**	**148**	**118**	**0.67**	**536**	**696**	**616**
32	08-SB-DU-135	156	118	0.84	490	616	553
33	08-KO-DU-111	109	103	0.13	313	314	314
34	**97-ML-0339**	**148**	**111**	**0.82**	**1183**	**1286**	**1235**
35	**SIGUI KUMBE**	**156**	**126**	**0.67**	**917**	**1123**	**1020**
36	04-SB-F5DT-42	163	126	0.82	490	616	553
37	**00-CZ-F5P-135**	**127**	**118**	**0.2**	**504**	**653**	**578**
38	**CSM-63E**	**133**	**96**	**0.82**	**290**	**336**	**313**
39	**97-SB-F5DT-150**	**156**	**139**	**0.38**	**867**	**1450**	**1159**
40	**Saba Soto (23)**	**141**	**98**	**0.96**	**637**	**671**	**654**
41	**Saba Tienda(28)**	**148**	**101**	**1.04**	**575**	**632**	**604**
42	**IRAT 204**	**96**	**88**	**0.18**	**242**	**376**	**309**
Mean		2.75	144	2.83	19.3		

Overall, for both plantings dates, genotype 08-FA-F5T-6-2 produced the highest grain yield (1424 kg/ha), followed by 05-CZ-F5P-67-1 (1146 kg/ha) and 97-ML-0339 (1235 kg/ha), performing better than the Saba Soto-23 (654 kg/ha) and Saba Tienda-28 (604 kg/ha). Based on these preliminary results, a group of four new genotypes with yield potential greater than 1000 kg/ha are selected for further testing (highlighted lines in Table 2). These genotypes include: 05-CZ-F5P-67-1, 97-SB-F5DT-150, 97-ML-0339, and 08-FA-F5T-6-2. In addition, other genotypes with yield potential of >500 kg/ha (highlighted in Table 2), and some low yield lines <500 kg/ha and standard checks will also be used.

Conclusions: These two experiments show that there is genetic variability for grain yield in sorghum genotypes. Potential genotypes for further evaluation under on-station and on-farm tests were identified. Farmers participation in the genotype selection is critical and will be taken up in future years.

3. Soil Nutrient Deficiency Studies in the Décrue Production System

Good and effective soil nutrition is critical for increasing grain yield of sorghum in the décrue production system. This is particularly important due the continuous and frequent inundation of soil with water from the lakes. In addition, farmers do not apply nutrients. Therefore, there is need to evaluate the response of sorghum to fertilizer application.

Goal and Objectives:
The goal of this experiment was to determine optimum fertilizers (combination of major nutrients) recommendation for décrue production systems.

Specific objective was to assess soil fertility in the décrue system through demonstrating sorghum responses to fertilizer.

Materials and Methods:

Nutrient subtractive method based on complete fertilizer N (nitrogen), P (phosphorus), K (potassium) and S (sulfur) was used to determine treatments. There were six fertilizer treatments: [NPKS (all nutrients), PKS (i.e. without N), NKS (without P), NPS (without K), NPK (without S) and no fertilizer control] in a randomized complete block design with 9 replications. Experiments were conducted in three regions (Goundam, Tonka and Mopti) in 2010. Soil samples were collected to estimated soil chemical and nutrient status. Data on biomass production and grain yield was measured at final harvest. Data was analyzed using PROC GLM procedures in SAS. Means were tested and separated using LSD.

Results and Discussion:

In Mopti, the data on yield could not be collected as the fields were completely flooded after panicle emergence. In Goundam, yield data was only available from 3 replications. Whereas, in Tonka, although all the data was available, randomization was not complete.

In Goundam, there was no significant differences among the various fertilizer treatments on growth or yield traits (Table 3). This suggest the soil at the experimental site was fertile and provided all the necessary nutrients. In addition, it is also possible that flooding brings in fertile soil. Soil samples were collected prior to planting and are currently being analyzed for nutrients. This data will provide more information on the nutrient status of the soil and reasons for such a response.

In Tonka, there was significant response to fertilizer (nutrients) for most of the growth and yield traits (Table 4). Lowest grain yields (765 kg/ha) were observed in no fertilizer control. Treatments with NPKS, and NPK produced similar but significantly higher yields (1926 kg/ha, and 2074 kg/ha, respectively) compared to all other treatments. This suggests that there was no need for S. In addition grain yield levels in NPKS were similar to those with NPS suggesting sufficiency or low requirements of K. Yield were significantly lower in the absence of P (NKS, 1136 kg/ha) or N (PKS, 877 kg/ha), when compared to other treatments.
There were also significant differences in number of harvested hills and panicles, suggesting that soil fertility influenced plant establishment. Overall, these preliminary data suggest that N and P are critical nutrients. Yield decreases due to N and P deficiency could be about 54 and 41%, respectively.

Table 3. Influence of various fertilizer on plant population, stover yield and grain yield of sorghum in the décrue production system of Goundam (Tele Lake, Farm of Abdrahmane Cisse) during 2010.

Treatment	Plant Population (plants/ha)	Stover yield (kg/ha)	Grain yield (kg/ha)
1. No fertilizer control	41,482	21,111	793
2. N, P, K,. and S	46,667	18,519	844
3. N, P and S (without K)	65,926	22,592	896
4. N, K and S (without P)	43,704	18,148	726
5. N, P and K (without S)	48,889	16,666	955
6. K, P and S (without N)	62,222	24,444	978
Mean	51,482	20,247	865
Significance	0.17	0.46	0.98
CV (%)	25	25	55

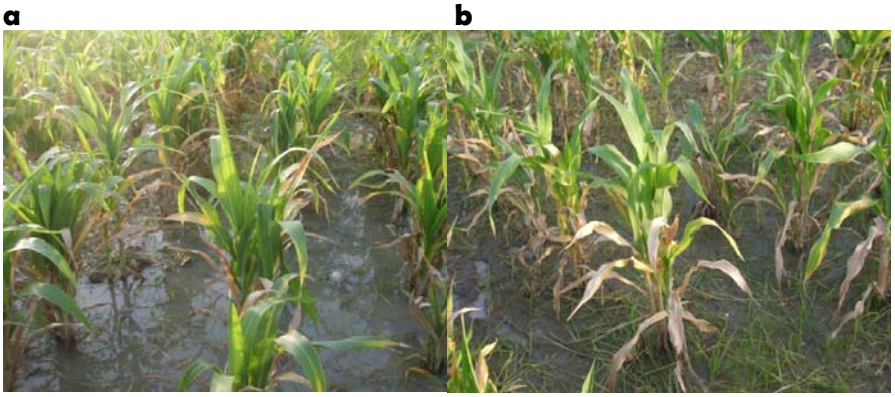
Table 4. Influence of various fertilizer on plant population and grain yield of sorghum in the décrue production system of Tonka (Horo Lake) during 2010.

Treatment	Plant Population (plants/ha)	Panicle yield (kg/ha)	Grain yield (kg/ha)
1. No fertilizer control	49,012	1531	765
2. N, P, K,. and S	57,778	2910	1926
3. N, P and S (without K)	55,555	2526	1716
4. N, K and S (without P)	51,605	1951	1136
5. N, P and K (without S)	64,692	2963	2074
6. K, P and S (without N)	52,346	1574	877
Mean	55,165	2242	1416
Significance	P<0.001	P<0.001	P<0.001
CV (%)	9	24	

Conclusions: The response of sorghum to fertilizer will depend upon the soil type and location. In poor soils such as those in Tonka crop can respond to nutrients. Maximum decreases in grain yield were observed when N or P were deficient. Further detailed studies at multi-locations with different soil types and textures along with measurement of soil nutrient and plant nutrient uptake would be help develop appropriate fertilizer management practices for décrue production system.

Photographs of décrue sorghum field plots

a b



Photograph 1. (a and b). Sorghum variety test under irrigation in Tombouctou (Koriome) conducted under partnership between a womens association, RCGOP, IER, INTSORMIL and USAID-MALI in 2010.

a b

Photograph 2. (a and b). Sorghum plots of variety test in Bourem (Koriome) conducted under partnership between IER, INTSORMIL and USAID-MALI in 2010.

a b

Photograph 3. (a). Abdoul W. Toure (IER Scientist), Noel (CONFIGES Technician) and collaborating farmer; and (b) Abdoulave G. Diallo (IER Breeder) and Noel interacting at on-farm variety test plot in Gao, 2010.

a b

Photograph 4. (a). Soil sampling before fertilizer application; and (b) fertilizer application at sorghum nutrient deficiency experiment in Mopti.

a b

Photograph 5. (a). Mixing of fertilizer before its application; and (b) sorghum nutrient deficiency plots in Goundam.

Training

Jess Lowenberg-DeBoer, Purdue University

Long term training

Fatimata Cisse continues to perform very well in her degree program at Purdue in Food Science. She will spend approximately 8 weeks in Mali this summer doing her field research.

Bandiougou Diawara and **Sory Diallo** are both pursuing master's in Agronomy at Kansas State. **Bandiougou Diawara** is progressing well in his graduate studies. He is getting good grades in all his classes. He completed his first season of field studies and is currently analyzing the data. In addition, he is conducting literature review on cold tolerance in sorghum. He will be repeating his field experiments in summer 2011. **Sory** enrolled in two courses this semester (spring 2011). He is performing well in both the courses. In addition, he started his thesis research. His research will focus on evaluating the sorghum germplasm collection for abiotic stress tolerance (cold stress, salinity stress, drought and temperature stress). The main focus will be on identifying stress tolerant genotypes. He is currently conducting research in controlled environments and will start his field research in summer 2011.

a) **b)**

(a). Sory Diallo in Crop Physiology Laboratory; and (b) Sory Diallo and Bandiougou Diawara in green houses watering sorghum plants.

a) b)

(a). Sory and Bandiougou in green house installing sensors; and (b) in front of controlled environment growth chambers.

Aly Ahamadou and Mamadou Dembele are enrolled in Level III (top class) of West Texas A&M University's English as a Second Language (ESLI) program. Both are working hard and making good progress. At this time, we expect them to complete ESLI this term and be ready for graduate study beginning this summer. Upon successful ESLI completion they will be conditionally accepted into the graduate program to pursue their non-thesis master's in agricultural economics. They plan to take two graduate level agricultural business and economics courses in summer 2011. Their non-thesis program should take 18 months with an anticipated completion date of December 31, 2012.

Short term training

Yara Koreisso Dembele, from the Food Processing project at IER Sotuba attended the 9th African Nutrition Leadership Program in South Africa, which built capacity in leadership, communication, and advocacy skills in the area of food and nutrition science. Dembele will apply her improved skillset in the INTSORMIL Technology Transfer Project, which aims to expand markets for millet/sorghum and other grains through the promotion of high quality and market-competitive processed products.

Abdoul Wahab Toure is planning to do his short term training at Kansas State this summer. His dates have not been finalized, but his training will probably start in late August or early September. He will work with Drs. Prasad and Staggenborg in Agronomy.

Gender Related Achievements

Women are integrated into all objectives and all components of the Project; 1) Production-Marketing, 2) Food Processing, 3) Décrue sorghum and 4) Training. Our appraisal indicates that Malian women are involved in all aspects of agriculture; production, storage, and processing and research and technology transfer. A project goal is to "help women to benefit from the adoption of new production and processing technologies which are likely to impact positively their welfare as well as the whole household's well being.

The Production-Marketing Project will have 340 new ha under project management in collaboration with DRA in the Mopti Region this crop season. This will include 360 women and 280 men farmers.

In Konniekamolethere was less than 50% repayment by the men and 100% by the women in the Production-Marketing Project so we will increase the area of the women in 2011 (by 20 ha) with no increase for the men. The men's storage facilities are also inadequate and badly used.

Jeanne Coulibaly, PhD student at Purdue University, is doing a study on the income and welfare consequences of the new sorghum technologies in the Koutiala region with an emphasis on the effects on women. She will also look at alternative policies and technologies to increase the welfare of women and children

Synergistic Activities Achieved with Partners

Production-Marketing

SCALING-UP INTENSIVE MILLET CROP PRODUCTION AND MARKETING PROCESS IN SMALL-SCALE FAMILY FARMERS GROUPS

2010 ANNUAL REPORT OF INTSORMIL/IICEM AND SAA PARTNERSHIP PROJECT

February, 2011

SASAKAWA AFRICA ASSOCIATION

B. SANDINAN, F. CAMARA, A. BERTHE and A. OSVALD

Acknowledgements
Research has developed technologies that improve small farmer's agricultural production and productivity. One of the major constraints to this improvement is access to resources (inputs, financing, etc.). SAA through its program of "Increasing production and crop productivity of small producers " in collaboration with the Regional Direction of Agriculture of Ségou made 498 hectares of Toroniou millet, one of the most sought millets by processors of millet/sorghum. This improvement was possible through the technical support of researchers from INTSORMIL and IER; the administrative and technical support of SAA and DNA; and the financial support of IICEM.

This is the opportunity to thank the small farmers of the circle of Baraoueli who agreed to collaborate in this initiative. The thanks also go to Dr. J. Sanders and B. Ouendeba of INTSORMIL; Jean François Gaye of IICEM; Dr. R. Juliana and A. Osvald of SAA and Dr. M. Diourté of IER.

Table of contents

1. Introduction

The continuous availability of good quality cereal is the first condition for the development of agro-food processing industry in West Africa. The goal of IICEM is to support the millet/sorghum involved stakeholders to ensure a steady supply of millet/sorghum which meets the requirements of emerging markets including agro food processing industries. The program also includes the development of production and processing technologies. One of the major challenges for the improvement of millet/sorghum production is to improve market demand for both quantitative and quality of millet/sorghum seed through productive varieties adapted to environmental conditions.

Since 1996, Sasakawa Africa Association interventions aim to spread new agricultural technologies to small-scale farmers. The intervention strategy for SAA is based on strengthening the capacities of the National Directorate of Agriculture which is the public structure of agricultural extension in Mali. SAA also encourages the win-win partnership with research structures, NGOs, civil society and mainly rural organized people. The current program is carrying on within the framework of a partnership for intensive production and marketing of good quality of millet/sorghum by men and women farmers' cooperatives in the circle of Baroueli - region of Segou in Mali.
This project takes stock of the SAA/INTSORMIL intensive crop production, productivity and marketing project implemented in Tingoni from 2006-2008.

2. Overall objective of project

To produce 600 tons of Toroniou millet on an area of 500 hectares involving farm households from of eight (8) villages in millet-based agropastoral livelihood zones of Mali.

2.1. Specific Objectives of project

- Improve millet crop productivity ;
- Increase farmers' incomes through marketing of good quality grains and;
- Strengthen capacities of women and men producers in marketing technologies;

2.2. Expected Outcomes of project

- millet crop productivity is at least improved by 30% ;
- millet grain quality follows the stated standards (i.e -5% of losses) ;
- incomes of farms 'households are increased through marketing of good quality grain;
- capacities of women and men producers are strengthened in marketing technologies ;
- The capacities of local human resources mainly CBFs from villages are strengthened.

3. Intervention strategy

3.1 Intervention area and targeted groups

The project concerned eight (8) villages in the neighborhood of the village of Tingoni which belongs to the circle and the commune of Baroueli in the region of Segou. The villages and farmers coops were selected by the regional directorate of agriculture and SAA. The producers involved in the implementation of project activities were members of village COOPs from the communes of Baroueli, Bouadie and Kalake (Table 1).

Initially, the production plan was 500 ha to be established by 500 farm households from ten villages. However, the project activities were implemented by 330 farm households and the established area was 498 hectares.

Table 1: List of villages involved in project implementation

Commune	Villages	UPA	Household	Sup (ha)	Distance from Tingoni (km)
Barouéli	Tigui	42	36	60	6
	Kéména	44	38	50	42
Bouadiè	Bouadiè village	230	103	150	54
	Siankoro	27	50	50	15
	Wentiguibugu	11	24	48	66
	Diarrabougou	25	21	40	76
	Siakabougou	10	14	50	66
Kalakè	Diawarala	45	44	50	36
		434	**330**	**498**	**-**

3.2 Implementation of activities

After the selection of villages and farmers, meetings were organized at village level for introducing the project. These meetings were followed by training of extension agents.


Information and sensitiveness meeting at Tigui village between men and women producers and the project staff, June 2010.

3.3 Training of extension agents

Two training sessions on crop cultivation and management techniques were conducted. It concerned eight (8) CBFs and (5) extension agents and SAA technician working in Ségou.

Training session of CBEAs and CBFs by Mr. Traore, Head of sector.

3.4 Procurement of inputs

The procurement of inputs was planned to involve the National Bank for Agricultural Development (BNDA). IICEM built a warranty deposit at BNDA. Farm coops had to open accounts at BNDA in order to get credit for purchasing inputs including seed and fertilizers. However, this strategy did not work due to misunderstanding between IICEM and BNDA. Finally, the procurement of inputs involved the partnership with agrodealers Arc-en-Ciel for mineral fertilizers (DAP and Urea) and Faso Kaba and farmers seed cooperatives for Toroniou seeds. 3000 kg of Toroniou seeds from Faso kaba and farmers seed cooperatives de Diawarala

and Tingoni and 22500 kg respectively of DAP and Urea from Arc-en-Ciel were procured with the financial support of INTSORMIL (Table 2).

Table 2: Inputs procurement for project implementation

Villages	Area (ha)	DAP (kg)	Urea (kg)	Seed (kg)	Amount of credit (FCFA)
Boidié	150	7 500	7 500	900	56100000
Diawarala	50	2 500	2 500	300	18700000
Kemena	50	2 500	2 500	300	18700000
Wentiguibougou	50	2 500	2 500	300	18700000
Tigui	60	3 000	3 000	360	2244000
Diarrabougou	40	2 000	2 000	240	1496000
Siakabougou	50	2 500	2 500	300	18700000
Siankoro	50	2 500	2 500	300	18700000
Total	**500**	**22500**	**22500**	**3000**	**153,340,000**

3.5 Cost of technology

The inputs for the technology included the use of Toroniou seed and DAP and Urea fertilizers (Table 3). The cost of the technology was 37400 FCFA per hectare.

Table 3: Input cost of technology

Inputs	Quantity (kg/ha)	Unit cost (FCFA/kg)	Total cost (FCFA/ha)
Seeds	6	400	2400
DAP	50	350	17500
Urea	50	350	17500
Total			**37,400**

3.6 Supervision activities

The local supervision of farmers was done by villages animators under the supervision of extension agents related to the agricultural sector. Various supervision visit involved Intsormil, SAA and the

Meeting between SAA, DRA, IICEM and INTSORMIL.

The son of the plot owner exchanging with IICEM and SAA supervision team.

4. Achievements

4.1 Yield analysis

Eight villages participated in the implementation of the project activities (Table 4). 434 UPA belonging to eight village-based farm cooperatives were involved in the intensive millet production and marketing process. The rate of realization of crop production area was 99.6%.

Table 4: Villages, producers and area for intensive millet production and marketing

Villages (Farm coops)	UPA	Number of farmers	Sup (Ha)
Boidie	230	103	150
Diawarala	45	44	50
Kemena	44	38	50
Tigui	42	36	60
Wentigibougou	11	24	48
Diarabougou	25	21	40
Siakabougou	10	14	50
Siankoro	27	50	50
Total	**434**	**330**	**498**

The 434 UPA were able to produce 605, 462 kg de millet from 498 ha. The rate of realization of millet production was 100, 1%. The average yield was 1185 kg per hectare is below the target yields of 1200 kg/ha. Only three villages (Boidiè, Diarrabougou and Siakabougou) have reached the target yield (Figure 1).

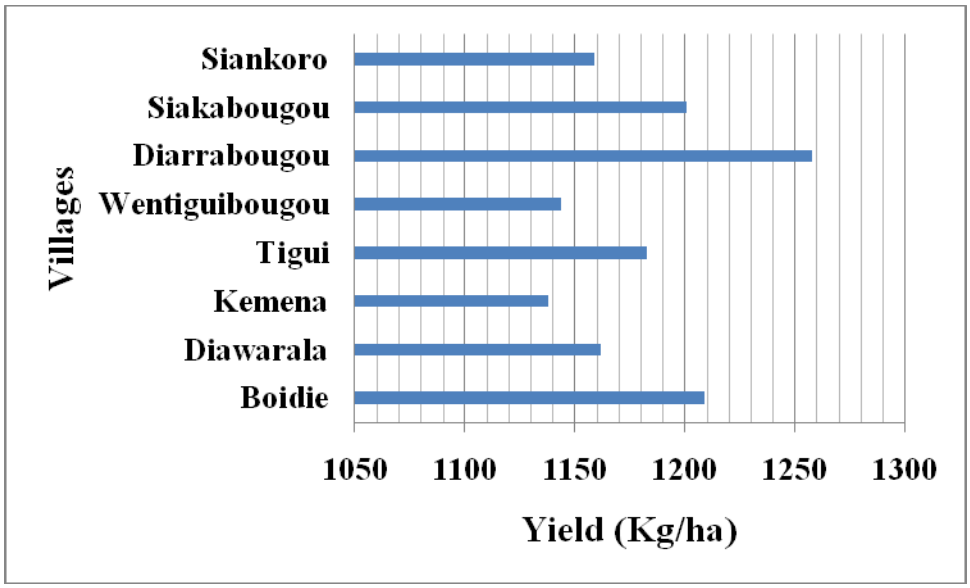


Figure 1: Average millet yields (Kg/ha) in project villages

The maximum and minimum yields were respectively 2400 and 600 kg/ha (figure 1). The high of yields may be related to the poor utilization of agronomic matter.

4.2 Benefit cost analysis

The average Benefit Cost Ratio (BCR) was 2,71. The BCR varied from 1,89 in Siankoro to 3,14 in Diarrabougou (Table 5).The Benefit Cost Ratio (BCR) vary from 1, 89 to 3,14.

Table 5: Benefit cost ratio of crop production technology

Village (Farm coops)	UPA	Number of producers	Area (Ha)	Production (kg)	Value of production (FCFA)	Cost of production (FCFA)	Net Benefit	Average BCR
Boidie	230	103	150	190252	24732760	7800000	16932760	3,02
Diawarala	45	44	50	58140	7558200	2600000	4958200	2,95
Kemena	44	38	50	57918	7529340	2600000	4929340	2,84
Tigui	42	36	60	72888	9475440	3068000	6407440	2,96
Wentigibougou	11	24	48	55772	7250360	2496000	4754360	2,86
Diarabougou	25	21	40	50660	6585800	2 080 000	4 505 800	3,14
Siakabougou	14	14	50	61880	8044400	2600000	5444400	2,00
Siankoro	27	50	50	57972	7536360	2600000	4936360	1,89
Total	**434**	**330**	**498**	**605482**	**78712660**	**25844000**	**52868660**	

4.3 Management of yields and production

The overall production is managed by the farmers' cooperatives of villages. Farmers have the choice of reimbursing the inputs at harvest without a premium or at marketing with a premium. The part of the farmer cooperative will vary from 325 kg to 288 kg par ha (Table 6). This amounts to 24, 30 to 27, 43 %.

Table 6: Yield and production management

	Average yields (kg/ha)	Farm cooperative part	Quantity reimbursed to the cooperatives	Quantity available for farm household use
Moyenne (kg/ha)	1185	400	400	1001
Price at harvest	115 FCFA/kg	325		
Price with premium	130 FCFA/kg		28827,43	
Farmers options		400		
% Yield		27,43	24,30	71,45

The remaining harvest amounting to 72, 57 to 75, 70% is available to the farmer household for its own use.

4.5: Linking farmers to markets

A review workshop on SAA/IICEM/INTSORMIL 2010 activities was organized from November 10 to 12, 2010. The objectives of this workshop were to link agro processors to producers for market access. SAA contributed to two presentations: (1) SAA market access intervention strategy by the SAA/Mali CD and (2) review of program implementation and planning for 2011-2012 cropping season by T1 Program Officer. Other presentation during the workshop concerned the following topics:

- Cereal value chain development and other aspects related to bread
- Utilization of millet and sorghum in bread making and other products
- Networking farmers' organization and millet-sorghum agro processors
- Scaling up pilot project : SAA and AMEDD plan for 2011
- Grain demand needs from agroprocessors and discussions on premium prices

The workshop was ended with a field visit in the SAA village of Tigui to which SAA MD, Dr. Juliana participated.

Dr. J. Sanders, INTSORMIL Coordinator exchanging with Dr. A Berthe

in company with SAA MD at Tigui village, Segou-region.

After village meeting of partners, Dr. Juliana, appreciates the spike of Toroniou, a millet variety which is cultivated on 498 ha in 8 villages for to link millet and sorghum producers to processors.

4.6 Impacts on income

The use of the marketing strategies allowed farmers to have a benefit varying from 157170 FCFA /ha in Bouadie to 147940 FCFA per ha in Kemena. The additional benefit with the premium is 13% higher than that without premium for the village of Boidiè. The project crop production and marketing options is profitable for farmers (table 14). The BCR vary from 4, 20 to 3,96 respectively for Boidié and Kemena.

Table 7: Impact of crop production and marketing strategies

Villages	Numb of producers	Area (ha)	Average yield (kg/ha)	Benefit due to yield effect (FCFA/ha)	Cost (FCFA/ha)	Benefit due to price effect (FCFA/ha)	Ratio Benefit cost (BCR1)	Ratio Benefit cost (BCR2)
Boidie	103	150	1209	139035	37400	157170	3,72	4,20
Diawarala	44	50	1162	133630	37400	151060	3,57	4,04
Kemena	38	50	1138	130870	37400	147940	3,50	3,96
Tigui	36	60	1183	136045	37400	153790	3,64	4,11
Wentigibougou	24	48	1144	131560	37400	148720	3,52	3,97
Diarabougou	21	40	1258	144670	37400	163540	3,87	4,37
Siakabougou	14	50	1201	138115	37400	156130	3,69	4,17
Siankoro	50	50	1159	133285	37400	150670	3,56	4,03

The delay in the procurement of credit from the Bank leads farmers to use their best plots for other activities. Farmers didn't receive training on agronomic aspects because of delay in the availability of funding. Only extension agents received training. Many crop fields suffer from flooding due to heavy rainfall.

5. Conclusion

Despite of the delay in supplying inputs to farmers and successive floods caused by heavy rains, results are satisfactory. The use of technology helped to increase yields by at least 60% compared to the national average estimated to 700 kg / ha. Studies have shown that only three (3) villages among a total of 8 villages reached the result of 1.2 ha / ha.
However, the average value of the norm indicates that 50% of the 330 farmers have received more than one ton of grain per hectare. With an average of RBC greater than 2, we can estimate that this technology can be proposed to farmers as part of a transfer. For this reason, it is planned to switch from 498 hectares in 2010 to 1,000 hectares in 2011.

6. References

Institute of Rural Economy (IER) 2007, Production Project Activities Report & Marketing, Program Mali, Campaign of 2006-2007, Bamako, Mali

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Report of Production-Marketing Networking with Partners

Trip Report to Sites of Production-Marketing, March 19-April 2, 2011.

John H. Sanders and Botorou Ouendeba

Our trip objective was to visit our three principal sites in preparation for our activities in the summer of 2011. The three sites are the sorghum activity in Koutiala in which we have been working with AMEDD (an NGO focusing on the Koutiala region), the millet zones of the Mopti region with DRA (regional office of the national extension service in the Mopti region), and the millet zone of Segou with SAA-DRA (an NGO formerly Global 2000 working all over Africa on the introduction of food crop technologies and the regional office in Segou of the national extension service).

On Monday we met with IICEM to coordinate our activities. They informed us that they are just working in Koutiala and Mopti in 2011 and have ceased new construction of storage due to a freeze on their pipeline funds. They also informed us that they would be working with AIID (another NGO working in Koutiala) rather than AMEDD. We agreed to meet with AIID and with the IICEM regional representative in Koutiala. We also agreed to buy certified Toroniou seed for their Mopti program. Jean Francois mentioned goals of 2,500 ha in Koutiala (Grinkan sorghum) and 2,000 ha (Toroniou millet) in the Mopti region.

The regional program directors of IICEM are in the process of signing up farmers in the two regions, Koutiala and Mopti. With these lists they will approach the BNDA in both regions. Lending for individual farmers' associations would then be available through vouchers to buy fertilizer. Since the fertilizer needs to be available on the farms in May, there is very little time to accomplish all the organization and travel required in the two regions. Nevertheless, this IICEM program seems like a systematic process to get the initial input credits and to organize farmers' associations for bank loans. The IICEM program and our pilot project field work will be aided this year by the extension of the inorganic fertilizer subsidy to millet and sorghum.
Then we traveled to Koutiala and met with AMEDD. We had funded AMEDD to acquire Grinkan seed for the 2011 planting. But we had insisted on germination trials after the poor germination experience of 2010 with Grinkan. Germination rates were around 60% in 2010. This poor germination has been attributed to insects but with the PICs triple sacks insects would have been controlled. Hence, late rains in 2009 and mold must have been the important factors. In 2010 late rains were heavy and pervasive. Germination tests by AMEDD in 2011 ranged from 0 to 20%. So in the pilot program in Koutiala we are calling off our diffusion activities for this crop year and will be engaged in seed production of Grinkan during the summer of 2011. This is probably fortuitous since for some time we have wanted to focus more on seed production to improve quality especially eliminating the off types from farmer based seed production. We also will be testing a limited number of new millet cultivars in 2011 as Toroniou is a very old selection from the Dogon region of Mopti (identified and promoted by Oumar Niangado when he was the Director at the Cinzana agricultural research station of IER).

We have also advised AIID that even with germination rates as high as 60%, it would be better to wait a season and produce very good seed in 2011 for an expanded program in 2012. Nothing can be as disillusioning for farmers in a new production program as poor seed and having to spend substantial time replanting. Farmers will be taking loans for inorganic fertilizer and be asked to do many other labor intensive operations. We need to be sure that the seed is excellent. We will be producing seed on three different sites and Niaba Teme will be handling the organization of this program. Niabe is also arranging presently for Toroniou millet seed for 2011 for our pilot project in Mopti and for 1,000 ha in the Mopti region for the IICEM project.3 The seed will be kept in the PICs sacks. In Mopti as in other regions the critical input is still the inorganic fertilizer in these low soil fertility zones so getting the bank lending to the farmers' associations on time for them to buy the fertilizer in May will be critical.

We were very happy with the Wollo farmers' organization (Mopti region). They turned down an offer for 12,000/sack for their clean millet and counter offered 17,000. They later sold for 16,500.It is great to see farmers getting independence and confidence to negotiate. With the triple sacks the risk is largely eliminated from holding their grain longer so they are learning that they do not have to respond to the first bid. Wollo farmers have built storage but already it is insufficient space. Also we have the issue here for the second year in a role that the President

3 We were disappointed to learn that in the Mopti region the PICs sacks bought for the farmers' associations in 2010 were never delivered and are still sitting in the IICEM office.

of the farmers' association held the money from the grain sales rather than opening a bank account. The Wollo farmers' association was told that they have to open a bank account to continue the program. They have now opened a bank account. Once farmers' associations hold bank accounts it becomes easier for them to get bank loans for their members.
In the Kountogoro site that the Minister of Agriculture visited in the fall of 2010 farmers were very happy with the millet yields. 2010 was the second good rainfall year. Farmers estimated traditional millet yields at 400 kg/ha and their yields of one to two tons/ha. These yield estimates of two tons are probably too high but we will be evaluating yield performance with further field interviewing and reviewing the crop cut data. 4

The big yield gains for millet are when the farmers combine the inorganic fertilizer with the organic fertilizer on their better lands. Meanwhile the farmers' associations continue to make gains on improving their marketing by storing and selling later, getting the millet off the ground to sell a cleaner millet, and convincing the farmers' associations to bargain for a better price. In the Mopti region the storage facilities generally are too small so we need help them expand these storage facilities.

In the new sites of Begne and also Tere there were also inadequate storage facilities so this lack of storage is emerging as a principal constraint for the farmers' associations in the Mopti region. Yields were low in Tere apparently from famers not following well the recommendations so we are only expanding by 20 ha with half for women. In Konniekamolethere was less than 50% repayment by the men and 100% by the women so we will increase the area of the women in 2011 (by 20 ha) with no increase for the men. Their storage facilities are also inadequate and badly used.

Also we need to emphasize to the farmers' associations that we have had two good rainfall years in 2009 and 2010 and we need to keep reminding farmers about the importance of water retention measures to use better the available rain in case of an adverse rainfall year. Organic matter helps here also.
There will be 320 new ha in the our new technology-marketing project in the Mopti region during 2011. There are already 420 ha in the program operating with the revolving funds. The IICEM program was expanded to 3,000 ha here.

In the Segou region SAA expanded the area in our new millet technologies and associated program by 494 ha (330 farmers) in 2010. We financed the fertilizer inputs which were then to be repaid to the farmers' associations as a revolving fund. IICEM financed the supervision costs and other SAA expenses. In 2010 IICEM cut out their support but SAA also has programs from Agra and the Gates program (Hope).

4 . Unfortunately, the crop cut estimates are not very reliable. When several crop cut estimates together are exactly the same or yields are over 2 tons/ha for millet both conditions are suspect.

The missing element in our pilot project approach is obtaining input financing from the beginning of the project. So we asked SAA to bring together the regional BNDA bank representative and the fertilizer dealer to discuss how they could become involved in the program. The BNDA representative was willing to finance the fertilizer purchase for half of the new area. His guarantee was the involvement of SAA and the ability of the farmers' associations to finance the fertilizer purchase for original 500 ha and 250 new ha with the profits made in 2010 from selling their millet at 140 CFA/ kg (to PAM when the market price was 115). Repayment rates were generally good. 137 tons were sold and 63 tons were in storage in late March.

Mme Deme, a prominent millet food processor in Bamako, continues to be an important buyer of millet in the Segou region and has bought 85 tons of millet this year from Tingoni this crop year. The cereal grain quality still needs to be improved and we will be looking into that this summer. But the contrast between the region known for a dirty millet and our prime site, Tingoni, known now for a clean millet, is striking and we need to extend the Tingoni practices to the 994 ha here in millet production added in 2010 and 2011.
In a region with mean yields of 700 ha the estimated mean yields for program participants in Segou were 1.2 tons/ha. There were numerous problems in 2010 including the fertilizers arriving late, insufficient agronomical instruction, and some flooding. So we should have even higher yields here as farmers imitate the best farmers, who were following well the recommendations
In Boajie the largest site in the Segou region in terms of area and farmer participants, there was poor repayment and some heated discussion on the need for repayment. Farmers complained about the delay in being able to use the screens for cleaning and putting the millet in storage. Reimbursement was 75% and they sold to PAM at 140 CFA/kg in Febuary. Note that we held a workshop for these farmers' groups and the processors in the fall and the concept of searching for and insisting on a good price for a clean millet seems to be understood now.

In summary: For Koutiala we will concentrate on producing good seed of Grinakan now with Niaba Teme taking the lead in organizing and supervising this activity and Ouendeba providing technical inputs. Niaba is presently arranging the Toroniou certified seed for our field activities in Mopti and for 1000 ha of the IICEM activities in the Mopti region; we will help SAA with their field program concentrating on the marketing aspects of building up the ties between those willing to pay premium prices for uniform, clean millet and those farmers' associations focusing on improving quality and marketing performance. Also in Segou we are building relationships with the BNDA and a fertilizer dealer; in Mopti we have all the production and marketing components of our pilot project and will have 760 ha in production in 2011. So we will not have a big area increase in 2011 in the country but we are excited about our three principal zones and the progress we will make with seed and marketing in Koutiala and Segou. We also will be investigating in the summer of 2011 some strategic small investments in storage to supplement farmer building activities, i.e. cement, doors, windows, pallets. We need to expand substantially the use of the PICs sacks to cut out the insect problems in storage combining that with expanded storage and better storage management.

In summary, in Koutiala we will concentrate on producing good seed of Grinkan now with Niaba Teme taking the lead in organizing and supervising this activity and Ouendeba providing technical inputs. Niaba is presently arranging the Toroniou certified seed for our field activities in Mopti and for 1000 ha of the IICEM activities in the Mopti region; we will help SAA with their field program concentrating on the marketing aspects of building up the ties between those willing to pay premium prices for uniform, clean millet and those farmers' associations focusing on improving quality and marketing performance. Also in Segou we are building relationships with the BNDA and a fertilizer dealer; in Mopti we have all the production and marketing components of our pilot project and will have 760 ha in production in 2011. So we will not have a big area increase in 2011 in the country but we are excited about our three principal zones and the progress we will make with seed and marketing in Koutiala and Segou. We also will be investigating in the summer of 2011 some strategic small investments in storage to supplement farmer building activities, i.e. cement, doors, windows, pallets.

Fiche Produced through IER/INTSORMIL Collaboration

FICHE DE PRODUCTION ET DE COMMERCIALISATION DU SORGHO, MALI

mars 2011

Niaba Teme, IER et Botorou Ouendeba, INTSORMIL

Variété Grinkan à maturité, Garasso, Mali, 2011

Pour plus de détails et d'information sur les futures modules de formation, prière contacter Botorou Ouendeba, Projet **Production et Marketing (INTSORMIL): bouendeba@yahoo,com**

Le programme IER/INTSORMIL/IICEM comporte plusieurs volets.

- Amélioration des technologies de production; Recommandations agronomiques
- Introduction de stratégies de commercialisation : Comment les producteurs peuvent obtenir des prix élevés a travers la mise en œuvre de stratégies
- Développement institutionnel des associations de producteurs

I. Agronomie

1. Zone de production et choix du champ paysan

- Zone de production : pluviométrie
- Choix du terrain : Le champ choisi **ne doit pas être un champ pauvre ou marginal**, mais doit être plat et homogène. Le sol du champ doit être de type sableux-limoneux ou limoneux-argileux ou tout type de sol adapté à la bonne production du sorgho dans la localité.

2. Préparation du sol

Le semis se fait sur des anciens ou nouveaux billons après une pluie de 20 mm. Un ressemis est prévus en cas de mauvaise levée après une dizaine de jours.

3. Quantité de semence à l'hectare est de 8-10 kg/ha.

4. Traitement de semences.

Cette semence doit être traitée avec un fongicide insecticide (un sachet d'Apron star pour 10kg de semence) ou suivant l'indication du fabriquant.

5. Doses et Application d'engrais

- **Apport de 50 kg/ha de DAP :**
  Le DAP est apporté à la levée au pied du poquet ; cet apport doit être suivi d'un sarclo-binage pour couvrir l'engrais.
- **Apport de 50 kg/ha d'Urée** : L'urée est apportée autour du poquet 45 jours après la levée ; cet engrais est **enfoui** dès son épandage.

6. Date et densité de semis

- **Période de semis** : La période de semis est spécifique à la zone de production
- **Densité de semis**

Pour le sorgho, l'écartement de semis entre les billons est de **0.75m** et il est de 0.50 m entre les poquets sur le billon (soit **0.75m x 0.50m)**.

7. Démariage

Sorgho : le démariage se fait deux à trois semaines au plus tard après la levée. Le nombre de plants par ha est estimé à **53 600** pour un démariage à 2 plants par poquet et de **80400** plants pour un démariage à 3 plants par poquet.

8. Entretiens culturaux

Pour éliminer les compétitions (pour les éléments nutritifs et aussi pour la lumière) avec les mauvaises herbes; le sarclage doit se faire à la demande pour maintenir le champ propre.

9. Protection des cultures

Au cours de la croissance végétative les cultures sont souvent soumises à des pressions parasitaires : maladies foliaires, attaques de punaises de panicules, de moisissure et bien d'autres fléaux. Les services de vulgarisation de la région doivent être informés afin de connaitre les dispositions à prendre.

10. Carrés de rendement et estimation des rendements

Cinq carrés de rendement de 5m x 5m chacun est placé dans un hectare d'un producteur. Il y'aura un carré à chaque coin de l'hectare et un autre au milieu du même hectare. Il est demandé de prendre au hasard 10 producteurs par zone pour un total de 50 carrés de rendement par zone. Le nombre de panicules, le poids des panicules et le poids de grain après battage pour chaque carré de rendement doivent être reportés dans le cahier des observations de l'agent chargé du suivi**.**

11. Récolte

La récolte se fait quand les grains sont complètement mûrs.

Recommandation: pour éviter tout contact avec le sable, les panicules récoltées ne doivent pas être séchées sur le sol mais sur des tiges ou d'autres matériaux disponibles tels que des petits hangars confectionnés pour les circonstances.

12. Battage

Pour le battage, les producteurs peuvent utiliser une batteuse mil, des bâtons ou des mortiers avec pilons sur des aires bien propres. Utiliser dans tous les cas des bâches pour éviter que les grains ne touchent le sol ou d'autres impuretés. Il faut toujours garder à l'esprit que l'objectif du programme est d'avoir un produit final (grains) très propre et de bonne qualité qui doit conduire à l'obtention d'un premium pour les paysans.

II. Techniques Post-Récolte

1. Magasin

Respecter le dispositif recommandé pour le stockage des sacs; utiliser des palettes pour éviter que les sacs soient à même sur le ciment ; laisser des allées entre les piles de sacs afin de maintenir la propreté du local et si nécessaire faire des traitements contre les insectes.

2. Ensachage

Les sacs plastiques normaux ont montré leur limite concernant les attaques d'insectes de stockage. La solution serait d'utiliser des sacs PICS connus pour stocker des grains de niébé et certainement des grains de céréales pour une longue durée (plus de 6 mois).

3. Contrôle de la qualité des grains

Tous les sacs amenés par les producteurs vont porter les noms de ces producteurs pour s'assurer de la traçabilité des grains. Un échantillonnage est fait au niveau des sacs stockés dans le magasin (10% du stock total). Ces échantillons (3 échantillons par sac) seront analysés pour déterminer l'humidité et les taux d'impuretés (sable, cailloux, débris végétaux et autres matières inertes). Ces informations sont mises à la disposition des acheteurs.

III.Stratégies de commercialisation

Pour éviter les deux principales chutes de prix et avoir des prix élevés (ou de bas prix d'intrants à l'achat) pour les paysans.

1. Eviter la chute de prix à **la récolte**

L'association des producteurs aide les paysans à vendre plus tard après les bas prix observés à la récolte

2. Vendre des céréales propres et exiger un sur- prix

Les producteurs individuels utilisent des techniques (bâches, batteuse, garder les céréales au-dessus du sol).pour produire des céréales propres. Les paysans sèment aussi une variété uniforme. L'association des producteurs exige un prix premium (20 fcfa) pour la céréale propre.

3. Devenir commerçant et vendre sur le marché à un meilleur prix

De nouveaux marchés se développent et l'association des producteurs devient une commerçante avec des facilités de stockage et donc de larges quantités que l'association des producteurs peut vendre aux transformateurs (alimentation humaine) ou aux producteurs d'aliments de bétail ou de volaille pour la production intensive de poulets (sorgho). En éliminant les intermédiaires, on pourrait obtenir des pris très élevés.

4. Renforcer les capacités de l'association de producteurs à vendre des céréales à un bon prix et à acheter des intrants pour ses membres

L'association des producteurs stocke et vend plus tard (avril - mai) des quantités beaucoup plus importantes qu'un producteur individuel. Elle cherche des acheteurs et obtient un prix premium avec plus d'information et un stockage plus long. Les producteurs peuvent aussi faire un achat groupé et obtenir une réduction des prix des intrants.

IV. Renforcement des associations de producteurs

Les producteurs ont besoin d'un pouvoir de négociation avec des produits compétitifs pour avoir des prix élevés dans la commercialisation (et aussi pour obtenir à l'achat des coûts d'intrants réduits). En développant des coopératives de commercialisation, les producteurs vont acquérir cette capacité de négociation.

1. Développent des associations de producteurs

Dans chaque village une association de producteurs est initiée ou bien le groupement existant est renforcé

2. Construire un magasin
Des magasins de stockage sont nécessaires ; s'il n'y en a pas nous recherchons de bailleurs de fonds intéressés à faire l'investissement pour leur construction

3. L'association est responsable de la production de céréales propres et du remboursement de crédit de ses membres
Les gestionnaires de l'association doivent être responsables du remboursement des crédits pris pour l'achat des intrants pour ses membres

4. L'association obtient du crédit pour ses membres
L'association développe des relations avec une banque de la région ou des institutions financières par l'ouverture de compte au nom de l'association. Cette relation va favoriser l'octroi de prêts pour faire du warrantage ou d'autres activités génératrices de revenus pour l'association. Une organisation de producteurs forte conduit à des prix élevés et facilite aussi l'accès aux crédits bancaires donc aux engrais

V. Production de semences

Au fur et à mesure que les superficies emblavées deviennent importantes avec le programme de scaling up, la production et l'approvisionnement en semences de qualite devient une problematique.

1. Production de semences au niveau des producteurs locaux
Au delà de plusieurs centaines d'ha, il faut commencer à assurer un approvisionnement régulier de semences des variétés adoptées en formant des paysans semenciers pour produire des semences certifiées en étroite collaboration avec les services de l'agriculture (Service Semencier National : SSN). Ces semences devraient être utilisées par les producteurs au plus pendant 3 ans. Au delà de 3 ans, le pourcentage de mélanges avec les autres variétés cultivées dans la zone devient important. L'arrivée prochaine en milieu paysan de cultivars hybrides va augmenter de manière significative la productivité et la production. A l'inverse de ce qui se passe avec les variétés, chez les hybrides les semences doivent être renouvelées chaque année. La formation des producteurs semenciers entreprise avec les variétés facilitera la production de semences hybrides en milieu paysan.

2. Conditions de production de semences :
Isolement des parcelles de production ; épuration des hors-types ; suivi rapproché pour contrôler l'homogénéité du cultivar.

3. Payer un bon prix pour les semences de qualité.
L'effort founi par le producteur semencier depuis les semis jusqu'à l'emballage en passant par l'élimination périodique des plants hors types, doit être récompensé. C'est pourqoi il est nécessaire que le prix de semence obtenu à la vente soit incitatif, condition essentielle pour attirer le secteur privé.

FICHE SYNTHESE DE PRODUCTION ET DE COMMERCIALISATION DU SORGHO

Pour favoriser et assurer l'adoption du paquet technologique (fiche de production et de récolte du sorgho) et permettre la maximisation des prix pour les paysans, il y a lieu de procéder en plusieurs étapes. Cela pérennisera la stratégie sur une base d'affaires.

I. Adoption du paquet technologique

1. Le paquet technologique exige l'utilisation optimale des intrants (fertilisants et semences améliorées) et des outils post récoltes (bâche et sacs appropriés d'ensachage).
2. Les organisations de producteurs qui ne possèdent pas de fonds de roulement suffisant pour appliquer ce paquet technologique doivent chercher des prêts/crédits auprès d'une institution financière.
3. Les institutions financières exigent habituellement une garantie (financière ou physique). A défaut, les organisations paysannes doivent avoir dans leur demande de financement un contrat d'achat dument signé avec un commerçant ou une entreprise connue de la place.
4. Le contrat d'achat comporte un cahier de charge incluant des critères de qualité de la céréale : variété, humidité, taux d'impureté.
5. Le contrat d'achat comporte le prix du marché plus un premium pour la qualité. Le contrat avec le remboursement direct payera l'emprunt de l'institution financière. Ce système permet l'utilisation du paquet technologique et assurer le remboursement rapide de l'emprunt. Les excédents céréaliers qui restent peuvent alors s'inscrire dans la stratégie de maximisation de revenu.

II. Maximiser le revenu

1. Les producteurs utilisent l'ensemble des semences améliorées et des fertilisants sur les hectares faisant l'objet du paquet technologique. Ils respectent l'itinéraire technique et les conseils agronomiques (fiche de production et de récolte du sorgho).
2. Les paysans sèment une variété uniforme, selon le cahier de charge du contrat.
3. Les producteurs individuels utilisent des techniques (bâches, batteuse, conservation des céréales au-dessus du sol) pour produire des céréales propres.
4. L'organisation paysanne regroupe les céréales propres et les stockent dans un entrepôt adéquat. Les volumes stockés permettent de négocier en gros, ouvrant de nouveaux marchés.
5. Les volumes en gros de céréales propres dans un conditionnement et un entrepôt adéquat permettent d'obtenir une prime sur le prix du marché local, maximisant la marge de revenu des producteurs.

6. L'organisation paysanne développe une stratégie de vente à plusieurs acheteurs et segments de marché. Cette stratégie de diversification des ventes diminue les risques de concentration sur un seul acheteur et assure la maximation du prix de vente.
7. Les différents acheteurs et segments de marché sont principalement: les petits transformateurs (alimentation humaine), les producteurs d'aliments de bétail ou de volaille pour la production intensive de poulets de chair (sorgho), les appels d'offres des organisations internationales et du gouvernement pour combler leur besoin en sécurité alimentaire (PAM, CRS, OPAM, Commissariat à la sécurité alimentaire, etc.) et les appels d'offres des grands moulins et commerçants. Elle peut aussi vendre à son acheteur «de sécurité » si les parties s'entendent sur le prix de vente.

III. Crédibiliser l'organisation paysanne

1. Les producteurs ont besoin d'être crédibles : vendre des produits recherchés et compétitifs pour avoir des bons prix, acheter les intrants en gros pour bénéficier d'une réduction du coût et finalement, obtenir le financement nécessaire auprès des institutions financières. En développant des coopératives crédibles, les producteurs vont acquérir une force de négociation.
2. Dans chaque village, une ou plusieurs coopératives sont mises en place, avec récépissé légal.
3. Des magasins de stockage sont nécessaires afin de dégager des quantités suffisantes permettant de développer des marchés de gros.
4. Les gestionnaires de l'association doivent être responsables du remboursement des crédits qui sont utilisés plus tard pour l'achat des intrants (semences, fongicides et engrais)
5. Pour assurer la crédibilité des organisations de producteurs, il faut une bonne gouvernance, une meilleure organisation et une autonomie financière. Les organisations de producteurs devront rechercher les connaissances et les habiletés suivantes:
   - Mécanisme de gestion, par des outils simples de comptabilité et de transparence ;
   - Mécanisme de capitalisation et de génération des ressources propres, par la distinction entre part sociale de l'organisation et les capitaux des activités économiques de l'organisation;
6. La coopérative développe ses statuts et règlements, en conformité avec la Loi des Coopératives de l'OHADA. Vie coopérative, statuts et règlements, réunion statutaire, exigence de la loi en termes de gestion

Variété Sorgho Grinkan en épiaison. Hivernage 2010

Decrue sorghum

Decrue SorghumTrip Report

Submitted by Scott Staggenborg,
Kansas State University
January 25 through February 4, 2011

The objective of week one was to host our partners at Mopti to discuss Décrue Sorghum results from the 2010 growing season. The meeting started with a proclamation from the governor of Mopti. This and an interview with the PIs (Abdoul Wahab Toure and Scott Staggenborg) were recorded for broadcast on Mali TV. Abdoul Wahab Toure presented a summary of his work over the past three growing seasons, with emphasis on the 2010 growing season. His presentation also included data from the NGOs who participated with us in the North as part of the Technology Transfer program.

The rest of the day was spent discussing needs and issues that have emerged from the decrue regions. Insect and disease problems were discussed. Insect activity appears to be both root feeding early in the year and potentially aphids as many reported observing "honeydew" on the leaves. Efforts have already been initiated with Bonnie Penndelton to assist and oversee the insect monitoring and management portion of the program for 2011. Disease descriptions were less detailed. However, one of the outcomes from this discussion was the development of a training program for field personnel in identifying and preserving insect and disease samples.

Another topic of discussion that emerged was cultivar development and the foci of this effort. Soba Tienda and Soba Sota have been identified as high yielding cultivars in the North. However, grain quality is not ideal for Soba Tienda. Yara Kouressi and Traore Faboumata (IER CRRA) both pointed out that the grain was not something that was preferred by the women they spoke with. The breeding program of IER indicated that they are aware of the problem and have made some selections that they believe will improve grain quality and provide high yields. This was also recommended as one of the long term goals for the program.

Some discussion over the fall décrue system used around Gao was included. This system plants sorghum in September and harvests in January or February. System du Mar was how it was referred.

The use of seed treatments and denser plant densities were discussed and it is likely that these treatments will be repeated in 2011. The N fertilizer rate study did not yield any results from Mopti due to flooding and no agronomic results from the North. This fits the recommendations of the farmers from discussions in 2008.

Meeting notes are attached as Appendix 1.

Participants from the Decrue Sorghum Research and Planning meeting at Sevaré, Mali, January 26-27, 2011.

IICEM Visit

On 31, January, we visited IICEM to meet with Jean Francios Guay and Dick Cook. They stressed the need to look at the entire system and described their plans to ramp up their efforts to establish large scale sorghum production areas (several 1000 ha). Their goal is to produce a consistent supply of high quality grain that can be contracted with a processor or grain buyer, thus creating a value added income stream for the farmers. Their belief is that grain grown and consumed by farmers individually do not contribute as much to the economy because a large percentage of is not sold. Their model depends heavily on selecting locations that are stable and have good infrastructure to aggregate the grain and if necessary ship to the processor. This is why they are interested in work in the Kayes region as they have already built a warehouse and the infrastructure in and around Kayes is quite good. Using these requirements, they also called into question the future of programs like theirs in the North areas of Tombouctu and Gao because of both the security and infrastructure issues that plague the region at present. In fact, they have put their plans on hold in that part of the country. They are very interested in our advanced work in Mopti and Kayes.

They also emphasized the need for selection of varieties that have good baking quality before releasing them. They emphasized that this needs to be based on lab measured parameters and end user/processor needs, not farmer perceptions alone.

Kayes Visit

The objective of this week was to engage DRA, IER and farmers in the décrue region to the north of Kaye, near Yelimane. We met with DRA Director in Kayes, Oumar Fofana upon arrival at Kayes. During our visit with him, he indicated that the décrue system in the Yelimane is a fall system. Sorghum was planted in the fall and harvested in January.

We visited a village near Yelimane with DRA specialist Boubacar Karambe. The village name was Niakatela (Lat:15.058416°, Long: -10.472273°; see Google Map Figure). The farmers that we visited had a very progressive attitude. The village chief, Sékou Doucoure, indicated that they were interested in anything that could increase their yields, but also cautioned that water supplies are typically their most limiting factor. They are operating in a environment where they start with a full soil profile (due to flooding), plant as the water recedes and then receive very little rainfall during this growing season. In 2010 at the IER CRRA station in the region, 36 mm was received in December. They were extremely interested in new sorghum varieties. The farmers also listed the following as problems they routinely face.

- Weeds – their fields were very weedy. They said they uses to use herbicides, but quit. They were not against using herbicides.
- Striga – the infestations were moderate. They also plant cowpeas and melons, so intercropping may be useful here.
- Insects – they described grasshoppers and “honeydew” as being seen in their fields.
- They did not appear to planting in rows, so this could aid in future weeding operations.
- Rodents – they killed what looked a lot like our ground squirrels in the U.S.

They gave us approximately 10 kg of their sorghum seed/grain. It was a white sorghum.

We also visited the IER CRRA at Kayes and met with the center director, Dr Dounankè Coulibaly. We discussed the prospects of their scientists assisting us with local efforts. Dr. Coulibaly indicated that they have scientists working in the Yelimane area (see Google map of Yelimane area, Kayes Region below) already (Mamadou Sissoko) and that they would be more than willing to assist our efforts.

Yelimane area, Kayes Region, Mali. Kayes City in lower left hand corner.

Sorghum samples were collected at Niakatela village near Yelimane, Mali.

Panicles of local sorghum cultivars acquired at Niakatela village near Yelimane, Kayes Region, Mali.

A souvenir picture of Sékou DOUCOURE, Niakatéla Chief of village and Abdoul Wahab TOURE (IER Sorghum Program scientist). Yélimané, Kayes Region, Mali

Striga observed in a field near Niakatela village near Yelimane, Kayes Region, Mali.

Niakatela village near Yelimane, Kayes Region, Mali.

Appendix 1

Report of Information and exchange workshop between partners about décrue sorghum Research (Campaign 2010) hold at Sevaré (Mopti) on January 26th and 27th 2011.

The year two thousand eleven and the 26th and 27th of January, was held at the Sevaré's Motel, the information and exchange between workshop partners on the results of research activities done during the 2010 campaign on décrue sorghum. The objectives of the workshop were to present the results of the 2010 campaign and to plan activities for the 2011 ones. The workshop starting ceremony was headed by Mr. Moumouni Damango, the Mopti Region Governor's Economic and Financial advisor who he was representing.

At this workshop forty-one participants showed up, among them we have the Directors and researchers from Gao and Mopti Regions Research Centers, researchers from Sorghum research program of Sotuba (Bamako) and Cinzana (Segou), The Agriculture Regional Director of Gao, the technicians from Governmental and no governmental organization (ONG) from Gao, Timbuktu and Mopti. The representative of Agricultural and animal breeding cooperative (Nafagoumo) of Kabara (One hour drive from Timbuktu) was also present.

The opening ceremony has been marked by three speeches, those of the regional Research Centers Directors of Mopti and Gao Regions, and the speech of Governor's Economic and Financial Advisor. All of the speakers thanked the participants for showing up, and USAID for the financial support without which the workshop would not have held. They all have wished success to the work.

After that, the staff of the workshop was set up:
Speaker or president : Patrice Samaké, DRA Gao
Reporters: NiabaTémé (IER/Bamako) and Amadou Sangho (Africare / Goundam ISAT).

Schedule:

Day of January 26th

During that day four slide presentations were given by Abdoul Wahab Touré, in addition the Agriculture Services and NGOs agents gave their opinions about the way were conducted the activities during the campaign.

Day of January 27th

Suggestions and approval of the previous day (26th) presentations synthesis and the 2011 campaign's activities planning.

The Presentation's Contents:

1. Evaluation of integrated agricultural practices;
2. Study of combined effects of soil and seed rate;
3. Evaluation of cultivars;
4. Trial in Experimental Stations in Gao and Diré.

Questions and debates

Many questions were asked. Satisfactory answers were given by the presenter and researchers from the Sorghum Research Program. Additional information was also given for better understanding by the participants. The results showed one can say that that the grain yield improvement is not related only to the use of chemical fertilizers, seed and soil treatment and high density but rather to the integration of all these factors including pests management.

The workshop pointed out that despite the high productivity of the variety called “Saba Soto”, it is less appreciated by women of the local area based on its taste (culinary level).

The discussions showed some shortage in décrue system characterization (lakes and ponds). The delayed inputs supplied were main constraints pointed by partners from NGOs and DRA.

Indicator Data Table

INTSORMIL Cooperative Agreement # 688-A-00-07-00043-00

Indicators/Targets	10/01/07 to 9/30/08	10/01//08 to 9/30/09	10/01/09 to 9/30/10	10/01/10 to 9/30/11 (Target)	01/01/11 to 03/31/11 (Current)
Program Element: 5.2 Agricultural Sector Productivity					
1. Number of new technologies or management practices under field testing as a result of USG assistance.	4	5	6	8	8
2. Number of new technologies or management practices made available for transfer as a result of USG assistance.	4	5	6	8	8
3. Number of additional hectares under improved technologies or management practices as a result of USG assistance.	500	974	1,000[1]	2,500	950[2]
4. Number of individuals who have received USG-supported short-term agricultural sector productivity training.	500 375 male/125 female)	1,000 800 male/200 female)	1,500 1,200 male/300 female)	2500 1800 male and 700 female	2500 1800 male and 700 female
5. Number of individuals who have received USG-supported long-term agricultural sector productivity training.	0	4	5	5	5
6. No. of farmers adopting new technologies or management practices.	500 375 male/125 female)	1,000 800 male/200 female)	1,500 1,200male/ 300 female	2500 1800 male/ 700 female	2500 1800 male/ 700 female
7. No. of processors or businesses/individuals involved in any form or post harvest activity.	6 1 male/5 female	18 3 male/ 15 female	25 10 male/ 15 female	50 20 male/30 female	45 10 male/30 female

[1] We are also collaborating with IICEM. The IICEM program included 1700 ha in Koutiala in 2010 and another 700 ha in the Segou region in addition to our 500 ha there. The IICEM project was asked by USAID-Mali to do the scaling up of our pilot project.

[2] In the IICEM, 2011 program are 2,500 ha in the Koutiala region and 3,000 ha in the Mopti Region. So this area increase would be in addition to our area increase here of 950 for a total of 6,450 ha through IICEM/INTSORMIL collaboration..

Problems

Production-Marketing

Difficulties

- Delay in the access to bank credit that has led many farmers to have a doubt on the project: many have used their good lands and kept the poor lands for this project which is still not taking shape.
- Farmers' lack of control in conducting the agricultural plots: for reasons of funding delay, farmers have not been trained on the agronomic aspects
- The Baraoueli area received successive heavy rains causing repeated flooding. In some localities, plots were completely flooded.
- More concrete plans for the types of storage facilities, the division of the contributions between IICEM (or other funding agency) and the farmers' groups and the dates for initiating activities will be a priority in 2011.
- Poor germination. Need for an efficient seed production system.
- We need to resolve the germination problems of Grinkan.

Challenges , constraints and perspectives

- Note that one remaining constraint for our Pilot Project is to develop a strategy to increase local bank involvement in input finance at the start of the crop season so that the input financing now provided by INTSORML can be transferred to local banks for sustainability of the project.
- We need to expand substantially the use of the PICs sacks to minimize the insect problems in storage and combining that with expanded storage and better storage management.
- Training of extension agents and farmers on storage and conservation techniques.
- Training of extension agents and farmers on marketing strategies.
- Organizing of the storage of 144 tons of grain representing the value in kind of inputs reimbursement.
- Organizing a common stock of 57 tons of grain representing a common fund of OP strengthening capacities.
- Cleaning of grain for to satisfy the standards required.
- Setting up a common fund to support the scaling up of the project.
- Extend this strategy of production and marketing of millet in 2011.

Training (long term academic)

Lack of English expertise has significantly increased the cost of the training program. Some trainees have spent the first three years only studying English. Due to the delay in their studies we will be requesting a no cost extension to allow them to complete their degree.
Recommendations:

- In selecting trainees for study in the U.S. more rigid screening process should be conducted and only those with adequate English should be allowed to apply for the training vacancy.
- Selected trainees should take their English in Bamako where it is much cheaper than in the U>S.
- Only applicants who successfully pass the English training in Bamako should be nominated to the U.S. universities.

Décrue

- Travel ban for U.S. PIs to Tombouctou area makes it difficult to manage the Décrue Sorghum Project.
- Need to supply at the appropriate time the technicians and farmers with inputs and others means needed for the research activities.
- Need to build the capacity of DRA , GNOs agents and farmers involved in the experiments.
- Birds in some studies caused almost 100% destruction of the grain.

Success Stories

Malian Thick Porridges and Satiety

Mohamed Diarra (IER) and Bruce Hamaker (Purdue University/INTSORMIL)

A study was recently conducted through INTSORMIL (Purdue Hamaker Project) to examine thick sorghum/millet consumption related to preference and satiation in the Sikasso, Segou and Mopti regions of Mali. This is part of a larger study to understand the effect of thick porridges, and delayed glucose delivery to the body, on satiety and overall food consumption.

The conclusions from the following data is that **thick porridges (tô) are generally eaten more frequently in the villages and are consumed in a thicker consistency (Figures 1 and 2), and are very satiating** (thicker porridges correlated with lower hunger scores at 2 and 4 hours post-consumption). We wonder if this could be used in a promotional campaign to encourage urban populations to consume more sorghum/millet tô – something on the order of "eat sorghum and millet – they are healthy satiating foods (not 'poor' foods)". Particularly in this time of high prices for grain imports, I think this could be helpful. (a little calculation – if one million families ate one more meal a week of sorghum/millet tô (using about 1 kg of flour for the meal), that is about 50,000 metric tonnes of grain a year, which is more than the total wheat imports into Mali in 2008).

This work will soon be submitted to *International Journal of Food Sciences and Nutrition*.

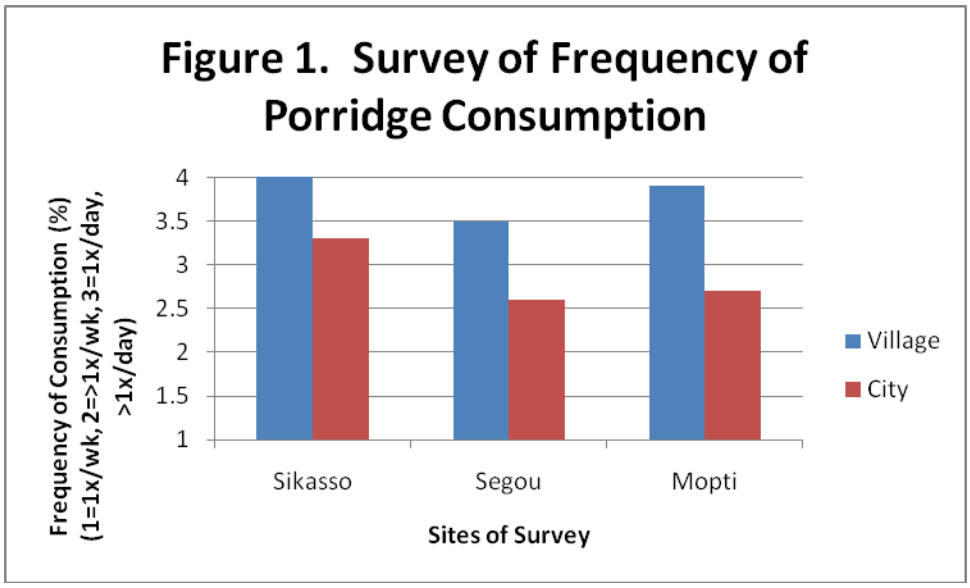

Figure 1 – Shows that thick porridges from sorghum/millet are consumed at higher frequency in villages than cities (Bamako likely is even lower in frequency).

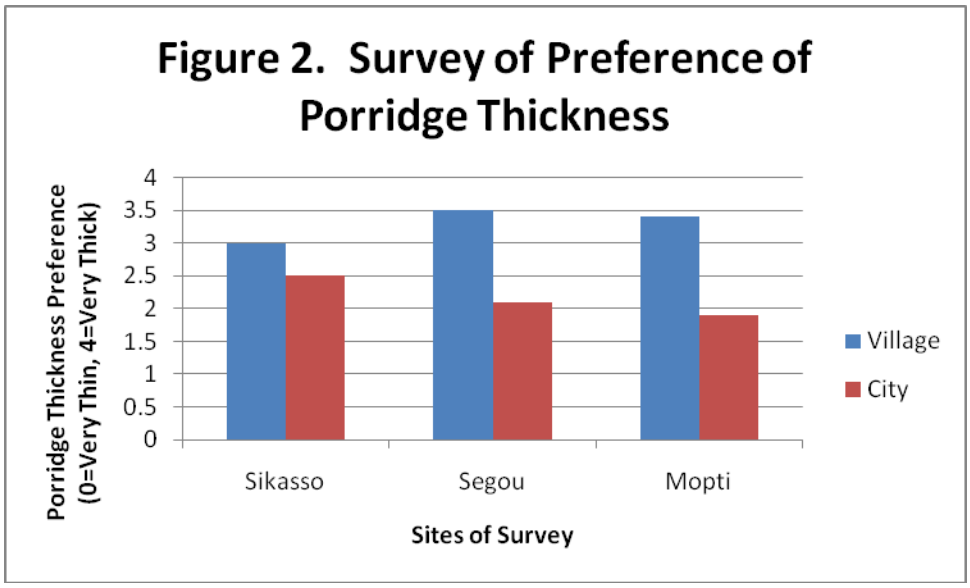

Figure 2 – Villagers eat thicker tô than city dwellers, perhaps related to its satiating effect and extended energy property.

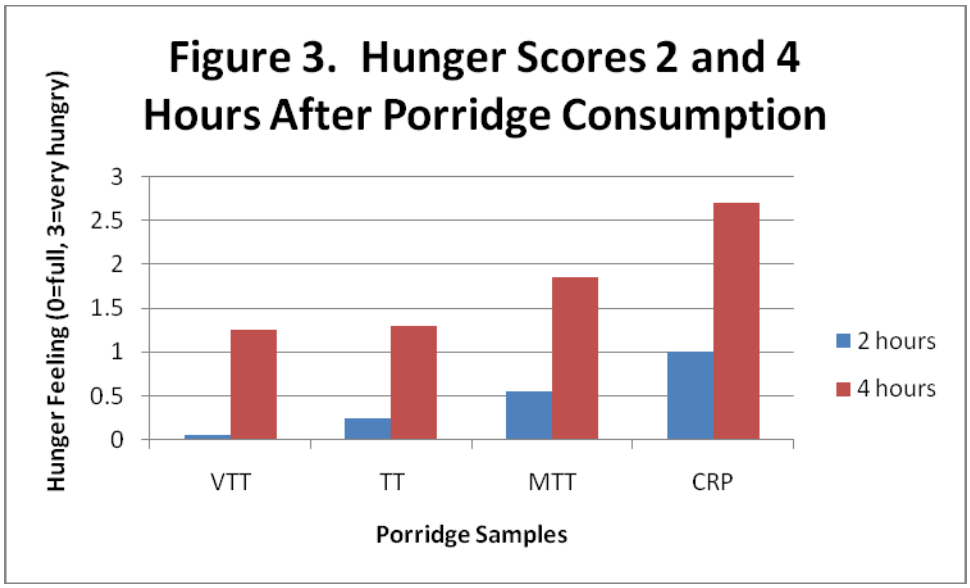

Figure 3 – Satiety study participants revealed large differences in hunger feeling 2 and 4 hours after consumption of porridges of different thicknesses. Notably, participants still felt full 2 hours after eating very thick and thick tô, and after 4 hours only felt slightly hungry. After consuming the control rice porridge, at 4 hours participants felt very hungry.The satiety study was designed so that participants consumed as much tô as they wanted until they felt "full". Participants were asked at 2 and 4 hours after consumption to judge their feeling of hunger (0=full, 1=slightly hungry, 2=hungry, 3=very hungry). VTT=very thick tô, TT=thick tô, MTT=medium thick tô, CRP=control rice porridge.

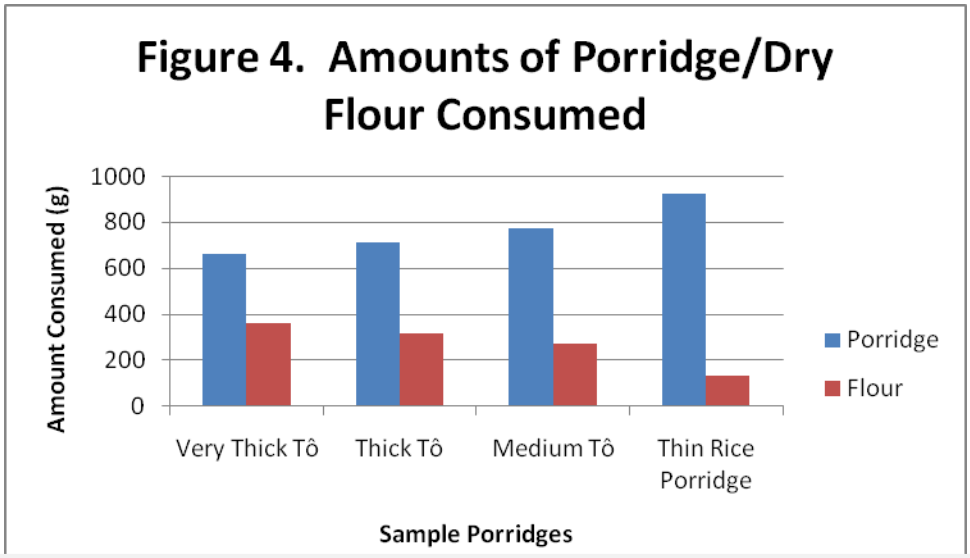

Figure 4 – Less volume of very thick porridge was required for participants to feel full (at time of consumption), they consumed more sorghum/ millet flour.

Activities Planned for Next Reporting Period

Production-Marketing

Work Plan for Production-Marketing for 2011.
John H Sanders and Botorou Ouendeba (Revised Jan 2011)

Introduction

In 2009 when the Production-Marketing project with IER help put almost 1,000 ha into new technologies, it was decided that for a more rapid expansion of the cultivated area IICEM would take over the scaling up process. Production-Marketing would remain as technical advisers to IICEM. In addition, Production-Marketing would continue their pilot project activities in those regions where the technology and marketing process were being developed and were not ready to move into a scaling up process.

In 2010 we collaborated in Koutiala and the greater Segou region with IICEM on two technology-marketing packages for the sorghum variety Grinkan and the millet cultivar Toroniou respectively. The primary innovation was the connection with the banks from the start of the process for input credit. Arranging bank financing turned out to be more difficult than expected. Nevertheless, IICEM put 2,500 ha into the new technology packages in these two regions. With the experience gained from dealing with banks in 2010 we are confident of much more success in 2011. A series of other implementation and technical problems were also identified in 2010.

After explaining where and how we will be operating in 2011 we will return to these specific implementation problems and explain how we will be responding to them. Thus there are now four components to our project: (1) Technical support to IICEM for the scaling up process; (2) Extension of pilot projects; (3) Resolving implementation and technical problems; (4) Publishing evaluation, marketing and gender impact studies.

Technical support to IICEM for the Scaling–up process

1). In Koutiala the process of bank negotiation between the extension agency, AMEDD, and the bank, BNDA, broke down in the spring of 2010. An agreement was reached at planting time but then farmers' associations lost interest in bank financing as fertilizer became available in the region for a much lower price than was being offered through bank financing. Rather than the 3,000 ha of bank financed new technology planned there was only 85 ha. However, due to the organization of the farmers' associations implemented by AMEDD and financed by IICEM, there

were an estimated 1,335 ha put into the new technology package. Almost all of these farmers obtained the DRA supplied subsidized fertilizer. The bank financing is expected to be more successful in 2011.

So for the crop year of 2011 we will again focus on facilitating the program of IICEM especially improving their dealings with the banks and the more rapid development of the farmers' associations. We will also concentrate in Garasso and another village on the process of developing regular seed supplier. This will evolve studying the germination and storage problems in PICs sacks and working with seed producers on branding. We will also work with the different farmers' associations on the marketing issues. For this we will need to identify the storage capacity already and assess the farmers associations that have attained viable size.
Another important lesson from the 2010 crop year was the inadequate training investment resulting in the failure of many farmers to follow the agronomic recommendations. It is common for farmers in the first year not to use their best lands, to implement some crop combination, or to fail to thin. Introducing the technology package to a group and multiple presentations to farmers generally resolves this problem because the average farmer, who is not following well the recommendations, can see the yield difference with the best farmers. Then in the second year the average farmers follow more rigorously the agronomic recommendations. However, with the scaling up the initial investments in improved agronomy have to be larger and more systematic. There will also be more focus on agronomic training for the new farmers' associations.

2). In the Segou region 500 new ha was planned and implemented by Global 2000 with 8 new farmers' associations. There were the same problems of poor agronomy especially the poor handling of inorganic fertilizer, poor soils utilized, and little thinning. Also another bank source for input credit needs to be identified. Sanders, Ouendeba, and Teme will make regular visits to both the Koutiala and Segou regions in 2011 to provide technical inputs and to identify problems. But we will also work with both the farmers' associations and the millet food processors to facilitate these networks and to encourage higher quality clean cereal production by farmers and a regular assured price premium from the farmers' associations. We will probably organize a marketing study to see how this system is functioning in 2011.

3). In the Mopti region we presently have 300 ha in new technologies in six different farmers' associations. Traditional storage of leaving the stalks on the ceilings and roofs is practiced here. Farmers are happy with the new technologies. But improving storage is particularly important. If IICEM does not do this, we need to investigate other sources of support for improved storage. More concrete plans for the types of storage facilities, the division of the contributions between IICEM (or other funding agency) and the farmers' groups and the dates for initiating activities will be a priority in 2011.

Extension of pilot projects into new regions

1). In the **Mopti** region in 2010 we had 300 ha in new technology. Here we need a new millet cultivar as Toroniou is an old selection and there has been new breeding work with millet in Mali. Also we will need to improve the agronomy being practiced though the most effective

force for improvement is the observation by farmers of other farmers' yields. However, the critical innovation is the rapid construction of storage facilities. This enables farmers to wait for better prices avoiding sales at the price collapse period after harvest. The farmers' associations can become "commercantes."They buy small quantities, store, and then systematically look for better prices for both their products and their inputs. We need to determine what agency is going to finance this storage if IICEM is not going to do this. The storage is urgent for the implementation of our new marketing strategies. New area in the pilot project with its three components in Mopti is projected to be 360 ha but this will also depend upon how well the various regions performed in reimbursement and in following the agronomic recommendations.

2). Koutiala is the largest area of the IICEM scaling up process. Here we will concentrate on developing a seed production system in Garasso and possibly another village. We will extend our collaborative activity to the DRA as well as AMEDD. We will work with AMEDD on making contacts with the banks for the farmers' associations and on improving the marketing aspects of the program. The ties to the intensive chicken producers will be especially important to avoid the price collapse of the good rainfall years. We have already been collaborating with IICEM on producing a new Fiche technique as a cook book for farmers and farmers' associations. We need to resolve the germination problems of Grinkan though we now are reasonably sure that they result from the late rainfall. So we need to establish a procedure to deal with this.

3). We have an excellent working relationship with Global 2000 in the Segou region for the approximate area of 500 ha in millet production in 2010. Here the agronomy training needs to be improved as many of the farmers performed very poorly in following recommendations during 2010. Besides this improved training we will dedicate our activities to building up the marketing capabilities of the eight farmers' associations and to developing the farmers' associations as bargaining agents for the farmers for both product sale and input purchases. We do not plan to be involved in extending the area in new technology but will probably organize a study to evaluate the performance of marketing and the ties to the millet food processors in Bamako during the summer of 2011 and identify how this can function better to get farmers higher prices and processors larger quantities of clean millet.

4). We began work in the Kayes region in 2008 but due to the pressures of expansion in other regions and then the scaling up were not able to visit again until August 2010. We are not satisfied with the performance of the old cultivar Seguifa here. **We have been pushing IER for a new cultivar that is a Guinea-Caudatum cross,** intermediate height and season length. As in Mopti there is a very good, supportive, regional DRA director. Our expansion here will depend upon the costs in the above three priority regions and our time available. We are budgeting for an expansion of 180 ha here but we may need the money or the time in the other regions. If that is the case, we can continue our push with IER to get better cultivars for this region than Seguifa.

5). Fana. Doumbia of IER has been introducing a new conservation technique here with an approximate cost of 5,000 CFA/ha. We will investigate putting our technologies and marketing strategies on top of his soils technique. This technique does water retention and slows erosion.

Since our combined technologies already cost 35,000 to 50,000 CFA/ha we will stay with farmers already using Doumbia's technique and then investigate the potential to diffuse the combined package on 60 ha.

Resolving implementation and technical problems

1) A high priority technical problem is resolving the germination problem of Grinkan as that is our flagship cultivar , which has been very successful in the Koutiala region. Germination rates around 60% were very common in 2010 necessitated replanting. The pervasiveness of this problem from many sources of seed indicates that this probably resulted from the late rains. Farmers rightfully were not happy with this. We will be introducing a simple test in 2011 for determining if the humidity is low enough for storage. We will also be extending the use of the plastic triple bags for all of seed production and for more of the grain going into storage. There is also a simple technique for farmers to identify good seed that would reduce the need for replanting. This also gets us to the need for a regular supply of high quality seed. However, two important problems were identified that have to be addressed in 2011. First, unlike in 2008 and 2009 there were germination problems with Grinkan all over the country. Moreover, our participant seed producers do a good job but have trouble removing off types and are probably storing with humidity over 11% when there are late rains. We need to improve their performance but also develop a few excellent seed producers and do branding here. We will concentrate on developing a seed production system for Grinkan in Garasso and another village in the Koutiala region.

2) Improve and rapidly multiply the storage facilities. We have already mentioned the collaborative activity with IICEM to rapidly increase the number of storage facilities in Mopti. If IICEM does not make the investments in storage facilities we will need to identify other NGOs that could help in this activity. As we get all the farmers to test for excessive humidity and to use the triple sacks, these measures should take care of fungi and storage insects. But we will need to bring in the IER and INTSORMIL entomologists to verify this.

3) New millet and sorghum cultivars. We need to replace both Toroniou and Seguifa with higher yielding, regionally adapted cultivars. These are available in IER but we can also look in ICRISAT. There is a continual testing process going on so we should not stay with these old cultivars. Toroniou is not especially high yielding and Seguifa is susceptible the mold-head bug complex.

4) Better training for farmers in agronomy especially where we are scaling up. Fertilizer was often carelessly applied and is the most expensive and the critical input for the success of the technology. Sometimes it was broadcast, sometimes applied by children,

and often not covered. It needs to be side dressed preferably just around the plants.[5] There have been two "fiche techniques" (in French) produced covering agronomic, marketing, and association development issues in 2011.We are in the process of producing laminated copies. Besides focusing on the three principal program components the fiches go into detail on the agronomic training especially on fertilizer placement, thinning, selecting good land areas and complementing inorganic with organic fertilizer. Organic fertilizer complementation is especially on the sandy soils where soil structure and microbial activities need to be improved for the inorganic fertilizer to be effective .

5) Training in dealing with banks. Knowing when they are getting good interest rates and repayment terms is important for both our extension NGOs and farmers' associations. This decision on input credits in 2010 was complicated by the availability of the subsidized fertilizer outside of the bank lending framework. That option of the availability of subsidized fertilizer will not always exist but farmers will continue to want input and "warrantage" (inventory) credits. So an important sustainability issue is building up the capacities of the farmers' associations and the main extension partners to deal with the banks.

Publishing evaluation, marketing and other studies

1) Each year we evaluate the economic results of the previous crop season. This includes yields, repayment of the input credits, prices received, and profits. We compare all these indicators with the performance of those not in the program. Note that for prices received we wait until the following summer after the fall harvest. One of the principal marketing recommendations is to sell later in the year to avoid the harvest time price collapse. Over time an important indicator of the confidence of the farmers in the farmers' association is the quantity of the production that the farmers let the associations sell for them after repaying the input credits in kind. Farmers' associations tend to be paternalistic. Rather than sharing profits and thereby increasing incentives, they often want to tell the farmers what to do with the association's profits. As the farmers' associations share profits and farmers get more confidence in the associations, the farmers will let the associations sell more for them.

[5] This is a labor intensive technique but fertilizer is the critical and most expensive input so it has to be applied well. Moreover the thinning is also very labor intensive. With all these labor intensive requirements for applying well the agronomy, smaller farmers have a natural comparative advantage in achieving higher yields from this project. But they have to be convinced that they should do all these practices. Usually what works best for convincing them is seeing the successes of other farmers in getting yields and prices up from the project.

2) We have already done a study of the millet food processors and the price premium for uniform, clean cereal and this study needs to be updated now that there are more millet food processors and more farmers' associations selling clean cereal. With the 500 new ha in Toroniou millet in Segou and the connection of their farmers' associations with the millet food processors in Bamako we need to document the problems and progress of this emerging network. Moreover, we need to do a study of the emerging intensive chicken production sector in Mali and its potential to use sorghum in the feed. We also need to connect the new farmers' associations in the Koutiala region producing Grinkan sorghum with the intensive chicken producers as we did in the workshop for Segou millet producers. Approximately 50% of the ration by quantity is cereal, maize or sorghum whichever is cheaper.

3) Jeanne Coulibaly, PhD student at Purdue University, is doing a study on the income and welfare consequences of the new sorghum technologies in the Koutiala region with an emphasis on the effects on women. She will also look at alternative policies and technologies to increase the welfare of women and children.

Décrue Sorghum

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Work Plan for Décrue Sorghum for 2011

I. Activities

1. Continuation of ongoing activities by including pests' management practices
2. Collect, evaluate and storage of lakes and ponds varieties
3. Participative Selection
4. Training for technicians and farmers

II. Sites

1. Mopti : Samakrie
2. Gao : Biya
3. Timbuktou : Lakes Faguibine, Oro

III. Collaborators

DRA Mopti, Tombouctou, Gao, GNOs.

IV. Recommendations

1. Characterization of agricultural systems in the lakes and ponds.
2. Continuation with the variety Saba Soto purification.
3. Supply at the appropriate time the technicians and farmers with inputs and others means needed for the research activities.
4. Build the capacity of DRA , GNOs agents and farmers involved in the experiments.

V. Transfer of Technology (Demonstration tests and Adaptive Research planned for 2011)

Demonstration tests		Region	Cercle	Commune	Village
DRA MOPTI	Testing varieties	Mopti	DOUETZA	N'Gouma	N'Gouma
	Nutrient deficiency trials	Mopti	MOPTI	Korombana	BAGUI
DRA TOMBOUCTOU	Testing varieties	Tombouctou	Tonka	Tonka	Débé Yourmi
	Nutrient deficiency trials	Tombouctou	Tonka	Tonka	Débé Yourmi
CONFIGES	Testing varieties	Gao		Taboye	Bya
RCGOP TOMBOUCTOU	Testing varieties	Tombouctou	Goundam	DOEKIRE	Koriome
AFRICARE	Testing varieties	Tombouctou	Goundam	Goundam	Goundam
Adaptive Research		**Region**	**Cercle**	**Commune**	**Village**
IER	Testing cultural practces	Tombouctou	Goundam	Bintagoungou	Bintagoungou
		Tombouctou	Goundam	Goundam	Goundam
IER	Testing varieties	Tombouctou	Goundam	Bintagoungou	Bintagoungou
		Tombouctou	Goundam	Goundam	Goundam
IER	Testing plant population	Tombouctou	Goundam	Goundam	Bougoumaïra
IER	Soil fertility test	Tombouctou	Goundam	Goundam	Goundam
IER	Testing insecticides and fungicides	Tombouctou	Goundam	Bintagoungou	Bintagoungou
		Tombouctou	Goundam	Goundam	Goundam

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