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Transfer of Sorghum, Millet Production, Processing and Marketing Technologies in Mali Quarterly Report July 1, 2011 – September 30, 2011

INTSORMIL

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

Quarterly Report
July 1, 2011 – September 30, 2011

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1. Introduction

"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 the use of millet and sorghum as a food for humans and as a feed for poultry**
- **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.**

2. 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**
SAA	**Sasakawa Foundation**
WFP	**World Food Program**
WTAMU	**West Texas A&M University**

3. Executive Summary of Achievements

The Production-Marketing team of B. Ouendeba, M. Diourte and J. Sanders visited the major sites of our activities in both July (July 19- August 6) and September (September 17-October 1). Grinkan is our flagship cultivar in the south of Mali with yields regularly over 2 t/ha when farmers follow the agronomic recommendations. In Garasso the center of our pilot project activity Grinkan has been referred to as the "Cotton of Garasso." We want to expand our pilot project activities by 1,000 ha in the Koutiala cercle in 2012 once this good Grinkan seed is available. The second major site for the Production-Marketing project, the Mopti region, was also reviewed on both trips. In Mopti there were 250 new ha for men and 90 ha for women in seven different villages (Oualo, Kanikombole, Kountogoro, Tere, Sadia, P.-Begne and Temegolo) in 2011. With the new ha the total was 760 ha in the improved technology-marketing strategy-farmers' association project in 2011. For the Mopti region Niaba Teme purchased certified seed of Toroniou from seed producers in the Cinzana region for both our project and for IICEM activities in Mopti. There was an excellent response from fertilizer in the farmers' fields that we saw and farmers were very happy with the Toroniou seed and the associated technology. We also visited some of the 500 new ha in 2011 in the Segou region. This is also a millet Toroniou zone and the millet is looking very good. Farmers are happy and there is a good response to fertilizer here as in Mopti. In the Segou region we have been concentrating on clean millet and the ties to the World Food Program. The Gates supported food aid program and the millet food processors purchased millet from our farmers. Millet prices of 140 and 125 F CFA/kg were obtained from these two buyers respectively. M. Diourte and N. Teme also visited two new sites where progeny of Grinkan (Tiandougou Coura and Tiandougou) are being expanded in 2011 after regional trials in 2010.The two sites were Kita (Kayes) and Beleco (Koulikoro). This is our standard technology package with 50 ha for men and 10 ha for women in each site. The results were excellent and we will be rapidly expanding the area in these new cultivars in 2012. We surpassed our target indicators in number of women adopting new technologies and in yields of both millet and sorghum.

Food Processing Project activities focused on 1) further building capacity and providing technical support to entrepreneur partners in the Mopti/Gao region of northern Mali, and 2) completion, testing and final work on the

Incubation Center at IER Sotuba in Bamako. These two parts of the Processing Project comprise activities in Mali concentrated on expanding markets for sorghum and millet. Other related work in this quarter relates to INTSORMIL training activities for Ms. Fatima Cissé, M.S. student at Purdue University who spent 3 months in Bamako conducting part of her research thesis work. Processors in the Mopti/Gao region are now generally functioning in terms of processing milled products that are being sold into the marketplace. We have a full-time food technologist, Niamba Fousseyni, who resides in Sévaré, the adjacent town to Mopti where our entrepreneur partners have their processing units. Niamba has played the critical role of working constantly with the processing units, in Sévaré as well on a monthly basis in Gao.

The Incubation Center (IER Sotuba) building and milling and agglomeration and drying equipment was fully functional in June 2011. At that time, we conducted a demonstration and training workshop for Bamako area processors and our Mopti/Gao entrepreneur partners. Over the summer quarter, final items were completed for the formal launch of the Center at October end. During the summer equipment was tested and procedures were further developed for processing of products. We have identified two Bamako area processors to work with and have installed two processing equipment pieces in these two units, with a repayment scheme similar to that used with the Mopti/Gao entrepreneurs.

Décrue sorghum project activities include 1) Expansion of the sorghum varieties Saba Tienda and Saba Sôtô with more farmers involved in other regions of the décrue system, 2) Introduction of new cultivars in Gao, Mopti and Kayes through an adaptation test, 3) Training on insect identification and pest management for all technicians involved in extension and research of the décrue system and 4) A better understanding of the response to fertilizer of sorghum, through soil and plant analysis from experiments conducted in the décrue systems.

***Short term training*- Abdoul Wahab Toure,** is currently training at Kansas State with Drs. Prasad and Staggenborg in Agronomy. Mr. Toure is learning new research techniques in the field and in the lab, attended the US Sorghum workers annual meeting at Oklahoma State University and presented his Mali research program to the Great Plains Sorghum Center faculty. He returns to Mali in mind October.

Long Term Training (Academic)- We have five long-term academic students from Mali studying the US and as of June 2011, all are enrolled in their respective Master's graduate programs. Their graduate school admission dates varied from January 2010 to June 2011, due to English language skill performance. Initially two of the five identified long term trainees were female, but one dropped out due to family issues and the USAID decision to not allow young children to accompany the trainees. However, one female trainee remained in the program and was the first to obtain the needed English skills (TOEFL score), the first to be accepted into a graduate program, and is now being considered for PhD rather than a Master's. This is both a gender achievement and a success story.

4. Progress

Production – Marketing: John Sanders, Purdue University and Botorou Ouendeba

The Production-Marketing team of B. Ouendeba, M. Diourte and J. Sanders visited the major sites of our activities in both July (July 19- August 6) and September (September 17-October 1). Our principal focus in the Koutiala cercle is on

the production of good seed of Grinkan for the 2012 season to resolve the poor germination problem resulting from the late rains of 2009 and 2010. Grinkan is our flagship cultivar in the south of Mali with yields regularly over 2 t/ha when farmers follow the agronomic recommendations. In Garasso the center of our pilot project activity before entering the scaling up process in 2010 Grinkan has been referred to as the "Cotton of Garasso."

As with any caudatum sorghum and with maize late rains can result in mold and increased insect problems thus creating germination problems in the following season. So it is important for farmers not to plant early this medium cycle length cultivar. With the organization of Niaba Teme of IER 12 ha of breeders' seed of Grinkan (less than 5% impurities) have been planted in four sites in 2011 including at two regional experiment stations of IER, Cinzana and Kogoni. Isolation has been good but we need to keep after the farmers about the roguing. Germination testing will be done in IER. We want to expand our pilot project activities by 1,000 ha in the Koutiala cercle in 2012 once this good Grinkan seed is available. On both trips we visited the seed producers in the immediate area of Koutiala and in Katsina.

The second major site for the Production-Marketing project, the Mopti region, was also reviewed on both trips. Here there were in 2011 250 new ha for men and 90 ha for women in seven different villages (Oualo, Kanikombole, Kountogoro, Tere, Sadia, P.-Begne and Temegolo). Adding in the previous years' areas, which were continued in 2011 with the rotating funds gives another 350 ha for men and 70 ha for women in our pilot project in the region. Then the total is 760 ha in the improved technology-marketing strategy-farmers' association project in 2011.

For the Mopti region Niaba Teme purchased certified seed of Toroniou from seed producers in the Cinzana region for both our project and for IICEM activities in Mopti.[1] There was an excellent response from fertilizer in the farmers' fields that we saw and farmers were very happy with the Toroniou seed and the associated technology. In spite of our specific recommendation to use Apron Star a cheaper fungicide was used in the Mopti farms and problems with Mildew were observed. Due to the potential seed transmission of Mildew we insisted on Apron Star and provided the additional funds for it. In 2012 we will buy it ourselves if necessary.

An essential component of our marketing strategy is enabling farmers associations and farmers to wait for the price recovery after the harvest price collapse so improving storage capacity at the village level is often critical. In 2011 due to a budget shortfall in IICEM they were not able to follow through on their plans to build storage facilities in the different regions. Hence Production-Marketing put up funds to complement the construction of storage facilities in the seven villages of Mopti mentioned above. The village contribution is the labor, clay bricks, sand, and gravel. Production-Marketing is paying for the cement, door, windows, roof, and pallets. Storage capacity is only 30 to 40 tons per village and the adobe bricks do not last as long as all cement facilities but this was a start for these farmers' associations. This construction activity was well organized and now is supervised by Soungalo Traore of the DRA-Mopti.

We also visited some of the 500 new ha in 2011 in the Segou region. This is also a millet Toroniou zone and the millet is looking very good. Farmers are happy and there is a good response to fertilizer here as in Mopti. In both Mopti and Segou farmers were nervous about the rainfall counting on some more rain for the grain filling of the cultivar.
In the Segou region we have been concentrating on clean millet and the ties to the World Food Program (P4P. The Gates supported food aid program obtaining some millet supplies in Segou) and the millet food processors. Millet prices of 140 and 125 F CFA/kg were obtained from these two buyers respectively.

The Segou region has a reputation for dirty millet. Now our original pilot project village, Tingoni, is known in the region for its clean cereal. We are trying to replicate this model on a large scale in collaboration with Sasakawa (an international NGO). Sasakawa expanded the area in the Segou region by 496 ha in 2010 and by 500 ha in 2011. Last fall

[1] The IICEM program was responsible for getting 2,200 ha into the new technologies in the Mopti region. They obtained BNDA financing at the favorable terms of 13% interest and 11 month loans so repayment was not forced during the low price period. There was not enough Toroniou seed so some local seed was used and farmers noticed the difference.

we organized a workshop for the farmers' association representatives and the millet food processors of Bamako to get better collaboration and regular ties between the two groups.

M. Diourte and N. Teme also visited two new sites where progeny of Grinkan (Tiandougou Coura and Tiandougou) are being expanded in 2011 after regional trials in 2010.The two sites were Kita (Kayes) and Beleco (Koulikoro). This is our standard technology package with 50 ha for men and 10 ha for women in each site. The results were excellent and we will be rapidly expanding the area in these new cultivars in 2012.

Food Processing: Bruce Hamaker and *Fatima Cissé,* Purdue; Yara Koreissi, IER/LTA; Mamadou Diouff, Consultant

For this quarter, the Processing Project had activities focused on 1) further building capacity and providing technical support to entrepreneur partners in the Mopti/Gao region of northern Mali, and 2) completing testing and final work on the Incubation Center at IER Sotuba in Bamako. These two parts of the Processing Project comprise activities in Mali concentrated on expanding markets for sorghum and millet. Other related work in this quarter relates to INTSORMIL training activities for Ms. Fatima Cissé, M.S. student at Purdue University who spent 3 months in Bamako conducting part of her research thesis work that is described below.

Component 1 –Mopti/Gao region entrepreneur partners

Processors in the Mopti/Gao region are now generally functioning in terms of processing milled products that are being sold into the marketplace. We have a full-time food technologist, Niamba Fousseyni, who resides in Sévaré, the adjacent town to Mopti where our entrepreneur partners have their processing units. Niamba has played the critical role of working constantly with the processing units, in Sévaré as well on a monthly basis in Gao. Activities for the quarter have included:

July 24 to 30, the processing team from IER/Sotuba visited the major sites (Sévaré/Mopti, Bandiagara and Gao) of our activities. The objective of this visit was to monitor and supervise the movement of previous stocks of grains procured for the processors mainly from farmer's groups from the Production/Marketing portion of the overall project, and to facilitate renewal of the stock where necessary. The processing units had finished the old stock, and some had renewed it themselves, while others had not. A new grain stock of 14 tons of millet was made available, for payment, for the Mopti and Gao processors to have good and clean grain for processing. It is quite clear that it is critical to procure sufficient high quality grains for processing to make competitive products for the marketplace.

September 24 to 30, our consultant, Mamadou Diouf from ITA/Dakar, and the LTA team visited Sevare/Mopti and Gao. Entrepreneur partners and their staffs were trained in good manufacturing practices including sanitation similar to the hazard analysis and critical control points (HACCP) approach used in the US. Documentation methods were stressed including how to fill the technical documents as well as to record amounts of products processed and sold. Stocks of grain were again evaluated and arranging for sources of high quality grains were discussed, so that at project completion that a system is in place to obtain such grains. During the trip, the INTSORMIL processing team had a meeting with IICEM/Mopti to exchange information on the activities of both project.

This visit was also made to monitor the state of the functioning of machines, and the building of minor outside shelters in two of the units and other minor complementary work for the improvement of working conditions in the units. An arrangement was made for a local mechanic to be available for equipment maintenance in Sévaré. Likewise, a resource person has been identified in Gao for mechanical issues of the processing units.

Niamba Fousseyni, the INTSORMIL project technician for Mopti/Gao moved to a new apartment that now acts also as our extension center for activities in the Mopti area. Niamba reports that, in general, the units are working very well,

though small problems persist in some processing units and thorough documentation at each unit by our processor partners is still an issue in some units.

After meeting and agreement with beneficiaries in Mopti/Gao (and Bamako), the entrepreneur partners will participate in the FEBAK 2011 (Foire exposition de Bamako) in November. This participation will be benefit to them to exchange experiences with processors in other localities and to have new contacts.

Component 2 - IER/LTA Incubation Centre

The Incubation Center building and milling and agglomeration and drying equipment was fully functional in June 2011. At that time, we conducted a demonstration and training workshop for Bamako area processors and our Mopti/Gao entrepreneur partners. Over the summer quarter, final items were completed for our end of October formal launch of the Center. Also during this time, equipment was tested and procedures were further developed for processing of products. We have identified two Bamako area processors to work with and have installed two processing equipment pieces in these two units, with a repayment scheme similar to that used with the Mopti/Gao entrepreneurs. Work is already underway to demonstrate the functioning of the Incubation Center in providing technical support and further process refinement with processors for processing of quality competitive products.

On July 12 a trip was made to Kafara to discuss and negotiate with farmers to get a stock of good and clean grain of sorghum (SEWA variety) to test the performance of equipment in the Incubation Center. From this trip a stock of 500 kg of sorghum was bought from the farmer's association and brought to IER/LTA for the testing at the Incubation Center. There was follow up of the last complementary equipment items for the Incubation Center with colleagues at INRAN in Niger (*couscous* agglomerator) and suppliers in Sénégal and Mali.

Our principal focus during the quarter was to test the performance of the equipment in the Incubation Center using the 500 kg of sorghum (Sewa variety) as mentioned above. Overall, the agglomerator is working very well and properly for the *couscous* and *degue,* but not for the *moni kuru* (main dish for breakfast). Further research needs to be done on the equipment for *moni kuru* processing.

After the meeting at USAID with Mamorou Diourte and John Sanders, the USAID team visited the Incubation Center at Sotuba in July.

Thesis Research Project of Fatima Cissé

Part of Fatima Cissé's research project at Purdue University involves collecting data on nutritional/health attributes of traditionally made foods from millet and sorghum that may make them desirable to buy and consume compared to imported grains and tubers used in urban areas of Mali. Our goal is to understand whether and how millet and sorghum foods may be promoted to urban consumers for market expansion for local farmers. In a previous study conducted by us in the fall of 2010, we found that at the village level, in three regions (Segoú, Mopti, Sikasso), participants preferred thicker porridges (tô) compared to urban consumers and that thicker porridges were significantly more satiating (less hunger feeling at 4 hours after consumption). In the present study, Fatima used a ^{13}C-breath test (stable, safe isotope of carbon that is naturally found in foods) to evaluate gastric emptying rate of traditional and imported foods for Bamako consumers. Rapid gastric emptying of starchy foods generally results in high glycemic response and may relate to feeling of fullness and caloric intake related to obesity. It should be noted that hunger feeling and consumption patterns of food are multi-factored events. Still, large differences in gastric emptying rates may be related to healthiness of foods. Eight foods were evaluated [rice, potatoes, pasta, thick millet and sorghum porridges, thin millet porridges with and without *moni kuru* (particulates), and millet couscous]. Gastric emptying rates of the foods were substantially different and grouped as follows: rice > potatoes, pasta > thin porridges > thick porridges > couscous. Thus, newer "imported" foods overall had faster gastric emptying rates than the traditional millet and sorghum foods. Further evaluation of the results is in progress

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

Specific objectives and the progress in each objective

1. To conduct a survey of farmers' perception about current management practices and their needs and preferences in the area of Gao and Kidal.

What was done during the reporting period:
-New cultivars are already submitted to farmers' for their appreciation in Gao. Kayes should be active by September; **but last reports from Kayes emphasize that only 30 % of the plots will be planted, due to drought** . Farmers' needs and preferences will be collected in October in Gao and in December in Kayes.

2. To collect soil samples from the décrue experiments and analyze for physical and chemical properties in relation to yields of crops in the décrue systems.

What was done during the reporting period:
-Soil samples were collected.
-The process of sending soils and plants in Kansas State University (KSU) for analysis has been completed but their analysis has not yet been completed.

3. To collect samples of the cultivars grown in the region near Gao and Kidal as well as identify existing varieties that may be adapted to the region.

What was done during the reporting period:
Cultivar sampling will occur at physiological maturity, which is expected by October.
Experimental sites: Tombouctou, Gao, Mopti and Kayes.

4. Establish field experiments on integrated soil, water and nutrients to develop décrue sorghum management strategies for improved productivity.

What was done during the reporting period:
Integrated soil nutrient and pest management strategies were expected to be conducted in Mopti where reports indicated crop failure in 80 % of the plots in Korienze.
In Kayes , recent report indicated in September, late planting of sorghum due to weather problems.

5. To diffuse the generated improved techniques in the new areas (expanded to Kayes).

What was done during the reporting period:
Personnel in Mopti and Kayes were contacted to undertake diffusion of improved techniques. Money was sent in June (first portion). Surprisingly, reports indicated crop failure in one case and weather for another.

Progress by Experiment

1. Evaluation of Crop Management Practices

What we learned as based on 2010 results:

-Increasing plant population (minimizing spacing) increased grain yield across all genotypes, suggesting better resource use (light, nutrients and water).

-Use of seed or soil treatment with pesticides increased the number of plants that survived till maturity. However, there were no clear differences for number of panicles infested with pests. Further research is necessary on use of other chemicals, rates and methods of application.

-Application of fertilizer did not increase grain yield. This suggests high fertility of the soil in the décrue system (especially in the selected sites).

2. Evaluation of cultivars

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 deficiencies study

The response of sorghum to fertilizer depended upon the soil type and location. In poor soils such as those in Tonka, the sorghum crop responds to nutrients. Maximum decreases in grain yield were observed when N or P were deficient.

4. Diffusion of Improved Technologies.

-For a wide diffusion of Saba Tienda and Saba Sôtô, seed production of the former and seed purification of the latter are needed.

-Demonstration plots were undertaken with Saba Tienda and Saba Sôto in Mopti region but severe drought occurred. The demonstration in the Kayes region was postponed due to weather problems.

-Demonstration plots were undertaken with new cultivars in Goundam: Saba Sôtô Koreye, Saba Al Bakar, Saba Sôtô Kara.

Progress during the reporting period

What was expected	Where we are now	Where we go next
1) Expansion of Saba Tienda and Saba Sôtô with more farmers involved in other regions of the décrue system	MOPTI: -24 farmers in two locations (Korientze and Gouina) planted Saba Sôto and Saba Tienda in Mopti region. -Reports indicated crop failure on 80 % of the plots in Korienze due to drought. KAYES: By the end of September, décrue sorghum was not planted yet due to climate change.	Technology development in the décrue system should take into account drought and earliness in crop improvement strategy. Only one third of expected plots will be finally planted.
2) Introduction of new cultivars	GAO and MOPTI -50 cultivars are being tested in	Participatory approach involving

in Gao, Mopti and Kayes for adaptation test.	the décrue system. KAYES: -50 cultivars should be introduced by the end of October 2011.	farmers, extension staff and scientists will be required for an efficient assessment of these introduced cultivars
3) Training on insect identification and pest management for all technicians involved in extension and research of the décrue system.	More than 20 technicians of research and extension were trained.	Strengthen technicians and farmers capacity in insect identification and pest management is still required
4) Crossing Saba Sôtô (found as tolerant to honey dew) with varieties reported for their earliness and grain quality	No report on this topic was not available yet	Update of related activities to the cross of Saba Sôtô is required with earlier varieties with grain quality.
5) Better understanding of the response to fertilizer of sorghum, thru soil and plant analysis from experiments conducted in the décrue systems.	Making available for analysis in Kansas State University labs, soils and plant samples from the décrue area has already started; but not ended yet.	-Ending expedition process of the soils and plant samples by December 2011, and their analysis by march 2012. Publication on plant response to fertilizer in the décrue area by September 2012
6) Better understanding of water dynamics in the soil profile of the décrue system, along the growing season of sorghum, particularly during its reproductive growth stage.	Lack of information on water dynamics in the soil profile.	Purchase appropriate equipment by November 2011 to monitor leaf area and water in the soil profile by January 2012.

Training: Jess Lowenberg-DeBoer, Purdue University

Background

Short term training

Abdoul Wahab Toure, short-term trainee going to at Kansas State, had some problems with the visa process in Mali. Due to this problem his training program was delayed from July 15-September 1, 2011 to August 15 to October 15, 2011.

He is currently training at Kansas State with Drs. Prasad and Staggenborg in Agronomy. Mr. Toure plans to present his research to the Great Plains Sorghum Center faculty during his visit.

Long term training

We have five long-term academic students from Mali studying the US and as of June 2011, all are enrolled in their respective Master's graduate programs. Their graduate school admission dates varied from January 2010 to June 2011, due to English language skill performance.

Short term training Progress

Mr. Abdoul Wahab Toure: Research Scholar, Kansas State University

Abdoul Wahab Toure is currently a research scholar in crop physiology and production laboratory at Kansas State University. He is participating ongoing field research activities on sorghum and soybean. He also initiated a controlled environment research experiment to understand the root growth of various crop including the sorghum genotypes from Décrue region in Mali. The objectives of his research are (a) to assess differences between crop species based on root parameters; and (b) to assess differences within crop species based on root parameters. Different crop species involves sorghum, corn, wheat and millet under full irrigation and drought stress condition. These experiments are set in controlled environment conditions in green houses. There were two experiments, the first to be harvested after two weeks of stress and quantify effects during early seedling stages; and second experiments to see the effects at late vegetative or reproductive stages of crop development. The first experiment was harvested in late September and data is currently be collected on root traits using root scanner and WinRhizo software.

Mr. Abdoul Wahab Toure preparing root samples for scanning.

Mr. Abdoul Wahab Toure measuring root traits of sorghum plants

Long term training Progress

Fatimata Cisse (Purdue Food Science) has successfully completed five semesters of coursework and her eight-week research visit to Mali to collect her data. In addition to one course, she is entering and analyzing her data and preparing another experiment. She will need to extend her training program to June 2012 to complete her MS degree. However, Bruce Hamaker, her major professor, would like to change Ms. Cisse's training to a PhD program if possible. He is in

discussions with the Food Science Graduate Committee regarding this bypass from a master's to a doctorate program and has discussed this with the ME and IER. If approved, the additional costs to complete her PhD training are proposed to be supported by other INTSORMIL funds, and would require her program to be extended to June 2013.

Sory Diallo and Bandiougou Diawara continued their Master's coursework in Agronomy at Kansas State. Mr. Diawara completed his fourth semester and Mr. Diallo finished his first. Both are working hard on their coursework and are progressing on their research which will be performed in the US.

Mr. Sory Diallo: MS in Crop Physiology, Kansas State University

Mr. Sory Diallo conducted field studies to understand the effect of nitrogen on grain quality of different sorghum genotypes. The objectives of his research were (a) to determine the effect of different levels of nitrogen application (0, 40, and 80 kg ha^{-1}) on grain quality of sorghum; and (b) to evaluate grain traits: kernel hardness, kernel mould, starch content and crude protein content across the sorghum diversity panel. In this study different levels of nitrogen (0, 40, and 80 kg ha-1) are being examined. In summer 2010, a two-year study was initiated to determine the effect of nitrogen levels on grain quality of sorghum. The field experiment was conducted in Kansas, Manhattan, Ottawa, and Hays in 2010 and the same experiment was planted in summer 2011. Treatments consisted of twelve genotypes (six sorghum hybrids and six sorghum inbred lines) and three fertilizer levels (0, 40, 80 kg ha^{-1} with the N fertilizer urea). Experiment was laid out as a randomized complete block design with four replications. At maturity the central four rows of each plot were harvested and threshed separately for obtaining the data of grain yield and grain quality analysis. The grain samples of 2010 experiment are currently being analyzed for grain quality at USDA laboratory. The focus is on kernel weight, kernel crude protein content, kernel hardness and diameter. The experiment from this summer (2011) is currently ongoing and will be harvested by end of this month.

As for academic courses, Sory Diallo took 6 credits hours of research this summer 2011 and is currently enrolled in 9 credits hours (Cropping Systems, Statistics, and Plant Management).

Graduate student Mr. Sory Diallo in his sorghum field at Manhattan

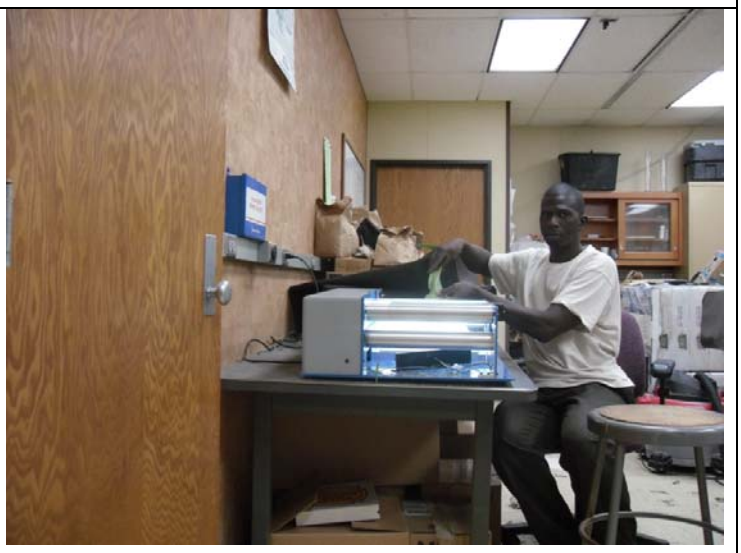
Mr. Sory Diallo establishing field plots in Kansas.

Mr. Bandiougou Diawara: MS in Crop Production and Physiology, Kansas State University

During the last quarter Bandiougou worked on his research project and at the same time taking academic classes. The main objectives of his thesis research are (a) to understand the impact of early planting on growth and yield of sorghum and (b) to understand response of selected sorghum hybrids to early planting. have two planting dates, three hybrids and two locations. There were two planting dates, fist in late May and second in late June. During the plant growing period, data on leaf area was measured at six leaf stage, at anthesis, and at physiological maturity for each plot. The plots for the first planting date in Manhattan were harvested and threshed. Yield, yield component, dry matter production, and partitioning were measured at maturity. The data is currently being analyzed. Due to the extremely dry and hot weather this season, experiment in Hutchinson had poor germination and poor crop development. In addition, to research he did literature review, data analyses from last harvest and preparing a poster for presentation. In addition to his research Bandiougou is working with other students in crop production laboratory to learn field techniques and data collection. These projects mainly include biofuel demonstration plots, evaluation of drip irrigation systems, and soil erosion experiments.

As for academics he is currently taking 8 credit hours in fall 2011. Three credit in soil nutrient management, four credits for two statistics classes, and one credit for seminar. All the classes are going well.

Bandiougou Diawara in field at Manhattan



Bandiougou Diawara conducting leaf area analyses with a leaf area meter

Aly Ahamadou and Mamadou Dembele were accepted June 1, 2011 into the West Texas A&M's Graduate School to pursue their non-thesis Master's degree in Business and Economics in the Department of Agricultural Sciences. Dr. Lal Almas, their major professor, reports both students performed well this summer. They have already completed three hours towards their degree and three hours for research is in progress. Both have submitted selected paper proposals/abstracts for presentation in the Southern Agricultural Economics Association annual meetings to be held in February 2012 in Birmingham, AL. They are required to submit the full papers (20 pages) by January 17, 2012 if their papers are accepted for presentation. Currently they are enrolled for nine hours of coursework and are making good progress towards their degree program.

5. Gender Related Achievements

Gender related achievements and how gender is mainstreamed into the activities- The land holding system in the Sahel is that the extended family farms together a communal area with the household head making the decisions on labor supply and product allocation. After the adult family members have provided their labor as specified by the household head, they can work the small area of private plot for themselves allocated each year to them by the household head. Women devote substantial efforts to these private plots but they are very small and often poor land far from the village. Women also have difficulty getting access to purchased inputs or to organic fertilizers, which are especially critical in the poor sandy soils on which millet is grown.

This project concentrates on the principal areas controlled by the household head but sets aside 10 ha for women for each 50 ha for the men. The specification is that the area of the women has to be from the private plots over which they control the output. Women cannot claim larger areas over which they lose control of the output as happened in the initial years of this project. Normally, the men have one ha, but each woman can have 0.25 ha so 40 women on the 10 ha allocated is common.

We have also begun pressing in the villages for the women to have better land quality for their private plots and to have access to animals for seed-bed preparation. We also urge the men to make the compost and the carts (to transport manure to the field) available to the women. Since the women use more labor intensive practices and follow better the agronomic recommendations[2] than the men, it is very satisfying when the womens' plots outyield the men's and we encourage the competition.

Food Processing Entrepreneurs- Nearly all the entrepreneur food processors we work with are women (in Mopti-Gao all are, and in Bamako most are). In this quarter, training in sanitation and quality of processed products was provided for our women entrepreneur partners in Mopti-Gao.

Thesis Research Project of Fatima Cissé- Part of Fatima Cissé's research project at Purdue University involves collecting data on nutritional/health attributes of traditionally made foods from millet and sorghum that may make them desirable to buy and consume compared to imported grains and tubers used in urban areas of Mali. Our goal is to understand whether and how millet and sorghum foods may be promoted to urban consumers for market expansion for local farmers. In a previous study conducted by us in the fall of 2010, we found that at the village level, in three regions (Segoú, Mopti, Sikasso), participants preferred thicker porridges (tô) compared to urban consumers and that thicker porridges were significantly more satiating (less hunger feeling at 4 hours after consumption). In the present study, Fatima used a ^{13}C-breath test (stable, safe isotope of carbon that is naturally found in foods) to evaluate gastric emptying rate of traditional and imported foods for Bamako consumers. Rapid gastric emptying of starchy foods generally results in high glycemic response and may relate to feeling of fullness and caloric intake related to obesity. It should be noted that hunger feeling and consumption patterns of food are multi-factored events. Still, large differences in gastric emptying rates may be related to healthiness of foods. Eight foods were evaluated [rice, potatoes, pasta, thick millet and sorghum porridges, thin millet porridges with and without *moni kuru* (particulates), and millet couscous]. Gastric emptying rates of the foods were substantially different and grouped as follows: rice > potatoes, pasta > thin porridges > thick porridges > couscous. Thus, newer "imported" foods overall had faster gastric emptying rates than the traditional millet and sorghum foods. Further evaluation of the results is in progress

[2] The women are much more likely to do thinning and weeding on time than the men.

Training- Initially two of the five identified long term trainees were female, but one dropped out due to family issues and the USAID decision to not allow young children to accompany the trainees. However, one female trainee remained in the program and was the first to obtain the needed English skills (TOEFL score), the first to be accepted into a graduate program, and is now being considered for PhD rather than a Master's. This is both a gender achievement and a success story.

6. Synergistic Activities Achieved with Partners

Production-Marketing

The entire program is synergistic. We collaborate with IER in getting their improved technologies into the field. Some of these technologies had been developed earlier with INTSORMIL collaboration. Then we rely on the DRA (national extension service) and several NGOs (Sasakawa and AMEDD) for the monitoring, input delivery, crop cuts and repeated interactions with the farmers' associations. We also develop ties with the private sector cereal buyers especially the millet food processors in the urban area and the emerging sector of intensive chicken producers (broilers and eggs with a focus on the former).

Our most important synergistic activity is with IICEM. USAID-Mali asked IICEM to scale up our technology project. IICEM has been concentrating on the financial aspects and farmers' associations have obtained substantial loans for millet and sorghum producers in various regions of the country principally from BNDA due to the IICEM intervention and loan guarantees. Besides technical support to IICEM we provided them with Toroniou certified seed in 2011 and will provide Grinkan seed to them in 2012.

We are also handling a series of issues on the technical pilot project side that will remain important to the scaling up of IICEM. These include the control of mildew in millet production with the appropriate fungicide, the future depletion of soil K with the continued fertilization with DAP, obtaining a price premium for the farmers' associations for the cleaner cereals, developing site specific fertilizer recommendations with increasing focus on soils laboratories and soil testing, developing the farmers' associations into functioning marketing coops, tying IER better into our farm level activities[3], improving repayment rates and farmer participation in the farmers' associations. Most of these things IICEM could not do at the same time that they are pushing for financing and a more rapid project expansion. However, a pilot project can do these activities and provide the results for the scaling up partner, IICEM.

Food Processing

For the food processing component the arranging for grain supplies from the production-marketing component of the project is an example of effective and productive synergy.

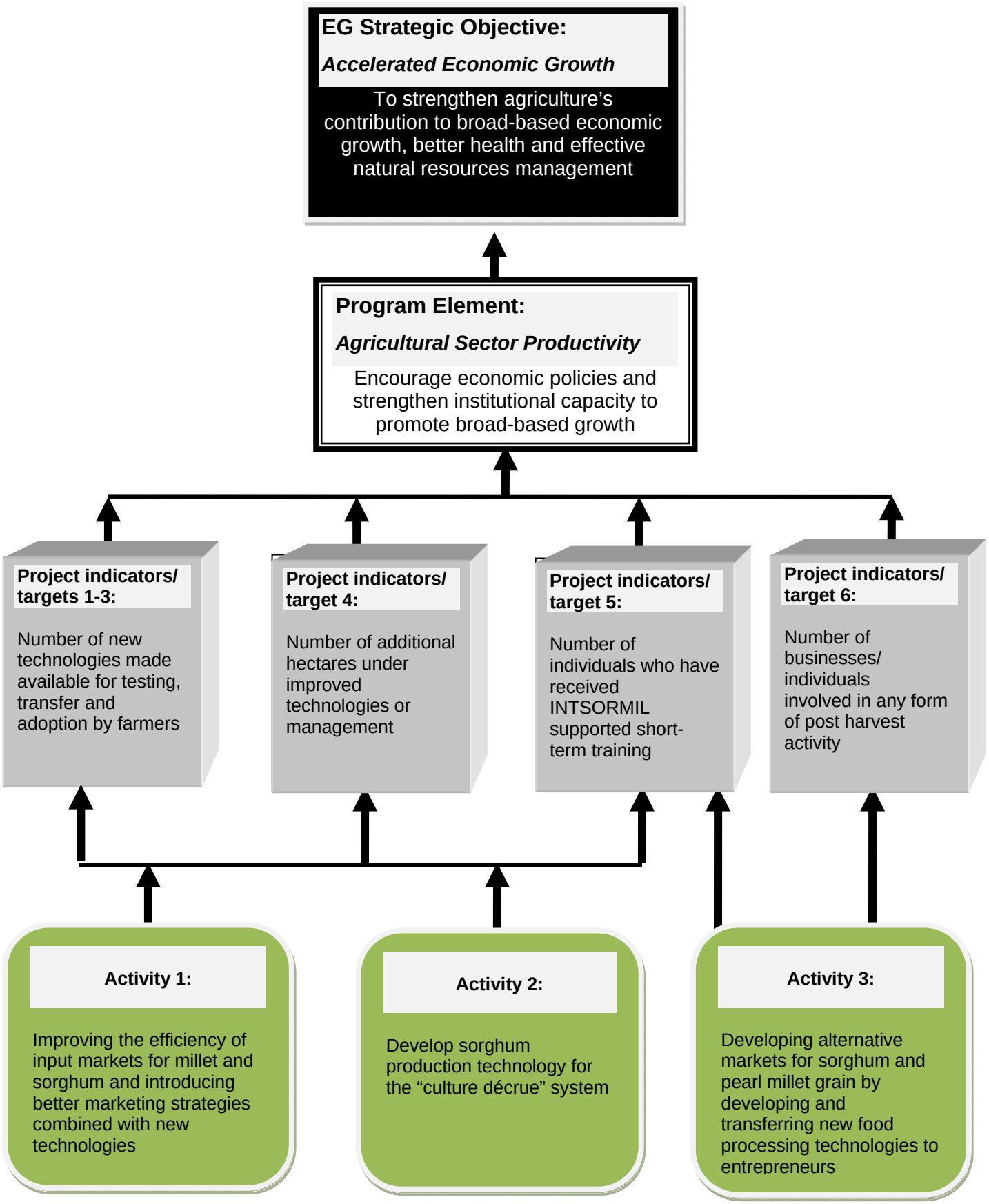
[3] Demonstrations, the usual extension technique do not work well in the Sahelian countries. Farmers do not believe that they have the same access to inputs and techniques. With our village level technique best farmers follow the practices and then other farmers follow the next year.

Décrue sorghum

Synergistic activities achieved with other partners (US and non US including Government of Mali, other donors and local NGOs)

Synergistic Activities	U.S. Partners	Non-U.S. Partners	Details
Technology development and transfer in the decrue area	USAID-MALI for financial support INTSORMIL for scientific support in technology development for millet and sorghum. AGRA for financial support in hybrids development ICRISAT for regional approach in sorghum research within West Africa	-Regional direction of Agriculture for technology test and expansion: (Tombouctou, Gao, Mopti Kayes) - NGOs for technology test and expansion in Tomboctou and Gao regions -Noragric for technology development, financial support in technology development focused on main décrue crops by year 2011	-Involvement of Noragric in financial support will give more opportunity to invest USAID money in providing more equipment to monitor water dynamics in the soil profile.

7. Indicator Data



How these indicators and targets lead to achievement of the EG strategic objective, Accelerated Economic Growth?

The (1) activities, (2) project indicators and targets and the (3) program element all lead directly to the achievement of the strategic objective, "*to strengthen agriculture's contribution to broad-based economic growth, better health and effective natural resources management.*"

Activity 1 is the main focus of the Production-Marketing project. In 2009 there were numerous successes in southern Mali especially in the Koutiala region with the sorghum cultivar Grinkan and in the Segou region with the millet cultivar Toroniou as we extended our cultivated area to almost 1,000 in the pilot project phase. In 2010 we collaborated with IICEM in scaling up our operation. IICEM became responsible for the implementation and financing of this scaling up of our model activities. Production-Marketing and Processing are the technical advisers to this development project of IICEM. In 2010 the combined effort reached almost 2,500 ha. We are discussing a major increase in 2011.

Activity 2 offers applied research and extension support for a potentially important production activity in the northern region and in the Kayes region. In 2011 this project will work more in combination with the Production-Marketing project as both extend their activities into Kayes. Décrue sorghum has substantial potential for increasing farmers' incomes and welfare and has been largely ignored in the past.

Activity 3 has two important components. Production-Marketing will continue to do market studies of millet food processing and the intensive poultry sectors (for sorghum substitution for maize in the ration). Moreover, we will facilitate ties between these markets and our farmers' associations with workshops and with training to the farmers' associations in marketing arrangements. The Food Processing project is providing mentoring and machinery to several millet processing entrepreneurs in the northern region. With the machinery Food Processing sets up incubator or model processing operations, which a larger sector of new processors can imitate.

Indicators	Year 1 **2008 Crop year**	Year 2 2009 Crop year	Year 3 2010 Crop year	Year 4 2011 Crop year
1. Number of new technologies or management practices under field testing as a result of USG assistance.	5	6	8	10
2. Number of new technologies or management practices made available for transfer as a result of USG assistance.	5	6	7	6
3. Number of additional hectares under improved technologies or management practices as a result of USG assistance.	500	984	894	972*
4. Number of individuals who have received USG-supported short-term agricultural sector productivity training. (.75% male/.25% female)	500 (approximately 450 male and 50 female)	800 (approximately 650 males and 150 females)	1,150	1,320
5. Number of individuals who have received USG-supported long-term agricultural sector productivity training.	0	4	5	5

6. Number of farmers adopting new technologies or management practices.	500 (approximately 450 male and 50 female)	800 (approximately 650 males and 150 females)	1,150	1,320
7. Number of processors or businesses/individuals involved in any form or post harvest activity. (10% male and 90% female)	6	8	18	20
		Crop Year 2009	Crop Year 2010	Crop Year 2011
IEHA: Number of Farmers/producers or processors adopting new technologies. Relevant technologies include:				
8. - Mechanical and physical: new land preparation, harvesting, processing and product handling technologies including packaging		984	1,150	1,320
9. - Biological: new germplasm that could be higher-yielding or higher in nutritional content, affordable food-based nutritional supplementation such as vitamin A-rich sweet potatoes or rice, or high-protein maize, or improved livestock breeds, and livestock health services and products such as vaccines		984	1,150	1,320
10. IEHA: Vitamin A-rich sweet potatoes or rice, or high-protein maize, or improved livestock breeds, and livestock health services and products such as vaccines				
11. -Chemical: fertilizers, insecticides and pesticides		984	1,150	1,320
12. - Management and cultural practices: information technology, improved agricultural production and marketing practices, better natural resource management practices.		984	1,150	1,320

*__Activities in 2011.__ The focus was on the expansion of area in Segou (500 ha) and Mopti (340 ha. Another 120 ha were expanded by M. Diourte as part of this program in Koulikoro region. Only 12 ha was planted in the Koutiala region and for the Koutiala region in the experiment stations as there was a concentration on producing high quality seed of Grinkan in 2011.

Comments on the above Table:

Row 1. This comes from the Décrue sorghum field testing activities which increased with the inclusion of the Kayes region in 2011.

Row 2. Essentially the same activity is being introduced in all the regions, an improved cultivar, moderate fertilization, a water retention technique, and a series of improved agronomy techniques. We also recommend that farmers use organic fertilizers especially for the sandy soils where millet is concentrated. The differences in technologies is essentially from differences in cultivars. In the future we will adjust more the fertilization recommendation as we link our farmers' associations to soil testing services.

Row 3, 4, 6 and 8. As stated before we were asked in 2010 to collaborate with IICEM and our initial estimates included some of their area extension. But then we were requested by USAID to delete those estimates so as to avoid over counting. In 2010 and 2011 we expanded considerably in Segou with Global 2000 and in the Mopti region with DRA. We also incorporated many more women by limiting them only to the crop area over which they had control of the output.

Row 5. Long term trainees from IER in the US is constant at 5.
Row 7. Number of processors includes both the processors with which Production-Marketing works and those working with the Food Processing project.
Rows 8-9 and 11- 12. This is essentially the number of new participants in the field operations. Note also that since we only had space for three years we just used 2009-2011.
Row 10. No activity here.

8.Issues, Problems, Challenges, and Solutions

1. Sorghum and pearl millet yields in Mali

- **Yield constraints to sorghum and millet production in Mali**

The principal constraint to high yields is soil fertility. Hence our technology strategy is moderate inorganic fertilizer with water retention technologies to reduce the riskiness of fertilization and new cultivars to give higher yields without lodging. Note that water availability is also critical. There was too much rain in many regions in 2010 so sorghum which is planted primarily on the lowlands was adversely affected but millet grown on principally on the plateau and slopes had great yields. This year there has been a late lack of rain and in many regions another good rain is necessary for grain filling according to Ouendeba. In these years sorghum on the lowlands will do better and millet can be most adversely affected. Farmers are aware of these differences, have different methods of reducing risk and we also have a series of measures to handle risk built into the program.

The estimates of yields are preliminary from an experienced agronomist as it was still not harvest season when we made these estimates. From the field visits Botorou Ouendeba estimated that sorghum yields in our seed production plots would be approximately 2 t/ha. These are very good yields. Seed producers get a quality premium price so usually are careful to do the agronomy recommendations. Normally we are very happy with millet yields of 1.2 to 1.4 t/ha as millet is grown on poorer soils with lower soil fertility and often more water stress than sorghum. We observed very good millet fields in Segou and in Mopti and Ouendeba felt that if there was a little more rain in the grain filling stage there would be yields of 1.7 to 2 tons. This indicates good seed quality and excellent observance of the agronomic recommendations as well as using organic fertilizers.

- **Yields of farmers that do not follow the recommendations**

Farmers not in the program and not following recommendations in the Koutiala region but following the cotton rotation and therefore getting the residual effects of cotton fertilization (P) get 800 kg to a ton/ha of sorghum. Millet producers in the Segou region get 500 to 600 kg/ha and 400 to 500 kg/ha in the Mopti region.

- **Barriers to technology adoption: What are farmers doing instead?**

Why is there still substantial yield variation even though we are increasing substantially mean yields? Farmers need to follow the recommendations. With only moderate fertilization you have to make sure that the plants have access to it hence the importance of side dressing. There is resistance to side dressing of fertilizer and thinning because they are new practices and more labor intensive. Instead of side dressing, farmers often broadcast and often have their kids do the fertilization. Sometimes they do not cover the fertilizer and it volatizes. Also, plant thinning is important but it is hard and farmers often have the erroneous idea that more plants and taller off types are better. We have run regressions on yields and both deviations

(fertilizer and plant thinning) from recommendations have large yield costs. So we keep visiting them and going over the basic agronomical, marketing and organizational recommendations for the program

For this reason we introduce the technology to groups of farmers in the village. Sahelian farmers (that we know) do not believe in demonstration trials. They feel generally that this is something that is difficult for them to get all the inputs and practices together to do. But they do follow what other farmers are successful with. If 50 farmers adopt the technology in a village (and we try to get this number in each village where we start operating the program), 15 to 20 will follow well the recommendations in Year 1. In the second year, most of the farmers in the village will follow the recommendations.

2. Seed production

The main problem of the 2011 crop year was renewing the supply of high quality seed for our excellent cultivar, Grinkan. In the Koutiala cercle and in IER experiment stations we now have 12 ha in seed production of Grinkan from which we will obtain 12 to 18 tons of seed. Also good seed of the two progeny of Grinkan will be obtained from the sites of Kita and Beleco. So we will have sufficient seed for a substantial area expansion in Koutiala. We will need 8 tons of seed 1000 ha there in 2012.We will also be able to supply IICEM with substantial quantity of Grinkan and progeny seed.

3. Downy Mildew: impact on grain yield and its management

Downy mildew (*Sclerospora graminicola*) was observed to be a minor constraint in the Mopti Region this year. We estimate that yield losses were <5%. Downy mildew is the major disease of millet in West Africa and may affect all of the above-ground parts of the plant including the panicle and leaves (see symptoms in photos below). It is a seed transmitted disease and can have a devastating effect on grain yield. Yield losses due to this disease have been reported to range from 3.5 to 21% in Mali according to John Leslie (Sorghum and Millet Diseases, 2002).

Substantial work has been done in international centers looking for resistance and there have been good resistant varieties developed for India by David Andrews (formerly with INTSORMIL after his time in ICRISAT) and widely disseminated. The millet varieties introduced earlier in the region (ICRISAT-Sadore in Niger) were completely wiped out. We are using an integrated approach (tolerant improved cultivar + seed treatment) to prevent the losses. The improved local cultivar (Toroniou) used in Segou and Mopti regions is tolerant to mildew but we recommend also the use of Apron Star (fungicide-insecticide) to treat the seed before planting. In Mopti region, the extension agent purchased in 2011 a cheap fungicide and the mildew infestation on the secondary tillers was around 5% (tolerant reaction).

We have explained to the farmers the seed transmission characteristic of downy mildew and the need to use the appropriate fungicide for the next crop. Here it should be pointed out that the failure of the extension service and the farmers to follow recommendations is a continual problem of education. Note our “fiche technique” explaining these for both sorghum and millet. We give these out to farmers (farmers like the pictures but generally don’t recommendations read French)[4] in our on- farm training programs and we discuss the agronomic and marketing aspects with the farmers. Suffice it to say that we expect to avoid the downy mildew problem this year through increased pressure in getting the farmers to use the Apron seed treatment.

4. Dirty grain: the need for clean grain for use by food processors

[4] Our principal effort of extension is getting a large enough number of farmers in each village using a practice so that the farmers will learn from each other.

Farmers are getting better at using the bache and also screens (Segou). But there are still problems. Beating the grain with "batons" on the "bache" or running over it with tractors destroys the "bache." The appropriate long term solution is mechanical threshers. But the small machines tend to break down easily especially under the joint ownership of the farmers' associations. We need bigger machines doing custom work as in Senegal. How to finance and organize this for the various zones of production now that the area in the new technologies is expanding rapidly is a question we need to address in 2012.

5. Repairs on mechanical threshers

In Tingoni, Sasakawa (our collaborator in the Segou region) introduced mechanical threshers during the last four years, three of which we collaborated closely with them.[5] Our observations over these three years is that the threshers are not dependable due to frequent breakdowns. The problem with the breakdown of the threshers was the lack of ownership of the machine and thus poor maintenance and poor threshing methods . People in the village just used it until it broke down. The millet from the Segou region is known to have the highest impurity level (sand, stones and physical impurities). The millet heads are spread on the ground and a tractor is used to run on the pile to do the threshing. When millet is threshed on the ground, dirt, pebbles and other debris end up in the machine and it breaks down. However in the Mopti region the millet grain is clean because the threshing is done in large mortars by women. But when dealing with large quantities, the threshing becomes very painful. The woman cannot thresh more than 100 kg of grain all day long. Thus threshers are needed.

The solution to the threshing problem? Individual (private) owners that can make a profit by providing commercial threshing services. Private owners need to be able to make simple repairs and make sure that the millet is not dirty. This would be a better ownership method than Sasakawa's procedure of just simply making the equipment available to the village without proper management. In Senegal for example, there are larger and more dependable machines that individuals travel around with and do commercial threshing services. Breakdowns there are not a major problem. In Kaolack region, the largest millet growing zone in Senegal, we met a private person who uses a big thresher (1 ton of grain per hour) to do services after harvest in the different villages, from December to February of each year.

Therefore millet threshers exist and work. Farmers in the greater region of Segou or Mopti could use the same strategy. With established ownership rights in Mali the owner would charge for services, check for the quality of the cereal being introduced into the thresher and would know how to do repairs. They might also be able to do this with the smaller machines made locally in Mali.

6. Mechanical issues with the mechanized food processing units

Mechanical issues are always a potential problem with mechanized processing units and we do have problems in this area, though they are manageable and can be dealt with. We are striving to make successful examples with the Sotuba Incubation Center and are already working with two Bamako area entrepreneurs in this regard. Our goal is to have this be a model for processing technology transfer and for it to be sustaining after the finish of the project through other partners, training fees, and entrepreneur fees.

7. What is the progress in increasing grain yields over time?

Each year in the spring or summer after the previous crop year (at this time because we need to wait for the farmers and associations to sell later after the price recovery) we interview farmers and get yields, prices received, incomes as

[5] We left Tingoni after getting 150 ha and a well functioning farmers' association able to arrange its own inputs including credit, do storage and sell its millet and following well our agronomic recommendations. This is our policy to graduate these farmers associations and move on. We stay in touch and try to provide technical help if we can. Sasakawa repaired their storage facilities.

well as estimates of yields of the farmers not in the program and prices received by these farmers. We have these bulletins for 2005, 2006, 2007, 2008, and 2010 is in draft form being revised now as and we have added the regressions to this one.[6] The progress in increasing grain yields is given' in these reports and they also show the profitability to farmers of these activities. Each year rainfall and other conditions are different so the best way to analyze this data is to take into account the climatic and other factors and to compare yields, prices and incomes with those not participating in the program. The between year comparsions suffer from the differences in climatic and other stochastic and economic factors. Yield comparisons over time do not mean much if one year was flooded (very adverse effect on sorghum and very good effect on millet- as in 2010) and another year was very dry at a critical period (let's see what happens to millet with the late rains in 2011 and note that on the heavier soils with sorghum we are in good shape). But the best way to evaluate profitability and sustainability is to talk to our farmers associations.

8. No cost extension for training program

Now that all five of the academic trainees have been accepted into their respective graduate schools to pursue their Master's degrees, our challenge is to make sure they complete their degrees with the funding provided. This will be difficult since all five trainees will take longer than anticipated to complete their degree. We are in the process of extending their training periods in TraiNet to allow each the needed time to finish. We have ***informed the Mali Mission of the need to grant a no-cost extension*** to increase our timeline to allow all participants to complete their Master's programs by mid-2013.

9. Success Stories

See the bulletin of Jeanne Coulibaly reporting on the yields, prices and income earned from the new technologies, marketing strategies and farmers' organizations in 2010.

10. Activities Planned for Next Reporting Period

Management Entity

We (E. Heinrichs and Tony Michaelsen from the ME and Vara Prasad (KSU) plan to visit Mali November 7-13, 2011 to review project progress and to produce videos of the décrue activities in Kayes and Mopti and the food processing activities in Mopti and Sotuba**.**

[6] In 2009 I (Sanders) missed two months in the summer with an eye problem and we were running around trying to maintain our program and help IICEM do a big scaling up as requested by USAID-Mali.

Production-Marketing

During a recent trip we evaluated millet yields and strengthening the capacity of the farmers' associations to produce clean cereals. In this next production period we need to focus on the evaluation of sorghum yields especially for the seed production of Grinkan and its progeny. The program will count on Niaba Teme and M. Diourte for fieldwork. We will need a return trip in early November.

We need by March 2012 to have the system ready with good sorghum seed for both ourselves and IICEM. We will expand 1,000 ha in Grinkan in the Koutiala cercle in 2012. We will be expanding another 360 ha in Mopti in the millet Toroniou. We also need to be identifying with the millet breeder of bIER a better new millet cultivar. Millet producers have accepted the new production system so that a new higher yielding cultivar could take advantage of this improved environment.

We need some management courses and modules for training of the farmers' associations into efficiently functioning marketing coops. Soil fertility remains the critical constraint and the necessary focus for the next five years. We need to prepare for the next project to build up soil laboratories and soil testing to move away from the same recommendation for different soils and crops.[7]

Décrue Sorghum

- Collecting farmer's points of view on new cultivars introduced in Gao Mopti and Kayes
- Harvests and data analysis
- Soil and plant analysis
- Reports

Food Processing

- We will have four units in the Mopti/Gao region component 1 project to be fully functioning and putting high quality of sorghum and millet value-added products into the marketplace.
- Formal launching ceremony of the IER/LTA Incubation Centre October 25, 2011
- Training workshop for INTSORMIL and IICEM processors at IER/LTA.
- Training of entrepreneurs at IER/LTA
- Installation of additional equipment in two Bamako entrepreneur processing units
- Production and marketing of additional high quality products in the Bamako market

[7] It is unfortunate that the low input concepts prevailed in the last two decades in the Sahel when there should have been emphasis on getting up inorganic fertilizer levels and on constructing soil laboratories in different regions.

- Have at least four units working properly and putting into the market high quality sorghum and millet value added products.

Training

- Fatimata Cisse will continue her data analysis and perform another experiment here in the US for her research.
- Aly Ahamadou and Mamadou Dembele will continue their classes and research – and are enrolled for 9 hours this semester.
- Sory Diallo and Bandiougou Diawara will continue with their classes and research activities.

11. Annex

Formal opening of the IER/LTA Food Processing Incubation Center, 25 October 2011

MINISTERE DE L'AGRICULTURE

INSTITUT D'ECONOMIE RURALE

CRRA SOTUBA

Laboratoire de Technologie Alimentaire

CENTRE D'INCUBATION

Pour la Transformation des Céréales

Avec la collaboration technique d' INTSORMIL **et l'appui financier de l'USAID**

INTSORMIL

USAID FROM THE AMERICAN PEOPLE | MALI

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