



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

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Introduction

This project is designed to move sorghum and millet production technologies onto farmers' fields, link farmers' organizations to food and feed processors and to commercialize processing technologies so as to enhance markets. To achieve this we propose to improve the supply chain from the farm level to the consumer. The program emphasis in the north will be on the development and transfer of *décrué* sorghum, and motor pump (irrigated) and rainfed sorghum and millet technology, while in the south the transfer of rain fed sorghum and millet technology, already begun in the previous three years of the Production-Marketing Project, will be accelerated.

This is the final version of the work plan. The initial version has been modified and amplified as based on recent site visits of the US scientists in which they further developed the work plan in collaboration with Mali scientists and discussions with the USAID Mission. In addition, the three lead US scientists and the INTSORMIL Management Entity met in Kansas City, MO December 11, 2007 to develop a cohesive integrated plan based on their visits to Mali. This workplan is herein described.

Objectives

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

Processing Technology and Training

Dr. Bruce Hamaker

The overall goal of the cereal ***processing technology and training*** component of the project is to establish a successful model of entrepreneurial sorghum/millet processing to competitive marketed food products. Year 1 activities focus on organization of the project, strengthening the IER Food Technology unit, and identifying processors to work with, preferably in the Mopti area. A consultant, Mr. Mamadou Diouf, with extensive expertise and experience in sorghum/millet processing and working with entrepreneurs (a former leader of the FAO initiative PROCELOS working with food processor groups, and was a food technologist with the Institut de Technologie Alimentaire, ITA, Dakar) was selected to assist with this activity.

The project was initiated with a planning and partner identification trip to Mali in February 14-22. The group consisted of Bruce Hamaker (INTSORMIL, PI), Mamadou Diouf (consultant, Institut de Technologies Alimentaire, ITA, Dakar, former head of PROCELOS) and Ms. Yara Kouressi (IER/Sotuba, Mali project PI). Meetings were had with the USAID mission personnel, Bamako area processors and national processor's association (FENATRA), and processor groups in Mopti and Gao areas. The project will partner with six (6) processors and their associations in the Mopti and Gao locations, and will proceed with primary cereal processing equipment purchases and training later this year. B. Hamaker and M. Diouf additionally met in Senegal at the Institut de Technologie Alimentaire (ITA) with the interim Director General, Dr. Ababacar N'Doye prior to the Mali trip to discuss strategies and plans.

The following were achieved in this first mission of the processing project:

- There was a meeting with the Accelerated Economic Growth team of Mali USAID Office and the team's strategy and initial plan was received and commented on.
- In the two regions, Mopti and Gao, covered by the project, stakeholders were convened and were sufficiently representative. They approved of the goals and approach of the project, and selected beneficiaries or partners who will be part of the project. They all seemed to meet the criteria we had set for partners.

Other comments:

- Conditions for implementing the project appear to be quite favorable for achieving the objectives in a timely manner.
- The situation perhaps is even more favorable for local processors considering the rise in cereal prices at the international level. Sub-regionally, there has been a resurgence of interest in alternative foods to counter expensive imported cereals and products, including rice and those that are wheat-based.
- The stakeholders spoke of constraints faced by them. Their principal concern is supply of quality grain, and packaging and marketing of finished products, as well as the lack of proper processing equipment.
- The team recommends that the project also include a survey to identify products derived from millet and sorghum commonly used in the project area, as well as those for which a market bearer exists in other parts of Mali, and for export. Partnerships could as well be established with organizations with projects working in the same or peripheral areas as this project, such as PCDA, IMS and FENETRA

Production-Marketing

Dr. John Sanders

The ***production to marketing*** activities are led by John Sanders (Purdue University) and Botorou Ouendeba (Consultant/Niger). The team is implementing a system including technology introduction, development of farmer groups, marketing strategy innovation, and linking of farmer groups to food and feed processors. This system is functioning well in southern Mali and activities there will be continued and expanded. But the main thrust is to move the project further north into decrue sorghum regions and into more marginal millet regions.

This activity draws on the expertise of INTSORMIL scientists in its technology development, extension and marketing activities. Activities are conducted in collaboration with the main

agricultural research agency in Mali, the IER (Gao-based scientists in the north), the AEG (Ministry of Agriculture and Extension), local NGOs in Koutiala and Tingoni and various extension-development organizations, various farmer associations, millet processors and intensive poultry producers.

In March, Ouendeba, Diourte, Toure, and Sanders spent several weeks visiting sites and talking to farmers' associations. In the summer of 2008 we will have approximately 500 ha in new technologies. In Kafara, Dioila, Koutiala, and Kolokani there will be 350 ha in sorghum. Then there are 150 ha in millet in Tingoni. The funds have been sent to Mali and Diourte of IER has been sending them out to the different farmers' associations and helping them buy the fertilizer.

We will again be visiting in July to see that all the money and inputs have been successfully received and to identify any problems. Note that only with area extension are there funds provided except for monitoring. In much of this area inputs and other expenses are paid by the rotating fund operated by the farmers' associations.

We also visited Mopti in March and arranged our activity schedule with the various government agencies and we will go back in July to see the designated region and to talk to farmers there. The suggested region is about two hours from Mopti. We are therefore well advanced in the process of getting our technologies and marketing strategies into the northern regions where there are more expensive inputs and greater distances to major markets.

August 12-14, 2008 we will hold a workshop for millet and sorghum food processors and farmers' associations and others working in this subject area in the West Africa Region. This international workshop to be held in Bamako has four objectives:

- 1) To indicate the importance of paying a price premium for clean grain and for the farmers to receive some of the benefits from the seasonal price increase. Clearly the processors need a supply of grain at harvest as well as throughout the year. Thus, grain sales need to be spaced throughout the year. If the processor wants to buy all the grain at harvest, then the farmers' associations should be paid a seasonal (as well as a quality) premium as if sales were spaced during the year.
- 2) To demonstrate the cleanliness of the grain threshed on the tarps, and if there are problems (as farmers' associations purchasing cheap tarps which develop holes when run over in the threshing process), to identify the problems and make modifications to the "bache" strategy;
- 3) To convince processors that there is potential to substitute sorghum for millet because we can increase sorghum yields much more than millet yields and because we are already doing well in linking millet processors with farmers' associations in Tingoni, Mali and Thiare, Senegal. Moreover, Lloyd Rooney will report on his experience in Japan where he has been encouraging processors to use more sorghum products and where there is now an important processing sector.
- 4) To build the contacts between the millet food processors and the INTSORMIL and IER food scientists. The Sahelian food processors often accuse us of doing too much for the farmers' associations and not enough for them. So we believe that these stronger relationships with food scientists will help consolidate the relationships between the farmers' associations and the Mali food processors.

Annually we evaluate and publish our results and innovations as well as documenting the problems encountered. We have produced a bulletin analyzing processors' difficulties in obtaining quality grain and estimating the price they can pay for clean grain. One of the objectives

of the above workshop is to disseminate and discuss the results of this bulletin (Aminata et al, 2007). A second bulletin will be released shortly, in this year of the Mali project, analyzing the yield and income results for an earlier year of the project, 2006. There is a lag in getting these bulletins out because we have to wait for the yield data. However, it is important to report both on increasing yields and implementation of the marketing strategy. One of the key components of the marketing strategy is to encourage the farmers' associations and the farmers to sell their grain significantly after the post harvest price collapse. Thus we need to wait until 6 to 8 months after harvest. This second bulletin, which describes the best farmers getting 2 to 3 tons of sorghum and 2 tons of millet and the average increase in farmers' yields in most regions being 50 to 100% while obtaining 20% higher prices, validates the Production to Marketing activities.

Of the five marketing strategies we have been most successful with the first two of getting the farmers' associations to sell later and using the "bache" (tarps) to produce a cleaner product plus encouraging the processors to pay a quality premium. A third marketing strategy component is to develop new markets to moderate the good weather price collapse. Besides working with the intensive poultry industry on this marketing strategy this workshop should help to build closer ties between the food scientists and the food processors. This bulletin will first be published in English (Abdoulaye et al, 2008, forthcoming) and then in French.

References:

Aminata Toure, Tahirou Abdoulaye, John H. Sanders, and Botorou Ouendeba, *Transformation Commercial du Mil et du Sorgho au Mali*, Projet Production-Marketing, INTSORMIL Bulletin No. 7, Purdue University, West Lafayette, IN , 47906, November 2007.

Tahirou Abdoulaye, John H. Sanders, and Botorou Ouendeba, *Evaluation of Sorghum and Millet Technology and Marketing Strategy Introduction: 2006-07*, Production-Marketing Project, INTSORMIL Bulletin No 8, Purdue University, West Lafayette, IN , 47906, forthcoming June 2008.

Area under new technology in the INTSORMIL Production-Marketing Project for the summer of 2007 and planned for the summer of 2008.

Country/crop	2007	Planned	
		2008	Specific site
Senegal			
Millet	200 ha	250[1]	Thiare
Sorghum	25	35	Nganda
Total	225	285	
Niger			
Sorghum	140	140	Gabi
Sorghum	90	100	Maraka
Sorghum	30	30	Safo
Sorghum	20	30	Angoua Mata
Sorghum	20	20	Dan Arao
Millet	40	60	Doutchi
Total	340	380	
Mali[2]			
Sorghum	78	100	Kafara
Sorghum	50	100	Diola
Sorghum	50	100	Koutiala
Sorghum		50	Kolokani
Millet	150	150	Tingoni
Millet		(50 ha planned for 2009)	Mopti
Total	328	500	
Overall Total	893[3]	1165	

Source: Assembled by Botorou Ouendeba from the reports of the collaborating national research and extension agencies.

[1] Increase of 25 ha paid by the Production-Marketing program and 25 ha financed by the farmers' association of Thiare. [2] Funded separately by USAID-Mali. Not included in the budgets. [3] Approximately another 100 ha in Senegal is still being continued by farmers' associations. In both sites they did not follow the agronomic recommendations and the yield data reported was considered to be very inaccurate according to our field visits and those of ANCAR, the national extension service. We understand that the farmers' associations are continuing to function but we have discontinued active collaboration with them as accurate reporting is critical to the establishment of this program.

Décrue Sorghum

Drs. Vara Prasad and Scott Staggenborg

The *décrue sorghum* activities are led by Vara Prasad and Scott Staggenborg, Kansas State University, Mamadou Diourte, Sorghum Program Leader, IER, Sotuba, Abdoul Wahab, IER, Traore, IER Sotuba and Samba Traore, Agronomist and Director of the Cinzana Research station of IER. Activities are conducted in collaboration with the sorghum program scientists from IER, Sotuba. The goal is to identify agronomic practices that lead to increased yields and increased quality of post water recession grown sorghum. Activities to be conducted by IER scientists will include cultivar collections and testing to identify most suitable cultivars for the region, testing of various cultural practices (cultivars, planting techniques, fertilizer regimes, pest management strategies including weeds, insects and plant diseases), and transfer of suitable technologies identified to farmers.

Global Objective

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

Specific Objectives

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

Activities

A visit was made to the *décrue* area associated with Lake Faguibine near Goundam, Mali in late January of 2008 by Scott Staggenborg. During this visit, several objectives were accomplished.

- We met with local administrators of the Lake Faguibine revitalization program in Goundam.
- We met with farmers from two villages surrounding the lakes Bintagoungou and Mgoudou to gather their input on how to improve *décrue sorghum* production in the region. Based on these conversations, we developed three research objectives for the first year. These objectives are:
 1. Characterize the soils in the lakes region where *décrue sorghum* is grown. The purpose for this objective is to determine the native fertility levels to confirm the local perception that no fertilizer is needed because the lake deposits nutrients during the flooding stage.
 2. Evaluate sorghum varieties in the region. We acquired seed from local sorghum varieties while visiting the village and have planted them along with IER improved varieties based on input from the sorghum breeder at IER.
 3. Evaluate management practices to reduce insect and disease pressure. Since the *décrue sorghum* is planted into relatively wet soils, it is feared that seedling diseases may be a problem, so treatments that include combinations of seed fungicide treatments and microdose (starter fertilizer) are being tested to determine if these easily adoptable technologies can improve sorghum yields in the *décrue* systems.

After traveling to the region and observing the lakes region, it was determined that working around Lake Faguibine was the most effective use of resources during the discovery stages of this project. The other lakes in the region do not have as many hectares of *décrue* potential.

Some lakes do not have any potential sorghum hectarage because of the unsuitable elevation and layout. Also, the travel requirements for the scientists to conduct this research are quite daunting. It requires approximately one and a half days to reach Goundam via ground travel and then most of the villages require approximately one hour of travel through the lake region. This travel is difficult as it must occur on seasonal/semi-permanent roads. I still believe that knowledge that is transferable and will have an impact can be attained in the first year. But I want to explain that there are obstacles to attaining some of the original scope proposed (such as conducting research at every lake in the region and also working extensively in the Gao area). If the scope of this project is to be expanded as originally proposed, then it is likely that additional human resources will need to be added to the project.

The following trip report on an earlier October 2007 visit provides more detail on the décrue region.

K-State Agronomists Help West African Farmers Increase Sorghum and Pearl Millet Production

by Katie Starzec

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Grain sorghum is an important crop not only to farmers in Kansas, but to farmers in many countries in Africa.

Some of the production challenges are the same, but many challenges are different or more severe in West African countries, said Vara Prasad, assistant professor of agronomy at K-State. West African farmers battle against drought, soil infertility and parasitic weeds.



Vara Prasad Holding the Panicle of a High Yielding Sorghum Variety in Niger

In October, Prasad and Scott Staggenborg, associate professor of agronomy, traveled to several countries in West Africa to kick off the beginning of a four-year program funded by the United States Agency for International Development and collaborating organizations in the U.S. and in host countries. The program is managed by the Sorghum, Millet and Other Grains CRSP (INTSORMIL) located at the University of Nebraska-Lincoln.

The Global INTSORMIL program involves 17 U.S. scientists at six universities (Kansas State University, Purdue, Texas A&M, West Texas A&M, Ohio State University and University of Nebraska-Lincoln), the USDA and 23 host country national research programs. The INTSORMIL mission is to use collaborative research to overcome constraints to sorghum, millet and other grains (fonio, tef and finger millet) production and utilization for the mutual benefit of agriculture in the U.S. and developing countries in West, East and Southern Africa and Central America.



INTSORMIL Regional Project Sites in Africa

The purpose of INTSORMIL is to find ways to improve production practices in those countries. West African farmers face serious problems of a localized and volatile market, the agronomists said.



Harvested Sorghum Heads in Bundles



Stack of Pearl Millet Heads

"We traveled to Mali, Niger, Ghana, and Burkina Faso. Everything in those countries is done by hand; sowing, weeding, fertilizing and harvesting," said Prasad. He and Staggenborg, who is a cropping systems specialist with K-State Research and Extension, will work to increase the water-use efficiency of the farmers' cropping practices to better cope with drought conditions.



Scott Staggenborg and Collaborators Jesse Naab (Ghana) and Hamidou Traore (Burkina Faso) in Burkina Faso

The K State scientists observed great diversity in the cultivars of sorghum grown in West Africa.



Sorghum Heads Showing Diversity in Head Form and Color

Prasad and Staggenborg observed the "zai" systems that many farmers there use to conserve water. "They dig numerous shallow holes in the ground, wait for rain, then plant one seed in each water-filled hole," said Prasad.

A new "half-moon system" is being used on an experimental basis in some fields. "In this system, a series of crescent-shaped mini-terraces is constructed on a sloped field to create a series of small catch-basins to collect water as it flows down the field. The seeds are planted in these half-moon shaped basins with rock walls to conserve water. A form of

terracing to complement this half-moon system is also being researched, and we are trying to extend both of these technologies to a number of villages," said Prasad.



Sorghum in Niger Growing in Half-Moon Shaped Basins with Rock Walls to Conserve Water

"Fertilizer is not as readily available in Africa as it is in the United States, mostly for financial reasons", added Staggenborg.

"To make the infertile soil more suitable for crops, farmers can purchase smaller, more affordable bags of fertilizer to divvy up among the plants. Farmers usually have only one or two acres," the agronomist said.

"Those who own goats and cattle have the option of mixing the fertilizer with organic manure so they can apply more over a larger area. There is also potential for composting", said Prasad, though it is not yet being practiced.

Leaving crop residues on the fields would help put nutrients back into the soil, but residues are often used for other purposes, he said.

"People use the sorghum and millet grain for their own consumption, but the residues are gathered or sold for livestock fodder. Because of its financial value, it is difficult for farmers to leave the residues on their fields. Also, any abandoned residues might be stolen."



Sorghum Field in Niger

Another problem they are working on is striga, a parasitic weed that saps the crops' resources during stress conditions. "Potential solutions for this are crop rotations and herbicide-treated seeds, which are being developed at K-State", Prasad said.



Striga in Niger

"The West African market for grains is extremely sensitive. In the U.S., demand may shift from one crop to another as prices go up and down, but in Africa, a price increase directly affects a large area because of their lack of efficient transportation", Staggenborg said.

Prasad and Staggenborg visited universities in several countries, and will work with the faculty to help improve their curriculum and to get information on sorghum and pearl millet production technologies to more farmers. "West African farmers are eager to learn; getting the knowledge to them will be the key", the scientists said.

