

AHEAD SEED GRANT REPORT:



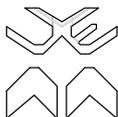
Alternative Sustainable Futures  
for Post-Resettlement in the  
Limpopo National Park

AHEAD SEED GRANT REPORT:

# Alternative Sustainable Futures for Post- Resettlement in the Limpopo National Park

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March 2010



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## ACKNOWLEDGEMENTS

First of all I would like to thank AHEAD for the opportunity to implement this project, our local partners from SDAE-Massingir, especially Mauricio Huo and Juvencio Tomo and the participating farmers from the Association Hluvukane, Association Chihumani and resettled residents from Nanguene for making it possible. I thank the district administrator of Massingir and the Limpopo National Park for welcoming our initiative. Seed was generously provided by IIAM and ICRISAT, without which we would have not had any varieties to test. I would like to acknowledge technical and institutional support from IIAM, especially Calisto Bias, Manuel Amane, Pedro Fato, Celestina Jochua, Camilo Sam, Egas Nhamucho, and the numerous technicians who interacted with us, facilitating seed, storage space and administrative issues throughout the course of the project. The University of Eduardo Mondlane also provided institutional and logistical support, and a special thanks goes to Almeida Siteo and Wilson Leonardo. From ICRISAT, I would like to thank Carlos Dominguez and Celso Ruface. From MIA I would like to thank Antonio Jorge, Antonio Marques, Lorena Adam, Sergio Ntemansaka, and Estrela Alberto. From UNAC I acknowledge the valuable participation of Ercilia Xavier Cau and Gimo Antonio Bobo. Sincere thank you to Eduardo Langane and Domingos Cossa from the National Department of Seeds; Paciencia Banze from USEBA; Joaquim Cuna from DNSA; Alberto Felisberto Chambal from Horticeriais; Benedito Chilengue from Hortimoc, SDAE Chokwe, SDAE Naamacha, Caçilda Tam Sam from Caritas; Ernesto Dimande, Felizardo Mabejane, Artemisa Magaia, Elisa Francisco Mate, Reginaldo Soto, and Alberto Nhantumbo. I would also like to thank Nicky Shongwe and Steve Osofsky for their support throughout the project. From Wageningen University I would like to acknowledge Gijsbertje Berkhout for her attentive and timely financial administration. As my PhD supervisors, I owe an important mention of appreciation to Cees Leeuwis and Janice Jiggins for assisting with the proposal and methodological challenges and to all of them for their support in this endeavor, especially Ken Giller for acting as PI for this project. Finally, I would like to thank Jose Gonzalez de Tanago for taking over the implementation of the project while I was on maternity leave, and for assisting throughout the entire process of the project from proposal writing, to project initiation and problem solving.

## ABBREVIATIONS

|         |  |
|---------|--|
| DNSA    | National Department of Agricultural Services               |
| DS      | Department of Seed   |
| ICRISAT | International Center for Research in the Semi-Arid Tropics |
| LNP     | Limpopo National Park                                      |
| MIA     | Moçfer Agro-Industries                                     |
| SDAE    | District Services for Economic Activities                  |
| UNAC    | National Campesino Union                                   |
| USEBA   | Basic Seed Unit  |

All photos used in this report were taken by Jose Gonzalez de Tanago and Jessica Milgroom

## SUMMARY

Population resettlement commonly leads to impoverishment in the absence of efforts to rehabilitate livelihoods. This AHEAD seed grant project aimed to improve food security through improving seed security for one village resettled from the Limpopo National Park (LNP), and for their host village in the resettlement area. The project was composed of four components: 1) continued research on the impact of resettlement on livelihoods, 2) increasing awareness of the importance of local agricultural seeds and varieties, and seed conservation, 3) on-farm testing of improved varieties, and 4) capacity-building for farmers and extension agents in local level seed production. Results from each activity are described below.

The biggest difficulty for resettled residents is access to land for agriculture, as they are forced to borrow fields with insecure land tenure. Until now, they have also been denied access to irrigable land by the host village despite being promised the opportunity for irrigation by the LNP and the availability of a pump. Livestock theft has led to a change in livestock management compared with their previous village, requiring closer accompaniment of animals, either by children, who therefore cannot go to school, or by hired labor that imposes an extra financial burden on the family. Access to forest resources is limited due to traditional rules, and scarcity of firewood and building materials. Some families have taken advantage of improved opportunities for market integration by selling commodities, and many have engaged in wage-labor.

We collected seeds of 27 types of nine crops inside LNP, samples of which were deposited in the National Germplasm Bank in Maputo. A seed fair was held and prizes were awarded to the farmers with the best quality and greatest diversity of seeds. Seed companies were also invited to sell their seed at the fair. Farmers were taught how to build an improved granary made from local materials to improve seed conservation, primarily to prevent weevil attacks. Challenges to working with both local seeds and improved seeds arose regarding conflicting development models and required careful attention to the learning process of the group, including farmers, extension agents, researchers and trainers.

The first round of variety tests was carried out under irrigation with 11 varieties of five different crops. Farmers evaluated the varieties at harvest and post-harvest (taste tests). Later interviews confirmed farmers' preferences and seeds from the preferred varieties were multiplied for distribution. Based on interview results we added 13 varieties of three additional crops for the second round. Evaluations and harvest will be done in March 2010. Varieties tested in the first round have already been planted by farmers outside of project activities, indicating preliminary adoption. Additionally, small amounts of seed were handed out to 75 farmers to test on-farm, under rain-fed, local conditions.

Pivotal in the learning process was a farmers' visit to variety trials at a private company (MIA) and on the local station of the Mozambican Institute for Agrarian Research (IIAM). Trainings were held with farmers on local seed production, focusing on

improving seed quality, then on associated, but key issues such as cooperation, leadership and gender. Extension agents learned how to teach farmers about both commercial and non-commercial seed production. Two newly trained extension agents taught a course for innovative farmers in Massingir. In an attempt to create synergies between the formal and informal seed systems to improve local seed security, a seminar was held that brought together representatives from all sections of the seed chain. Debates and group work from this seminar and from training sessions illuminated key problems in the seed chain and potential alternatives for local seed production. This material was documented, on the basis of which a proposal is being written for future work.

Other unforeseen outcomes of the project include certified seed multiplication initiatives by one agricultural association and small scale farmers in Massingir with the support of a seed company (MIA) through sub-contracting and inspection by the National Seeds Department of the Ministry of Agriculture. Local seed production has the potential to improve the quality of available seed in semi-arid, rural areas, and become a lucrative cash crop and a driver for development.

The question of whether or not this work has contributed to improving food security can only be answered in the future, but we believe that the host village benefitted more than the resettled residents because of difficulty in integration between the two villages and lack of access to irrigation for the resettled village. Improvement of the agricultural system through improving seed security is one potential intervention, but insufficient to balance out the costs of resettlement for both the people resettled and the surrounding environment.

## 1. INTRODUCTION

### 1.1 Project background

The establishment of the Limpopo National Park (LNP) in Mozambique as an important step in the creation of the Great Limpopo Transfrontier Conservation Area (GLTFCA) has brought with it a series of challenges both for conservation and for development. The park is home to 27,000 people most of whom depend primarily on natural resources for their livelihoods. Human-wildlife conflict and efforts to develop tourism in the park have necessitated the resettlement of eight villages situated along the Shingwedzi river to outside of the park along the Elefantas river. The objective of this seed grant project was to mitigate risks of human impoverishment and natural resource degradation associated with population resettlement.

Resettlement commonly brings a set of risks for resettled residents, from impoverishment to social marginalization (Cernea 1997) and new social conflict for both resettled and host villages (Brockington 2002). In the case of conservation-induced resettlement where original lands are still intact, the risk of residents returning to inhabit original sites or file land claims is significant if livelihoods of resettled residents are not rehabilitated (de Wet 2006). The risk that economically and physically displaced residents illegally utilize resources inside the conservation area, or sabotage conservation projects is also considerable if sustainable livelihood alternatives are not available (Chatty & Colchester 2002). Conservation-induced displacement has also been shown to cause environmental degradation outside and around conservation areas due to an increase in population density and concentration of resource use along the borders (Rangarajan & Shahabuddin 2006). However, opportunity for viable and alternative livelihoods is likely to reduce unsustainable use of natural resources. While resettled villages are compensated, host communities are asked to share their resources without receiving explicit benefits and it is important for the success of the resettlement project that livelihood rehabilitation or development initiatives benefit host villages as well. In order for the GLTFCA to be a sustainable land use option in the long run, local livelihoods of residents directly impacted by the establishment of the conservation area must be secured as a first step towards the dual objective of bringing development and conservation through transfrontier conservation initiatives.

Research on livelihoods and the farming system in villages inside the park prior to resettlement and in neighboring villages outside the park found high rates of seed loss and low seed quality (Milgroom, in preparation). Therefore, we identified that improving seed security was one way to contribute to closing the gap between actual and potential production and to improve food security. In post resettlement conditions there is increased pressure on the available land and a need to intensify agricultural production. Improving seed security was chosen as an entry point because it is an intervention that does not depend on continued external support.

The working definition of seed security used here is based on a seed security framework developed by Remington et al (2002), that distinguishes among

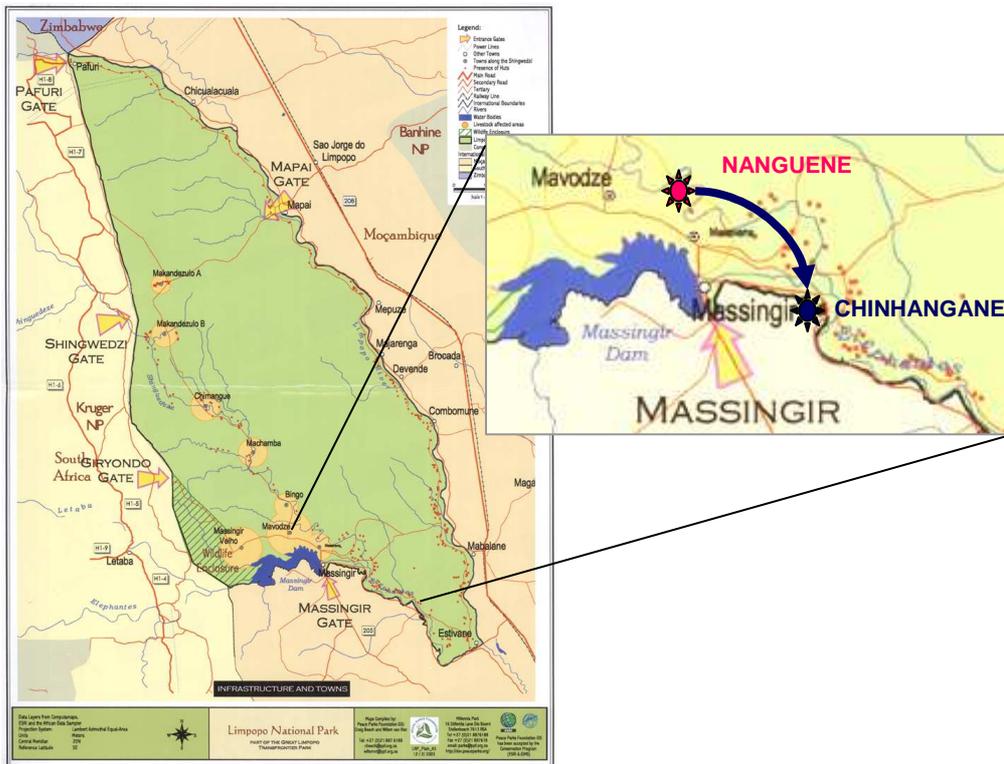
availability, access and utilization of seed. Availability refers to quantity of seed of adapted crops within the proximity and time critical for planting. Access refers to having the resources to purchase or barter for appropriate seeds, and utilization refers to the seed being of desired quality and variety. This project focused mainly on improving availability and utilization.

This seed grant project aimed to monitor changes in livelihood strategies for resettled residents and to improve food security by means of strengthening seed security for both host and resettled residents. The specific questions posed at the outset of the project were:

1. How do livelihood strategies change as a result of resettlement, including the role of livestock and relative dependence on natural resources?
2. Can promoting food security through improved seed security alleviate pressure on natural resources?

These questions translated into four concrete activities: 1) continued research on post-resettlement livelihood dynamics, 2) collection and description of local germplasm, 3) initiation of a process of participatory varietal testing, and 4) training for local extension agents and farmers about seed selection, multiplication and conservation.

The village of Nanguene was resettled in November 2008 to the village of Chinhangane (Figure 1). Nanguene was the first village to be moved from the LNP as part of a pilot project. While most of the villages to be resettled from the LNP are composed of more than 100 nuclear families (Woodburne, Prangley & Mabuza 2002), Nanguene is a very small village of 18 nuclear families with approximately 200 domestic animals (LNP 2007). The small size of this first resettlement pilot initiative provided an ideal opportunity to study the local, context-specific challenges of resettlement and livelihood rehabilitation to inform the process for future resettlement of the other villages currently in the LNP.



**Figure 1** Map of the LNP with the villages slated for resettlement highlighted. The original location of Nanguene and the location of the host village, Chinhangane.

## 1.2 Project approach

This project aimed to combine research and development in an action research approach to experiment with and document post-resettlement livelihood rehabilitation. We recognize that one year is not enough time to engage in a full action research process, but having chosen seed security as our intervention starting point based on previous participatory research, we attempted to provide the building blocks for a sustainable process of seed security improvement that could last beyond the lifetime of the project. As action research is an iterative process, we constantly readjusted our activities and questioned the project objectives and assumptions to best suit the needs of the participants and avoid imposing a pre-defined model of development. We considered that our role as project implementers was to:

- Identify and facilitate opportunities for synergies that may exist through connecting people (breeders, researchers, district agricultural extension services, and farmers), as well as connecting systems (the informal and the formal seed system).
- Provide a space for experimentation, learning and mutual teaching.

We recognized that while introducing improved varieties:

- Adoption would only be successful if it is well adapted to local conditions, both pre- and post-harvest, as well as amenable to local preferences, cultural practices and structural limitations.
- Landraces are also a genetic resource that should be conserved and valued.

- Working on all components of the seed system, from seed selection to multiplication and conservation, is key to improving the system as a whole.

### **1.3 Project Implementation Team**

Implementation of this project has been a joint effort that has consisted of the following people:

Continued research:

Jessica Milgroom  
Elisa Francisco Mate

Seed collection:

Jose Gonzalez de Tanago  
Jessica Milgroom  
Felizardo Mabejane  
Abilio Virissimo Alfonso

Variety Trials:

Jose Gonzalez de Tanago  
Jessica Milgroom  
Juvencio Tomo  
Ernesto Dimande  
Felizardo Mabejane  
Association Hluvukane  
Association Xihumane

Capacity-Building:

Jessica Milgroom  
Ercilia Xavier Cau  
Gimo Antonio Bobo  
Eduardo Langane  
Juvencio Tomo  
Alberto Nhatumbo

## **2. ACTIVITIES**

### **2.1 Ongoing research on post-resettlement livelihood dynamics**

Since December 2006, we have been carrying out ethnographic research in the village of Nanguene as they waited, negotiated and prepared for resettlement. Data collection methods included mainly participant observation and informal discussions, but also semi-structured interviews and a photo-visioning exercise using disposable cameras. Data collection continued after resettlement in November 2008 until of March 2010. The research relevant to this report focused on livelihoods, and dependence on and access to natural resources in pre- and post-resettlement. This report focuses on the main differences in livelihood dynamics in post-resettlement. Detailed results will be published at a later date.

The LNP resettlement team has defined ‘family’ as one couple (or a single parent) with children. However, for sake of understanding resource use, this definition of ‘family’ is not useful and ‘household’ is the unit of analysis used to describe research findings. A ‘household’, for the sake of this report, is a group of people, mostly family members (extended or nuclear) who share the same pot of food, granary and/or monetary resources. Nanguene, according to the LNP, is made up of 18 nuclear families, however according to our research it is made up of 11 households. The results below are based on 10 of the 11 households.



**Figure 2 Nanguene resettlement neighborhood**

### **2.1.1 Preliminary results**

#### *Agriculture*

Access to agricultural land post-resettlement has proved to be the biggest setback obstacle for resettled residents. Every interview post-resettlement has contained an unsolicited comment about their lack of land. Their food security depends on being able to produce as much food as possible given the already challenging agro-ecological conditions of the area and the lack of other regular income (Milgroom, in preparation). The park’s compensation for resettlement included 1 ha of opened land for agriculture, and monetary compensation for all remaining land holdings. Resettled residents were also promised access to irrigation infrastructure at the insistence of the World Bank. However, the plots of land that they were allotted are too far from the river to be viable for irrigation and the host village refuses to allocate more land for the resettled village, especially land along the river.



**Figure 3 The broken-down caterpillar in the new fields, still not prepared for the rainy season 2008-2009**

Plots of one ha per family were not opened in time for the 2008-2009 rainy season, forcing families to ask to borrow fields. The lending of fields is a common practice in the region, where nothing is expected in return for the land used, but the owner can reclaim the land when wanted or needed. Nanguene residents have complained of investing time and effort into clearing land just for it to be taken back by the owner, sometimes without even having had the time to plant anything, sometimes after one season. Table 1 shows the number of fields used by the village before resettlement, and the number of borrowed and secured fields after resettlement, first in 2008-2009, then in 2009-2010, including the fields that were reclaimed by their owners. For the first season, the village only managed to borrow 11 fields and this number only increased to 12 for the 2009- 2010 season. Only three households managed to secure permanent fields (all on the other side of the river; see below). By the end of the 2009-2010 season (only 1.5 years after resettlement), the total number of fields almost reached the pre-resettlement number, but the borrowed fields are reported to be small (portions of someone else's fields) and the fields granted by the park are only 1 ha. Although only two households have reported clearing fields to have them be taken back, many families are afraid of the same thing happening to their fields and losing the investment they put in the land. A good harvest during the years that it rains well is crucial for survival until the next good rainy season, which tends to come once every 5 years (Milgroom, in preparation). Table 2 shows the average number of carts harvested in Chingangane and Nanguene during the 2008-2009 season.

**Table 1 Number of fields secured, borrowed, and taken away at the village level, Nanguene post-resettlement 2008-2009 and 2009-2010 cropping season**

| # fields pre-resettlement | Fields post-resettlement |                  |                  |                   |                          |                        |                  |   |
|---------------------------|--------------------------|------------------|------------------|-------------------|--------------------------|------------------------|------------------|---|
|                           | 2008-2009                |                  |                  | 2009-2010         |                          |                        |                  | # families secured or looking for fields on other side of river |
|                           | # fields borrowed        | # fields secured | # fields planted | # fields borrowed | # fields secured by park | # fields secured by HH | # fields planted |   |
| 35                        | 11                       | 0                | 11               | 12                | 16                       | 3                      | 31               | 5   |

**Table 2 Number of fields planted and carts harvested in Cinhangane and Nanguene 2008-2009**

| Chinhangane      |                   | Nanguene         |                   |
|------------------|-------------------|------------------|-------------------|
| # fields planted | # carts harvested | # fields planted | # carts harvested |
| 2                | 8.1               | 1.1              | 3.2               |

The 1-ha plots per family were opened before the rainy season of 2009-2010, but 1 ha per family is not enough. Given the resistance of the host village to grant land to the resettled villages, some households opted to cross the river, moving back into the park to ask for land there. All residents that requested land from the village leaders on the other side of the river were granted permanent fields there.

#### *Livestock*

Grazing resources in the pre-resettlement location were practically unlimited. From Nanguene to the northeast there was no other village for several days walking, including areas with small stream beds and good grazing grass even in the dry season. Livestock would be allowed to go to pasture for weeks at a time without any herder; livestock owners checked on their herd about once a week. That livestock could stay where grazing was available for weeks at a time (some families reported leaving their cattle for months at a time) allowed them to escape the dry season hunger and sometimes death seen elsewhere in the district. There was little fear of livestock theft due to the limited routes to market and tight family ties in neighboring villages.

In the post-resettlement location, however, there are six times more animals grazing on a smaller, limited area and animals cannot graze without being accompanied. Livestock theft is common and in the month of November, 2009, three pregnant cows were stolen from Nanguene's leaders' corral and slaughtered on the road to Massingir. Since that event, most families have rebuilt their corrals inside the village (they had been instructed to build their corrals at the edge of the forest for the sake of implementing a more modern village model).

Households that have no children have had to hire a herder to accompany their livestock to pasture imposing an extra burden on the household. Those that have children have had to keep a least one child, sometimes two, from going to school so they could herd the cattle (Table 3).

**Table 3 Herd and herd management dynamics in Nanguene, one year after resettlement**

| % claimed taking a child from school to herd | HH a from to | % HH pay for herder | % HH claimed lost livestock | % HH claimed stolen livestock | % HH increased herd size |
|--|--------------|---------------------|-----------------------------|-------------------------------|--------------------------|
| 50   |              | 40                  | 20                          | 30                            | 10                       |

*Natural Resources*

Access to firewood and building materials is scarce in Chinhangane for both residents from Chinhangane and the newly resettled residents. In their pre-resettlement location, firewood was never more than a few minutes away and only took the time necessary to collect and carry it. In post-resettlement areas, firewood is far away and daily requires much more time to walk to where some is available, look for it, collect it and bring it back. As one woman said “Some days here we go to bed hungry because there is not enough firewood.” In addition to firewood, building materials are also scarce. The resettlement initiative had foreseen the problem of access to building materials and resettled residents were asked to cut posts in their pre-resettlement location to transport them to their new location. However, these materials have already been used and any future construction activities will present challenges and extra costs for the sourcing and transport of the posts.

The traditional rules that govern access to fruit from wild trees, such as the culturally important marula fruit, restricts harvesting from any tree that is on someone else’s field. Given the fact that most marula trees are found on the agricultural areas, that the resettled residents have few fields, trees found on borrowed fields are still the property of the field owner and that the 1 ha plots that they were given were cleared of all trees, resettled residents have very limited access to these fruits. In order to partake in the cultural ceremonies, they have to help make the drink in someone’s household that has fruit.



**Figure 4 Preparing marula drink**

Trees found in households in pre-resettlement location were compensated with fruit tree saplings planted around the new houses. However, most of these trees died despite being watered. Residents claim that it is because of high levels of salt in the water.

The traditional rules that govern access to fruit from wild trees, such as the culturally important marula fruit restricts harvesting from any tree that is on someone else's field. Given the fact that most marula trees are found on the agricultural areas, that the resettled residents have few fields, trees found on borrowed fields are still the property of the field owner and that the 1 ha plot that they were given was cleared of all trees, resettled residents have very limited access to these fruits. In order to partake in the cultural ceremonies, they have to help make the drink in someone's household that has fruit.

### *Water*

In the pre-resettlement location, underground water in the riverbed was the source of water. Despite having to dig a hole to reach the water, there was always a plentiful amount of good quality water available (the quality of the water was a common topic of conversation in Nanguene amongst the residents, especially after returning from another village). In post-resettlement areas, the LNP drilled a well that provides Nanguene with water. According to residents, the water is too salty even for livestock and is only used for bathing and washing. All water for consumption comes from Chinhangane. The management of the well water in Chinhangane is based on monthly payments. Nanguene, despite having their own well, has to pay that monthly payment to access water for drinking and cooking.

### *Market Integration*

Before resettlement, there were very few opportunities for selling items within the village or for wage labor. Although the main source of income for two families was cross-border trade, they bought and sold outside of the village. Only one household had a small business of selling basic foodstuffs. Wage-labor was also scarce and only available in neighboring villages. Within the village, labor-barter arrangements were made, but almost never paid in cash or maize.

After resettlement two more households have begun to sell items within the village, representing a 20% increase, and members from seven households (70%), have reported to have engaged in wage labor. Although this is a source of cash or maize, some of the women have mentioned that if they had fields they would not be working on someone else's fields. One man has reported to have engaged in wage labor in the charcoal production camps.

### **2.1.2 Conclusion**

Transition after resettlement is a long, multi-generational process. However, changes in immediate livelihood dynamics may determine the path of resource use and indicate potential impoverishment in the future. Our findings suggest that until now, no family has significantly changed their livelihood strategy, but there is less access to natural resources and more dependence on the cash economy.

## 2.2 Local seed collection and description

### 2.2.1 Collection trip

Collection of local seed was built into this project for several reasons: 1) to document local agro-biodiversity and the corresponding socio-cultural context, 2) to identify and preserve local varieties for later reintroduction, or for use in national breeding programs, and 3) to compare local varieties with modern varieties in our variety trials.

In March of 2009, at the end of the cropping season, one of the two planned seed collection trips was made to three villages inside the Limpopo National Park. The team involved in this collection trip included the project manager, field technician, and a seed specialist from the National Institute for Agronomic Research (IIAM).

Seeds from 27 different landraces of nine crops were collected. These crops included maize (six landraces), sorghum (six landraces), watermelon (four landraces), cowpea (three landraces), squash (three landraces), melon (one landrace), groundnut (two landrace), millet (one landrace), and common bean (one landrace). Information collected on each variety included: the name of the variety, its properties and uses (medicinal, nutritional, etc.), and agronomic aspects (pest and disease resistance (or susceptibility), kind of soil where it is best cultivated, adaptation to drought, etc.). Geographical coordinates were also recorded by GPS at the site of each collection.

Seed samples were processed and prepared for characterization by the staff at the National Germplasm Bank at IIAM. The characterization and multiplication of five maize landraces and six sorghum landraces is underway at this moment at the National Germplasm Bank at IIAM. The characterization activities are not funded by this seed grant, but have been in part catalyzed by our collection trip. The researcher that accompanied us reported back that on subsequent trips he collected landraces of maize and sorghum despite being sent to collect seeds of other crops.



Figure 5 Samples of maize and sorghum collected in the LNP

### **2.2.2 Seed fair**

A seed fair was held and prizes were awarded to the farmers with the best quality and greatest diversity of seeds. Seed companies were also invited to sell their seed at the fair. The goal of the seed fair was three-fold. We wanted to document agrobiodiversity that is difficult to ascertain through interviews. We have found that interviewees tend to under-report the seed that they have, thinking that if they report that they do not have any, we will distribute seed to them. The second objective of the seed fair was to send the message that it is also important to conserve landraces for seed security. Our work with improved varieties is more visible than our work with landraces and some farmers had the impression that we wanted them to replace their landraces with our varieties. The third objective of the seed fair was to make available some other improved varieties in the rural setting of the village. Many people had expressed interest in buying seed and had complained that their district had no source of quality seed (no seed retailers).



**Figure 7 The seed fair**

The panel of judges to decide the prizes was composed of the director of the International Center for Research in the Semi-Arid Tropics (ICRISAT) Mozambique and the director of the district agricultural services. The winner of the prize for agrobiodiversity had 28 different varieties. The landraces collected on the collection trip and those documented at the seed fair (48 in total) overlap only 20% of the landraces. Without further investigation into the morphological and genotypic differences between the landraces, it is impossible to know if they are different or just have different names. The difference in the results from the two activities could be a result of the method, the season, the location or the people conducting the activity.

**Table 4 Landraces documented through the collection trip and seed fair**

| Source 1        | Source 2  | Crop          | landrace name/description |
|-----------------|-----------|---------------|---------------------------|
|                 | Seed fair | Bambara nut   | Red                       |
|                 | Seed fair | Bambara nut   | White                     |
|                 | Seed fair | Banana        | Mutsenga                  |
|                 | Seed fair | Banana        | Macaco                    |
| Collection Trip | Seed fair | Bean          | Feijao                    |
|                 | Seed fair | Cowpea        | Nkongondzo                |
| Collection Trip | Seed fair | Cowpea        | Nkululu                   |
| Collection Trip | Seed fair | Cowpea        | Red                       |
| Collection Trip |           | Cowpea        | Xidjaiandlala             |
|                 | Seed fair | Garlic        | no name                   |
| Collection Trip | Seed fair | Groundnut     | Nhamangane                |
|                 | Seed fair | Groundnut     | Waxintiwane               |
| Collection Trip |           | Groundnut     | Nwaxitua                  |
|                 | Seed fair | lady's finger | fine                      |
|                 | Seed fair | lady's finger | Large                     |
| Collection Trip | Seed fair | Maize         | Xinwandzane red           |
|                 | Seed fair | Maize         | Xinwandzane yellow        |
|                 | Seed fair | Maize         | Merise                    |
| Collection Trip | Seed fair | Maize         | Mathlatuva                |
|                 | Seed fair | Maize         | Matuba                    |
| Collection Trip |           | Maize         | Noy                       |
| Collection Trip |           | Maize         | Nhakoweni                 |
| Collection Trip | Seed fair | maize         | Kubasa                    |
| Collection Trip |           | Millet        | Nwahuva                   |
|                 | Seed fair | Pumpkin       | Swikuyani                 |
|                 | Seed fair | Pumpkin       | Xikutani                  |
| Collection Trip | Seed fair | Pumpkin       | Macuembe                  |
| Collection Trip |           | Sorghum       | Makhaha                   |
| Collection Trip |           | Sorghum       | Malhalane                 |
| Collection Trip |           | Sorghum       | Xikombe                   |
| Collection Trip |           | Sorghum       | Muduvane                  |
|                 | Seed fair | Spicy pepper  | no name                   |
|                 | Seed fair | Squash        | Matobo                    |
| Collection Trip |           | Squash        | Riwa                      |
| Collection Trip |           | Squash        | Bondassi                  |
| Collection Trip |           | Squash        | Maranga                   |
|                 | Seed fair | Sunflower     | no name                   |
|                 | Seed fair | sweet potato  | Matavele                  |
|                 | Seed fair | sweet potato  | Nweti n'we                |
|                 | Seed fair | sweet potato  | Maria                     |
|                 | Seed fair | sweet potato  | Pekan                     |
|                 | Seed fair | sweet potato  | Xihandza ndlala           |
| Collection Trip | Seed fair | sweet sorghum | Matimba                   |
| Collection Trip | Seed fair | Watermelon    | Red                       |
|                 | Seed fair | Watermelon    | White                     |
| Collection Trip |           | Watermelon    | Roy                       |
| Collection Trip |           | Watermelon    | Xivita makamba            |

## **2.3 Participatory varietal testing**

The main goal of this activity was to explore, together with farmers, possibilities for appropriate and sustainable agricultural production improvement in the district. Selection of crops and varieties is the first step towards developing a local seed multiplication and conservation system that can help farmers have access to seed despite consecutive years of drought. The concept behind our varietal testing was not to work together with breeders to develop a variety, as in participatory varietal selection or participatory plant breeding, but to bring improved varieties to an area previously unexposed to the material. The first step of the process was to see how well those varieties adapt to the climate and conditions of the area, then to choose the ones that also meet local preferences, to multiply seed and conserve it well for future use (planting), sale or trading.

### ***2.3.1 Testing varieties under irrigation with farmers' associations***

#### *First Round of variety trials*

We carried out two cropping cycles of trials on the land of two agricultural associations. For the first trials, planted in March 2009, seed was obtained from ICRISAT and IIAM. Crops included four maize varieties, three improved, open pollinated varieties (Changalane, Djanza and EV8430SR) provided by IIAM and one local maize, three improved cowpea varieties (IT16, IT18 and INIA 36) provided by IIAM, two pigeonpea varieties (0040 and 0020) provided by ICRISAT, one chickpea variety provided by IIAM and two sorghum varieties (Macia and MLT2) provided by ICRISAT. All varieties were chosen by lead researchers as the most appropriate for the local dry conditions of northern Gaza. The maize and cowpea were introduced to test cultural acceptance and the performance of improved varieties under local environmental conditions and management practices. Chickpea and pigeonpea are crops that are not commonly grown in the area and were introduced as potentially productive alternatives to the cowpea that is more commonly grown. Pigeonpea was also chosen due to its utility as fodder for livestock in the dry season. Sorghum was chosen as a more drought resistance alternative to the more commonly grown maize. Previous research indicated that local farmers have stopped growing sorghum for reasons associated with labor demands, bartering power and changing taste preferences, but that sorghum has the potential to perform better than maize in drought conditions.

The trials were organized in plots of 5m x 4m of each variety, one repetition in one association and three repetitions in the second association where more room was available for the trials. Trials were managed by the farmers from each association, including irrigation, weeding, pest and disease control, and harvest. Daily rainfall data were also recorded at each site. Pest attacks by mice and birds were severe and as a result yield measurements could not be taken for maize, sorghum or chickpea. After integrated attempts to control the pests (traps, poison, scarecrows, human monitoring, etc.) we had to resort to covering the remaining sorghum panicles and maize cobs with newspaper so that we could at least harvest enough to use for the taste tests.



Figure 8 Maize attacked by birds and mice.

Measured yields of cowpea and pigeonpea are displayed (Figure 9 and Figure 10), but these data are not reliable given the farmers' habit of selective harvesting. The preferred variety of cowpea, IT16, yielded 200 kg/ha more than the other varieties and consistently yielded the same across the plots. There was no difference between the pigeonpea varieties, but pigeonpea yielded twice as much as cowpea despite heavy pest attacks. Pigeonpea is a crop that was not commonly grown but that has significant potential to improve food security in the region.

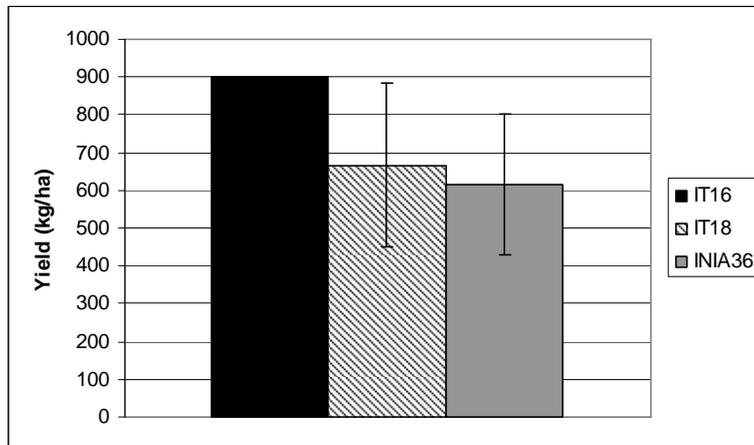


Figure 9 Yield (kg/Ha) of three varieties of cowpea

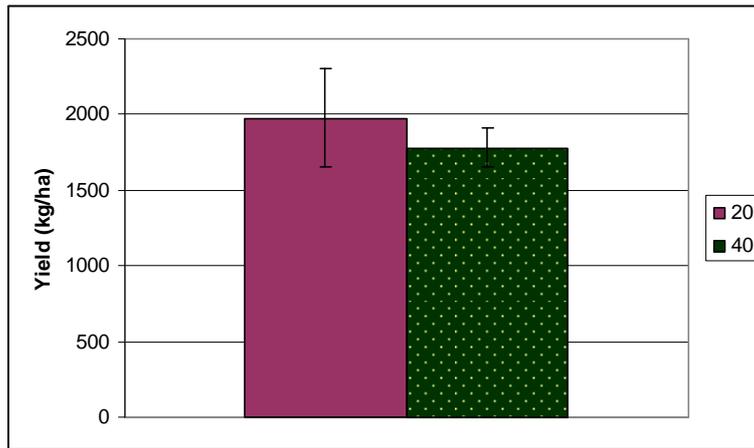


Figure 10 Yield (kg/ha) of two varieties of pigeonpea

The evaluation of the varieties was carried out before harvesting with the interested farmers from each association (12 and 30 respectively). Pigeonpeas had not yet matured when the evaluation took place and chickpeas and sorghum were too devastated by birds and mice to be evaluated for inter-varietal differences and preferences. At the evaluation, farmers were first asked to choose their preferred variety within each crop. IT16 and Djanza were the preferred varieties for cowpea and maize respectively (Figure 11 and Figure 12). These varietal preferences are mirrored in the results from the survey that were carried out after the evaluation (Table 5). Post-harvest evaluations were carried out on each association to test taste and cooking preferences, but preferences did not differ from the previous evaluation.

Survey results showed that among the crops, cowpea was the first preference and maize second (. There was no difference in choice by gender. Despite problems with pests, sorghum was chosen among the top three preferences by 5 out of 29 farmers and chickpea by 2 out of 29 (Table 5).

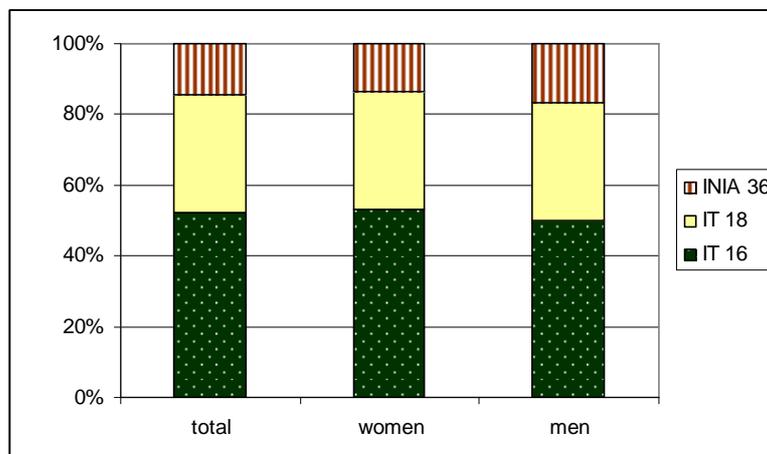


Figure 11 Variety preferences of cowpea (n=42)

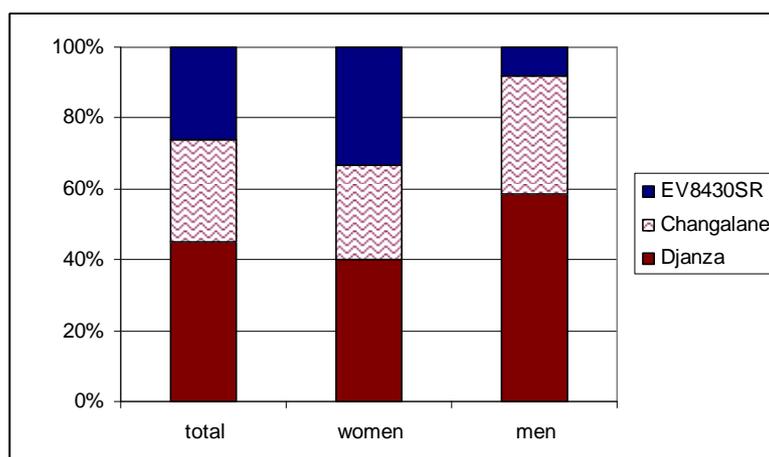


Figure 12 Variety preferences of maize (n=42)

Table 5 Overall variety preferences (n=29)

| Crop         | Variety   | Number of people that chose as first preference | Second preference | Third preference |
|--------------|-----------|---|-------------------|------------------|
| Maize        | Chagalane | 1   | 4                 | 0                |
|              | Djanza    | 5   | 10                | 1                |
|              | EV8430SR  | 0   | 5                 | 3                |
|              | Total     | 6(20%)  | 19(65%)           |                  |
| Cowpea       | IT16      | 13  | 6                 | 0                |
|              | IT18      | 6   | 2                 | 1                |
|              | INIA36    | 2   | 1                 | 0                |
|              | Total     | 21(73%)   | 9(31%)            |                  |
| Sorghum      | Macia     | 2   | 0                 | 2                |
|              | MLT2      | 0   | 0                 | 1                |
| Chickpea     | n/a       | 0   | 1                 | 1                |
| Total (N=29) |           | 29  | 29                | 9                |

#### *Breeders' visit to the field*

Dr. Manuel Amane and Dr. Pedro Fato, the main legume and maize breeders at IIAM, respectively, came to Chinhangane to visit the trials. The visit provided the breeders with farmer feedback about their varieties, how they measure up to local preferences, and the behavior of the varieties under local conditions. The visit also gave farmers an opportunity to learn from the breeders.



**Figure 13 Dr. Amane (IIAM) discussing with farmers**

### *Second round of variety trials*

The second round was designed based on feedback from farmers in meetings and in the survey. We added an additional 13 varieties of three crops: groundnut (Nametil, ICGV-SM99568, ICGV-SM99541, SL-24, ICGV-JM90704), sweet potato (Resisto, Jonathan, Gordner, Gaba-Gaba and Xingova), Mandioca (Maria Branca, Xinhembwe, Munhaça), two new maize varieties (Sussuma and Matuba) and repetitions of the most preferred varieties of cowpea (IT16 and IT18) and maize (Djanza). These trials are still in the flowering stage as this report is being submitted in March 2010 and evaluations have not yet been carried out.

### **2.3.2 On-farm, farmer managed variety trials**

To carry out on-farm, farmer-managed variety trials, we provided seed to 75 farmers: 30 to association 1, 25 to association 2 and 20 to Nanguene. Each person was asked to cut stakes and bring to the meeting place. The bags of seed for handout were painted each a different color. As a person was being given the bag of seed, we painted one of their stakes also the same color. They were indicated to drive the stake into the ground next to where they had planted the seed with the same color code. A list of planting dates has been made and as people plant, they record the date. We will follow up on these varieties as the season progresses in April 2010.



**Figure 14 Seed and stakes were color coded to identify the varieties on farmers' fields**

### **2.3.3 Seed multiplication**

After the first round of variety trials, discussion during the final evaluation indicated that farmers were interested in keeping seed from all of the varieties, but especially from maize varieties Djanza and Changalane and cowpea varieties IT16, IT18. The pest attacks and subsequent post-harvest evaluations (taste tests) left very little seed from the first round of trials so we planted plots for seed multiplication.

Multiplying uncontaminated open pollinated maize seed is not simple and the lesson of how to keep a maize variety 'pure' became a central point for capacity building. In practice, the number of farmers that will want to keep the maize variety pure for their own use is minimal. However, the commercial or certified production of seed seemed the logical next step for the project (although not foreseen) and the opportunity emerged to produce seed for commercial sale (see section 3.1).

The first step to seed multiplication was sourcing basic seed. Seed of the varieties that we had used for the first round of trials were not available. We were able to obtain 5 kg of Djanza, but we were not able to get basic seed for either of the other two varieties that we had tested. We planted these 5 kg of seed in one of the two associations because at that time there was no other maize growing in the vicinity. Unfortunately, during the vegetative stage of the plant development, elephants raided and destroyed the crop. Therefore we had to start again looking for a source from which to multiply seed.



**Figure 15 An elephant destroyed our seed multiplication efforts**

Eventually, we obtained seed for IT16 and Djanza from IIAM and have so far successfully multiplied seed under the conditions necessary for certified seed. The cowpea is currently being selectively harvested and the maize is in flowering stage.

### **2.3.4 Seed conservation**

Weevils are among the top three threats to food security according to focus groups carried in six villages in the LNP, because they “eat all day and night and never rest”. Post-harvest losses are significant and improved seed conservation would contribute to an important increase in food security. More productive, improved maize varieties are typically not as well adapted to post-harvest storage as the local varieties due to their short sheaths that do not cover the cob as tightly as the sheaths of the local

varieties. We contacted the National Campesino Union (UNAC) from Chokwe to teach us how to build improved granaries and the first model is in the process of being built.

## **2.4 Training of farmers and local agricultural extension agents**

The elephant raid, together with the previous season's problem with mice and birds, had serious impacts on the project. As we began to plan the second round of trials, farmers brought a series of issues to the table about the benefits the project would bring to them. We saw that the very basic concepts key to the project objectives were still unclear: What is a seed? What is seed improvement (breeding)? What is the utility of variety trials (as opposed to just handing over seed of different varieties for them to test in their own way)? Most importantly, what would they get out of all of the work they invest in the trial plots? There was a generalized desire to have the seed that had been tested previously and to receive new seed of other crops, but the group was unsure as to why they had to test them in an organized fashion. Therefore, we decided to start, not with more trials, but with a series of activities to help clarify the objectives of variety testing and what they would get out of it. We first took 36 farmers (15 from one association, 17 from another and four from Nanguene) to the nearby city of Chokwe (150 km distant) to visit a private company, MIA, that was testing varieties for their own business and the IIAM local experimental station.

### **2.4.1 Field visit**

At two MIA field sites the group was introduced to variety trials where cowpea, common bean, wheat, soy and maize were being tested, as well as seed multiplication plots of groundnut, wheat and maize. With respect to maize, 39 open pollinated varieties were being tested and hybrids were being tested as well as multiplied. At the IIAM experimental station the group was given a tour of the whole station where they saw not just variety trials but also drought and disease resistance trials, varietal purification, and seed multiplication. It was particularly appropriate as most of the varieties that we had tested with them on the association plots were present at the experimental station at the time and the farmers saw a mirror of what they were doing in a different context. However, the explanation of the other kinds of trials (and the point of research as a whole) was less well understood, partly because of the technical terms used by the researchers explaining the trials, and partially because of the information overload from the day's activities.



**Figure 16 Farmers visit MIA variety trials in Chokwe**

Of particular interest during the visit to Chokwe was one of the first questions asked by one of the farmers at the MIA field site. After a brief introduction by MIA of their activities and the objectives behind their variety trials the question was: how do you improve seed? The ensuing discussion throughout the day about the male and female parts of the plants became an issue of great interest and fascination. They had never heard about such a thing with plants. The explanation of hybrid varieties sparked considerable discussion where the topic was best illustrated -- there were lines of female and lines of male plants. At the IIAM experimental station, the very last explanation of the day of varietal purification where the maize cobs had been self pollinated and covered with paper bags inspired the group to finally put a name in Changaana (the local language) to the process that had been described the whole day. The final decision was that it would be called 'marriage'.

Another point of interest in terms of the catalyzing force of this project was the second question asked in the beginning of the day. While the project had been designed with the idea of production of seed for commercialization in the future, at a later stage of the work, at this point the project took a life of its own. The question was: "we have been introduced to a cowpea variety that produces a lot but we don't have any market to sell to—would you buy our product?" MIA (Antonio Jorge) responded that this was possible. After lunch a discussion ensued as to how to pursue the possibility for the associations of Chinhangane to produce seed as sub-contracted farmers for MIA. Some questions, doubts and limitations were put forward by both sides, such as who takes responsibility for losses when the elephants raid the seed production fields. A field visit was planned for MIA to see the Chinhangane associations (described section 3.1).



Figure 17 Farmers visit IIAM experimental station

#### 2.4.2 What is a seed?

The visit to Chokwe served as a common reference point for the group and the ensuing learning process. Ercilia Xavier Cau from UNAC came to begin to clarify the questions of the difference between seed and grain, between quality local seed and certified seed, seed selection, conditions necessary for multiplication and conservation of quality seed. In total 74 farmers attended the training over two days (one day was intended for each association), of which 47 were women and 27 were men. A practical day was planned the following day, but weather did not permit us to go to the fields.



Figure 18 Training sessions with Ercilia Xavier Cau in Chinhangane (left) and Nanguene (right)

The village of Nanguene had been invited to attend the training but no one from the village came. According to their feedback, we identified the need to organize a training event just for them, on topics of specific interest to them. While Chinhangane

has been the beneficiary of many development projects that have supported the creation of the agricultural associations, provided them with a pump, markets, accounting support, etc, Nanguene is in a different stage in its development. As a village recently moved from the park they still had little experience with irrigation and none with establishing an association, working together in a formalized way, managing communal funds, or dealing with the paperwork necessary to ask for subsidies. Therefore we developed a training session particularly dealing with these issues for the village of Nanguene.

UNAC supports farmers' associations, cooperation, gender equality and self-help development. UNAC is a farmers' union that functions on the basis of regional groupings of associations. The UNAC leader Ercilia that had come to give one of the training sessions and suggested that perhaps given the large number of associations around Massingir, there might be interest in creating a Massingir union. We had noticed throughout the project that there were problems in the functioning of the associations in Chinhangane. Many farmers had come to us to discuss the dysfunction of the leadership of one of the associations. Therefore we invited Gimo Antonio Bobo to come to Massingir to introduce the associations of Chinhangane to the philosophy of UNAC. He got each association to discuss their internal problems and provided them with tools to deal with them. He touched on issues of leadership, gender, and initiative.



Figure 20 Training with Gimo Antonio Bobo



Figure 19 Studiously taking notes

#### **2.4.3 Seminar: Seed Security as a key to food security in semi-arid, rural areas**

One potential way to improve seed security is to link the local seed system to the national or formal seed sector. On a very small scale, testing formal, improved varieties at a local level begins to link these very separate and often parallel systems (Almekinders, Louwaars & de Bruijn 1994). However, it became clear that the sustainability of our actions was going to be limited if we did not connect the systems further.

Mozambique lacks seed in the formal market. Many varieties are not available on the market due to lack of seed multiplication. On the other hand, many small farmers end

up buying grain instead of seed due to lack of seed in their region or lack of seed at an accessible price. Most of the seed available for purchase is in fact imported. Therefore, the idea of local level seed production has considerable potential to fill an important niche in the seed system and connect the formal with the informal system.

In discussions with the various stakeholders in the formal seed sector, there appeared to be a considerable disconnect between them. Therefore the idea was born of a seminar to bring together the different members of the seed chain to propose and discuss the possibility of local level seed production—how it could be done, where, the limitations, etc. The seminar, held in Chokwe, Gaza on 2-3 December 2009 brought together 35 people for one and a half days. On the first day, a representative from each sector the seed chain made presentations and the second day was dedicated to the creation of proposals for actions in the future.

Presentations were made by researchers (breeders) from IIAM, the Seeds Department of the Ministry of Agriculture, the National Unit for Basic Seed (USEBA), a national seed company (HORTIMOC), a regional seed retailer, ICRISAT working at the level of promoting small to medium sized seed businesses, two presentations of organizations working to promote local level seed production, National Department of Agricultural services (DNSA) talking about seed fairs, district level extension services, and finally the end users, farmers (See Annex 1 for program, summary and presentations given at the workshop).



**Figure 21 Presentations (left) and development of action plans (right)**

To prepare for the seminar, farmers were given cameras to take pictures of their seed system. They wrote a narrative to describe the pictures they took, that they then presented in the seminar in the form of a poster (See Annex 1). One of the unexpected results of the seminar was the interest, surprise and lack of knowledge on the part of the seminar participants from outside the area about the reality of the semi-arid, rural area of Massingir. Many questions were directed to the farmers about their basic farming system and agro-ecological conditions.

The second day of the seminar was used for developing action plans. Each person was asked to write on a piece of paper his/her personal interest or the area he/she thought

needed the most work for improving availability of seed in semi-arid, rural areas. The topics were gathered and the group decided on three main working groups:

- production of local seed,
- commercialization and distribution of local seed
- capacity building

Concrete action plans were developed, presented and debated. (Annex 1)

As a result of these action plans, trainings were planned for extension agents to be more equipped with the information that they need to teach farmers about local seed production.

#### **2.4.4 Training of trainers (extension agents)**

On 20-22 January 2010, we held a training session for extension agents in local level seed production. It was a training session for trainers who would then teach farmers how to produce certified or non-certified seed. The training was held in Chokwe and taught by an employee of the national Seed Department (DS) locally responsible for field inspections and certification. Course participants were chosen carefully based on their capacity to use the benefits gained from the course in practice in the future to jump-start seed production or teach others about local seed production. While the project's activities are focused in Massingir, it was decided that extension personnel in Massingir with potential to apply the course information in practice were few in number (there are only two government extension agents working in Massingir), therefore we opened the course participation to extension agents from Chokwe where there has already been more experience in seed production, and Namaacha where the SDAE director is attempting to promote local level seed production. In total, 4 extension agents from Massingir and the director of SDAE, 5 extension agents from SDAE Chokwe, and 2 from SDAE Namaacha participated in the course.

The first day consisted of a revision of all of the technical necessities for seed production: the conditions, protocols and operations practiced for the production of certified seed. For some this was revision, for others it was entirely new information, however the debate that emerged about the issues on the fringes and challenges encountered was extremely useful and informative for the group as a whole. In the afternoon of the first day, participants were asked to share their experiences with seed production, challenges they had encountered and what they would like to learn in the course. The debate was so rich that the plans for the rest of the afternoon were abandoned to facilitate the informal exchange of information and experiences.

Limitations to local seed production were identified:

- Lack of access to quality basic seed from which to multiply
- Lack of buyers for local seed after production/ need to link production to commercialization
- Lack of resources to follow through on the whole season/process of seed production

- Need to develop more dialogue with breeders/need for more collaboration from other sectors of the government
- Time lag between seed production and buyer (need for proper storage)
- Lack of government recognition of local capacity for seed production (State goes to the large farmer instead for sub-contracting seed production)
- Seed prices are too high for small farmers
- High price of seed inspection processes post-harvest
- Corruption in the stores, DS/ need for more inspection in the stores/ stores sell grain as seed
- Difficulty of raising awareness about the value of seed, as opposed to using grain to plant
- Farmers do not accept thinning of extra plants or plants that are not of the correct variety



**Figure 22 Eduardo Langane (DS) training the trainers in the classroom, then in the field**

On the second day, the technical training was continued until all issues were covered, at which point participants were asked to design a lesson plan for the course they were to teach to farmers. The group was divided into four groups based on the debate of the previous day and participants were asked to propose solutions or alternatives to the challenges that they had debated: 1) How do you raise awareness about the value and benefit of planting with SEED and not grain, 2) seed production, from field preparation to harvest, 3) seed selection and post harvest treatment, 4) commercialization and alternatives to formal seed certification processes. All proposals developed were specifically required to be something that the participants could do, not a proposal for an action for someone else to do.

Some of the proposals that emerged had considerable potential and Ercilia Xavier Cau has taken the initiative, with our support to merge the ideas and develop an innovative proposal on future work on local seed production.

The third day of the course was the practical day in the field. Two seed production fields were visited, one of rice and another for maize. Participants were asked to inspect the fields.

#### **2.4.5 Extension agents teach farmers**

During the seminar in December, the difficulties of working with an association were brought to the table while sharing experiences of local seed production. Given the demands for precision in the management of the seed crop, the general consensus was that working with individual farmers is much more likely to produce quality seed

than working with an association that has communal management of their production. Therefore, although we did not exclude the association, we invited 10 farmers considered to be innovative in the district to participate in a course on seed production given by the newly trained extension agents. The course was held on 27-28 January 2010 in Massingir.

The DS agent was also present to support the extension agents in their first experience in teaching about seed production. The first day was mainly theory, but the farmers had many questions being an entirely new topic for them. Some of the comments consisted of: “Oh, that is why seed is so expensive in the stores.” And “I never knew that when the plant doesn’t grow well it could be because of poor seed.”



**Figure 23 Farmers share their knowledge with each other (left and center) and extension agents explain seed production on the association’s seed multiplication plot (left)**

The second day was a practical day where we visited one of the associations in Chinhangane. Many issues were raised, questions asked and answered between the farmers themselves and topics that had not been covered in depth in the classroom were covered in the field. At the end of the course 0.5 kg of Nametil (groundnut, basic seed) and 0.5 kg of IT16 (cowpea, basic seed) was given to the participating farmers to begin to produce seed. They will contact the SDAE when they want to plant and SDAE will accompany the seed production process through the whole process.

One unexpected result of the training was the interest that the field visit sparked in the group. Plans were made to organize more exchanges and visits to each other’s farms, coordinated by SDAE.

### **3. CATALYZING ACTION: NEW INITIATIVES**

#### **3.1 Sub-contracting**

After the farmers’ visit to the private company MIA and initial discussions about a potential collaboration, MIA came to visit Chinhangane. MIA was looking for a way to open the seed market to the small farmer by lowering the price of production of seed and therefore lowering the price of the seed. The company wants to experiment with buying locally produced seed that has been given technical assistance by the company and certified by the DS. It was agreed that MIA would sub-contract one of the associations for seed production as soon as the association had land available (Feb 2010).

The seed production training taught by the extension agents to private farmers and members of the associations was aimed at this goal of producing for a company through sub-contracting, because it solved a major problem associated with local seed production: the need to link production to commercialization. When MIA returned in February to negotiate the contract, they also visited the farm of one of the farmers that had attended the training. He will also be sub-contracted by the company.

Seed production is more labor intensive and costly than the production of grain, but is also more lucrative. It is a skilled job requiring careful management on the farm and in post-harvest. With the right support and infrastructure in place, the production of improved seed by small farmers has the potential to improve availability of quality seed for the district. It also has the potential to become a driver of development for Massingir given the access to irrigated land.

### **3.2 New ideas**

Based on the debates from the seminar and the training sessions, a proposal is being developed to further work on local seed production that outlines innovative alternatives to get around the main existing constraints (listed above section 2.4.4). The proposal focuses on partnerships and arrangements that would allow the small farmer to access the seed market and increase the availability of certified, quality seed in the region.

The proposal consisted of three main parallel seed production arrangements. These ideas are still in the process of being developed, but preliminary ideas are described below:

- 1) FARMER PRODUCTION OF CERTIFIED SEED FOR THE FORMAL MARKET IN COLLABORATION WITH SEED COMPANIES. Farmers would sell 'primary material'(non-certified seed that has been grown under the conditions necessary for seed production and inspected in the field) to seed companies through a system of subcontracting so that the farmers are not burdened with the costs of post-harvest seed testing for certification. In this case both the costs and the profit to the farmer would be inferior to formal seed production, but would allow the small farmer to access the seed or 'primary material' market (still more lucrative than selling grain). This model has been tried before in Mozambique and is attaining variable degrees of success in other parts of the country. It is the model that we are experimenting with in Massingir, but there is still considerable work to be done in studying and adjusting the model.
- 2) FARMER PRODUCTION OF CERTIFIED SEED FOR THE SMALL FARMER. Reexamine the rules for post-harvest quality control for local seed production. Mozambique has a lenient policy towards local seed production. It requires only one inspection in the field, instead of the 3 or 4 inspections required on commercial farms. However, this leniency does not extend into post-harvest inspections. These inspections require numerous laboratory tests that are costly and prohibitive for small farmers. The suggestion was made that the laws governing local seed production could be reexamined for more consistency. It

has been shown that despite regulations, there is still a considerable amount of corruption and variable seed quality in the formal system.

- 3) FARMER PRODUCTION OF GUARANTEED SEED. To increase the quality of the local seed, the third model would incorporate production of “farmer-guaranteed seed”. This seed would not need to pass any official inspections, but the quality would be controlled by other farmers. The farmers or farmer associations interested in producing seed under this umbrella would form a union that would be responsible for quality control, marketing, the development of labels, and raising awareness among other farmers.

## IMPACT/OUTPUT

This project intended to improve local seed security through the introduction of improved varieties. While we tested new varieties, we were also able to advance further than expected with improving seed production. Commercial or certified seed production was not a foreseen component of the project, nor was it expected that we would have a chance to work on seed multiplication (certified and non-certified), conservation (building an improved granary) and local capacity building (training the trainers) in the way that we did.

The question of how much this work had contributed to improving seed security and how much that contribution has improved food security can only be answered in the future. However, glimpses of changed practices were caught outside of project activities: we observed women selecting maize seed from the center of the cob, removing infected plants from the multiplication plots, and the introduced varieties have already been planted in fields, indicating initial stages of adoption.

We hope that the networking between the district level agricultural services and the national research institute that developed through the seminar, the trials and the breeder visits to the district will lead to future research in the district. Agricultural research in Mozambique tends to be carried out in more accessible, more productive, agricultural zones, leaving the semi-arid, rural areas without the benefit from technological improvements stemming from research. We hope that the district will actively search out and facilitate more agricultural research as well as to have piqued the interest of the researchers to initiate research in those areas.

While the results in this report are still preliminary, drafts of two scientific papers are being written and will be submitted for publication shortly.

## CRITICAL REFLECTION

The project was designed to benefit both the resettled and the host villages. We did not expect to have problems with the participation of the resettled villagers in the experience of the variety trials. In the end, the resettled residents did not feel welcome to participate with the host village associations. Unfortunately, the resettled residents benefitted much less than the host village from the project activities, mainly due to lack of access to irrigation. Although the resettled residents were given

improved seed to test on their rain-fed fields, the season has not been consistently rainy enough for any harvest. This implies that, as a livelihood rehabilitation effort in post-resettlement, the outcome fell short of what was expected. However, if resettled residents had been provided with access to irrigation, as was expected, the project would have provided an important resource to ease the transition to the host village and to facilitate learning about irrigation.

On the other hand, carrying out this project created a platform from which to study the integration of the two villages in post resettlement. It was evident that when we did not explicitly invite Nanguene personally, they did not participate in the meetings or events. Projects such as this one that are designed to facilitate the transition in post-resettlement could do more to facilitate integration of the two villages, but proper legitimacy is needed in the eyes of both villages for this to be effective.

We had intended to introduce varieties that were drought-resistant, and to test them under rain-fed conditions, as well as under irrigation. Unfortunately, the first planting was delayed for political reasons and for the second round of trials that was paralleled with rain-fed trials on individual farms, the rainfall patterns did not cooperate. As would be expected, testing of varieties in areas with unreliable rainfall requires more than one year.

Although more difficult to document, the learning process was key to the success of the project, and in the end more important than the outcome of the variety trials. If we had begun earlier with a more purposeful sequence of trainings, the project would have been more successful. Our original proposal only included capacity building for extension agents.

## CONCLUSION

Allocating sufficient agricultural lands, or alternative resources such as access to irrigation, to resettled residents is essential to avoid that they return to the conservation area in pursuit of livelihood activities. If there is not enough land available, the resettling organization should provide tangible, immediate alternatives to land-based livelihoods for resettlement to be sustainable, or decide not to resettle villages. Improvement of the agricultural system through improving seed security is one potential intervention, but insufficient in itself to balance out the costs of resettlement for both the people resettled and the surrounding environment.

Local seed production has the potential to improve the quality of available seed in semi-arid, rural areas. Synergies between the informal and formal system can open doors to innovative opportunities that get around the constraints of certified seed production for the small farmer.

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## FINANCIAL REPORT

| <b>Type of Expense</b>                     | <b>Total Amount</b> | <b>Amount spent</b> |
|--|---------------------|---------------------|
| Salaries/field staff & assistants          | 14,400              | 15,174              |
| Purchased services                         | 1,200               | 3,093               |
| Equipment \$250-\$5,000 (please list)      | 4,000               | 1,680               |
| Equipment over \$5,000 (please list)       | 0                   | 0                   |
| Expendable supplies & materials            | 12,200              | 13,325              |
| Repairs & maintenance                      | 500                 | 140                 |
| Food/per diems (# of people at daily rate) | 9,180               | 7,897               |
| Communications                             | 360                 | 645                 |
| Postage & freight                          | 0                   | 0                   |
| Travel                                     | 0                   | 0                   |
| Miscellaneous (please list)                | 0                   | 0                   |
| <b>Total amount</b>                        | <b>41,840</b>       | <b>41,956</b>       |