

# Mainstreaming Disaster Risk Reduction in Agriculture.

An XCSEL Learning Paper

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*Members of Mixixine FFS using the irrigation system in Chinde, Zambia*



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## Introduction



A consortium comprised of Concern Worldwide (CWW), Welt Hunger Hilfe (WHH) and ORAM implemented the “Strengthening Civil Society to enhance livelihoods through supporting economic skills diversification, markets and gender equity in Zambezia” (XCSEL) project in the province of Zambezia from 2015 to 2017. CWW targeted extreme poor communities in extremely remote areas in the districts of Inhassunge and Chinde (including Micaune) while WHH targeted poor communities in peri-urban and less remote areas in the districts of Quelimane and Nicoadala. The project has been implemented integrating 5 different focus areas and associated activities to achieve the objectives:

- Farmer Field Schools (FFS) (CWW and WHH)
- Care Groups (CG) (CWW) and mother’s & father’s nutrition groups (WHH)
- Dialogue Clubs (CWW)
- Farmers’ Associations (FA) (ORAM)
- Village Saving and Loan Associations (VSLA) (CWW and WHH)

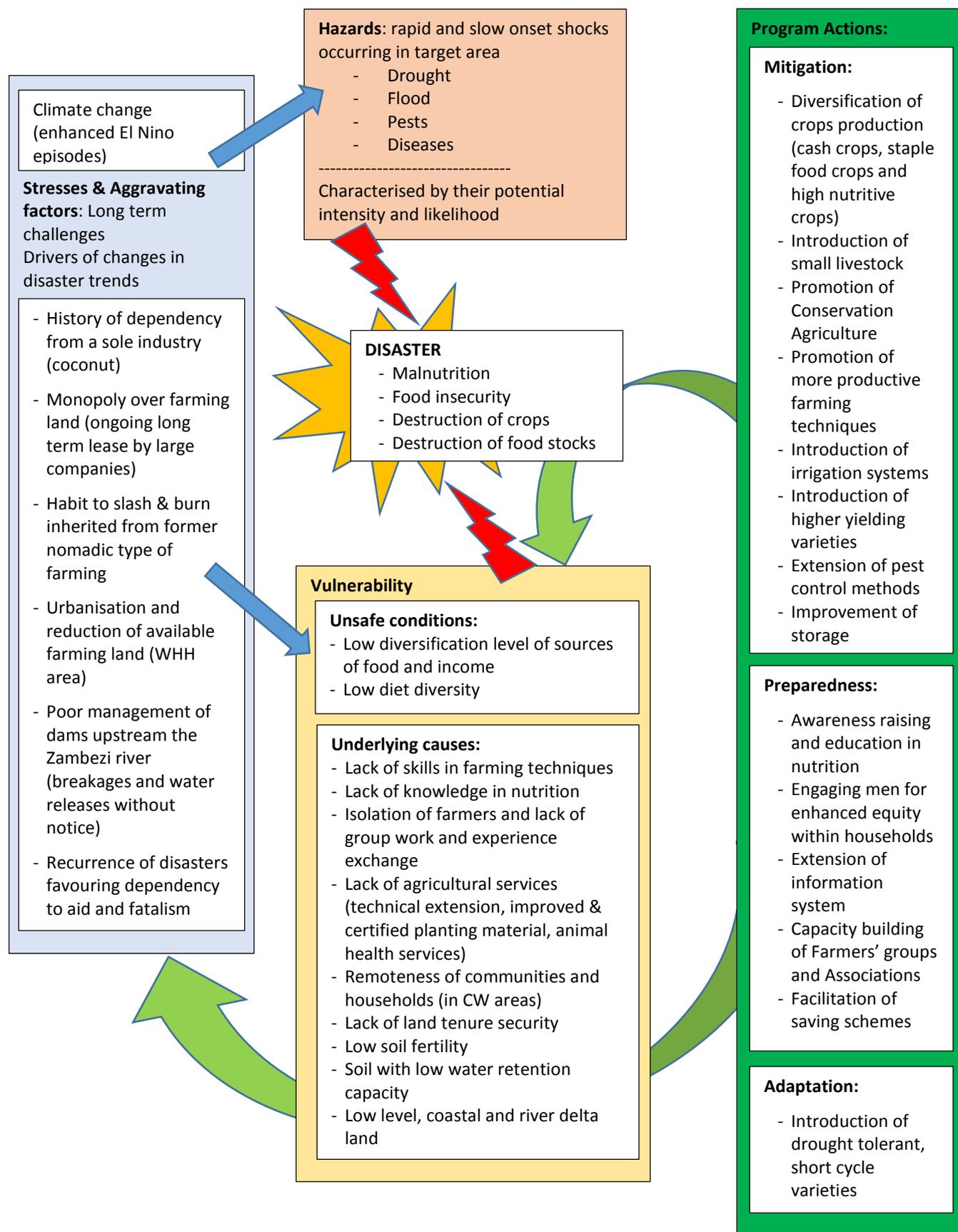
The project formed Farmers Field Schools (FFS) where farmers trialled and learned a wide range of improved farming practices and crops, encouraging a gradual adoption on their own plots. Better Infant and Young Child Feeding (IYCF) practices and gender equality were promoted through Care Groups and mother’s & father’s nutrition groups, FFS and Dialogue Clubs.

This lesson learning paper was developed with the objective of identifying key learnings from the XCSEL project’s mainstreaming of DRR practices over the course of three years working with rural and peri-urban farmers. The key focus was to understand how DRR practices were applied, the key results and to what extent these practices will continue to be applied by the farmers in the future.

This paper gathers findings from eleven focus group discussions (FGD) conducted with male and female project participants across three out of the four target districts, covering both Concern Worldwide (CWW) and Welt Hunger Hilfe (WHH) intervention areas. It also integrated quantitative data gathered via monitoring tools applied throughout the project implementation<sup>1</sup>.

<sup>1</sup> To put things into context, it is worth mentioning that this paper was prepared shortly after the main harvest which had been badly impacted by unfavourable weather conditions for the third year in a row.

## Project logic: an overview based on Concern's conceptual model of Disaster Risk Reduction<sup>2</sup>

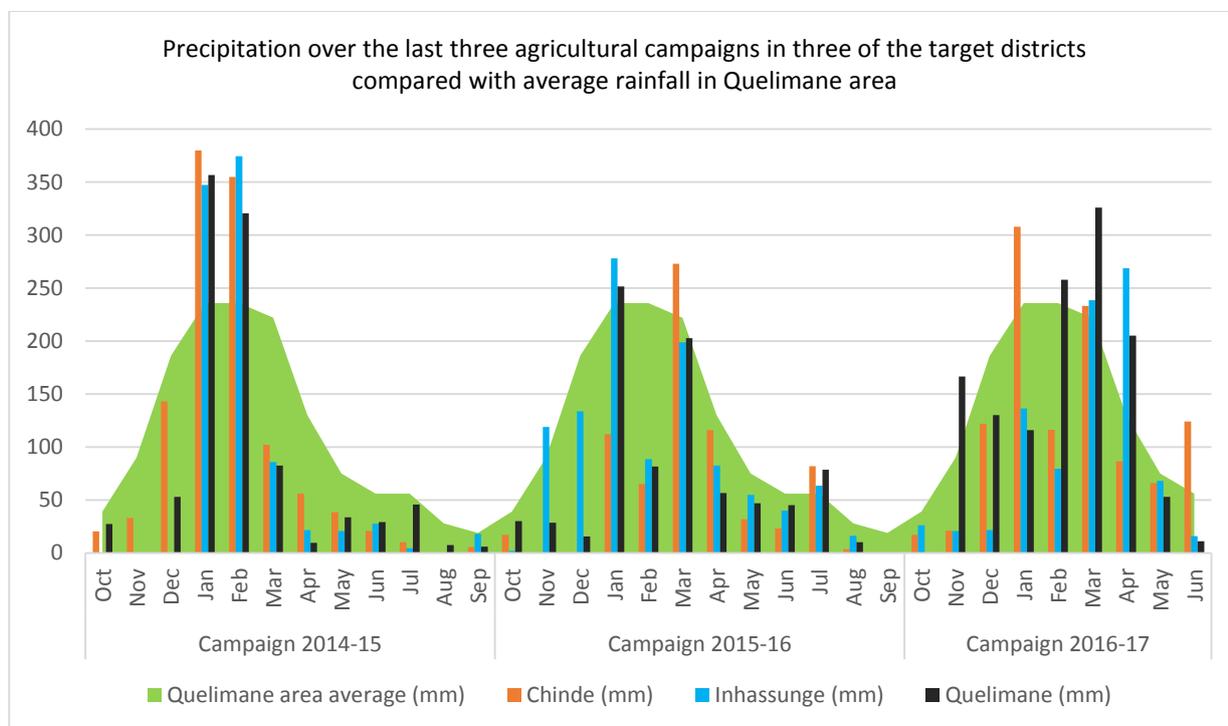


<sup>2</sup> Concern Worldwide's Approach to Disaster Risk Reduction. October 2016.

## What is a concern for the participating farmers?

According to data from the weather stations of the SDAE (District Service for Economic Activities) in the three districts of Quelimane, Inhassunge and Chinde, shows that when compared with average annual rainfall in the Quelimane area<sup>3</sup>, the agricultural campaigns that coincide the project lifespan suffered notable irregularities in rainfall. A late start to the rainy season in 2015 was followed by excessive rain and flooding during January and February, then an overall deficit during the 2016 campaign and again a late start to the 2017 campaign when precipitation only reached the average level in March. Limited access to information and low level interactions with agriculture extensionists from government means that farmers also struggle to make informed decisions to protect their crops. The following key challenges were cited in the following order as the most disruptive to their lives:

**Drought and irregular rainfall** was unanimously cited by participants as the worst disaster to affect them. Surveyed farmers generally defined a drought by the failure of the rice which is the main crop. They also explained that droughts led to waste of seeds as sowing is repeated in hope that rain will eventually occur and they also noticed that drought is associated with increased impact of pests. Both midline and endline data shows that over 70% of farmers experienced drought in the past two years. Drought is associated with food insecurity and malnutrition, indeed, participants in Nicoadala reported “surviving through the foraging and consumption of forest products” in 2016.



**Pests** were cited as the second greatest impacting challenge for the farmers. **Rats and mice** are described by far as the worse nuisance as they destroy crops in the fields (especially rice and vegetables) and also attack stored grain and seeds. Other described plagues are **insects** like grasshoppers and caterpillars (damaging cereals and vegetables) as well as the yellow leaf lethal disease on coconut trees (caused by a bacteria that is transmitted by a hemipteran) that is devastating what used to be a major industry in the intervention area.

**Newcastle Disease** was cited as the third greatest challenge, which kills a great number of chickens during the same period of each year, “when the mango trees begin to flower”. Along with drought this is a challenge that was cited by all participants. Out of the 113 consulted participants, only one person cited having vaccinated her chicken (for free) during the last campaign in July 2017. A majority had heard at least once about vaccination campaigns on the radio but never observed them happening in their community, and indeed that one person had benefited from the fact that she lives close to the local technician. Discussions revealed that knowledge on the control of the disease was very poor. For example many seemed not aware that there is no treatment but a vaccine and did not know how to access to this control measure. Paradoxically, most declared being willing to pay for getting their

<sup>3</sup> Source: TotoGEO.org

chicken protected. Based on the evaluation reports a majority of target households own chicken (60% in WHH area and 76% in Concern area at endline) and the average number of chicken per HH is 5.05 at endline.

**Floods and cyclones** (or “strong winds”) came fourth but did not appear to have as great an impact as the others mentioned above given that they don’t occur as often and don’t destroy entire crops. Farmers in Chinde reported that late – but suddenly heavy rains badly damaged sesame crops while it was in its early vegetative stage while some participants also argued that “while floods can do some damage they are usually followed by a good cropping season, while droughts just destroy everything”.

## DRR techniques

The project engaged in a number of actions that aim to strengthen farmer’s resilience to drought and irregular rainfall. The table below summarizes how the project design intended to tackle each of the main disaster experienced by the surveyed farmers.

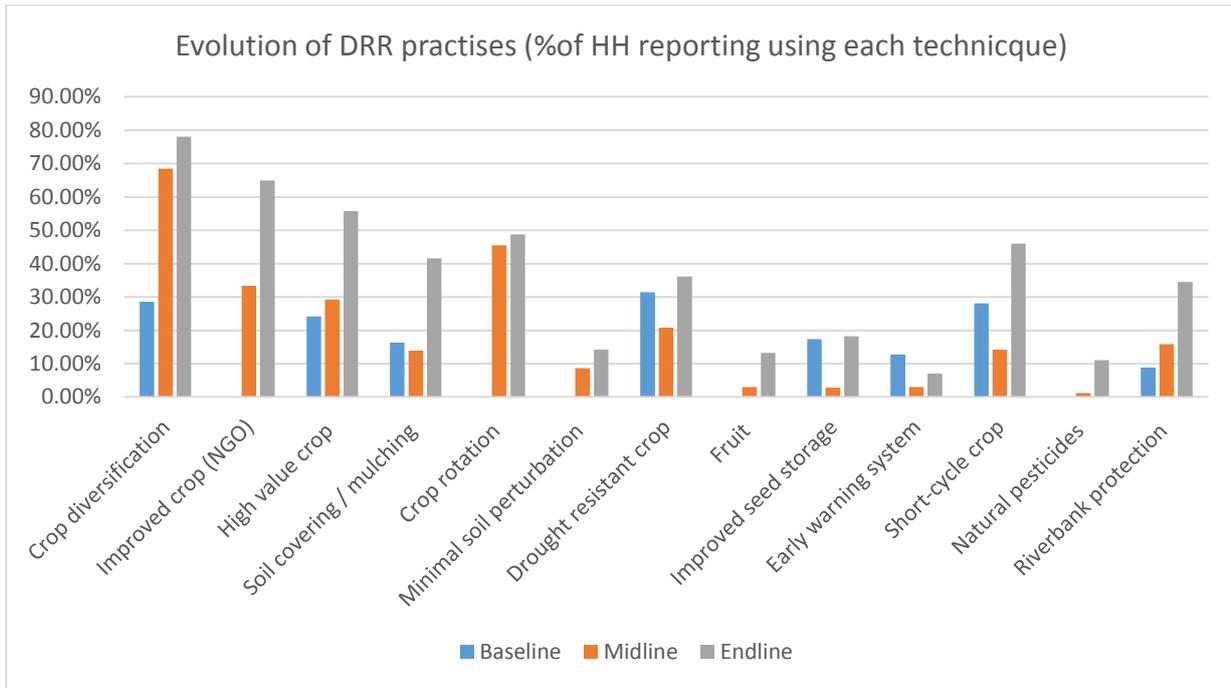
	Drought and irregular rainfall	Pests (rats)		Pests (insects)		Newcastle disease	Flood and cyclone
		In the field	In storage	In the field	In storage		
Crop diversification	X						X
Improved crops varieties	X						
Improved farming techniques	X						
Livestock	X						
Conservation agriculture	X						
Improved storage			X		X		X
Bio-pesticides				X			

A key strategy of the project was the promotion of the **diversification of crops** through the introduction of new crops such as sesame, soybean, vegetable and orange fleshed sweet potato. This aimed to both respond to the need for cash, production of staple crops and high nutrition food for target households, with the key cited benefits being mitigation of negative impacts of a disasters as crops are cultivated in various locations (for example low land and high land) and over an extended period during the year. The project included the promotion of drought-resistant crop such as cassava and sweet potato and introduced small-scale irrigation system (rehabilitation of agricultural wells, donation of hand pumps) particularly to support vegetable production during the dry season.

The second key strategy of the project was the extension of **improved farming techniques**, including **sowing in lines** and applying **adequate planting density** with the expected benefit of improved crop performance enabling better yields and as such more food and higher earnings when environmental conditions are favourable. This was implemented alongside key **conservation agriculture** practices which include minimal soil perturbation, soil cover and crop rotation. Participants were unanimous describing the positive effect of applying mulching on the yield (instead of burning crop residues, as they were previously doing). Another key strategy was the testing and extension of improved varieties of existing crops, including **short cycle, drought tolerant** and **higher yielding varieties** of maize, rice, cowpea and sweet cassava. This involved continuous gathering of data and follow-up on application of the different techniques, particularly with regard to rice intensification. The second half of the project saw the introduction of **village savings and loans associations** and **small livestock**, building on the momentum gained with the different groups.

When it comes to pests damaging crops the project strategy focused on two actions: training farmers in the fabrication and use of **bio pesticides** and promoting **better storage practices** whereby *community storage aimed* at protecting grain and seeds from rats and flood, the “gorongosa” silo is protects grains from rats and SuperBags provide protection from weevils and humidity.

None of the project actions, however, addressed Newcastle disease, while the systematic seasonal loss of chicken appeared to constitute a disaster for all of the surveyed groups.



## Key Results

### **Improved farming techniques led to increased productivity on FFS plots**

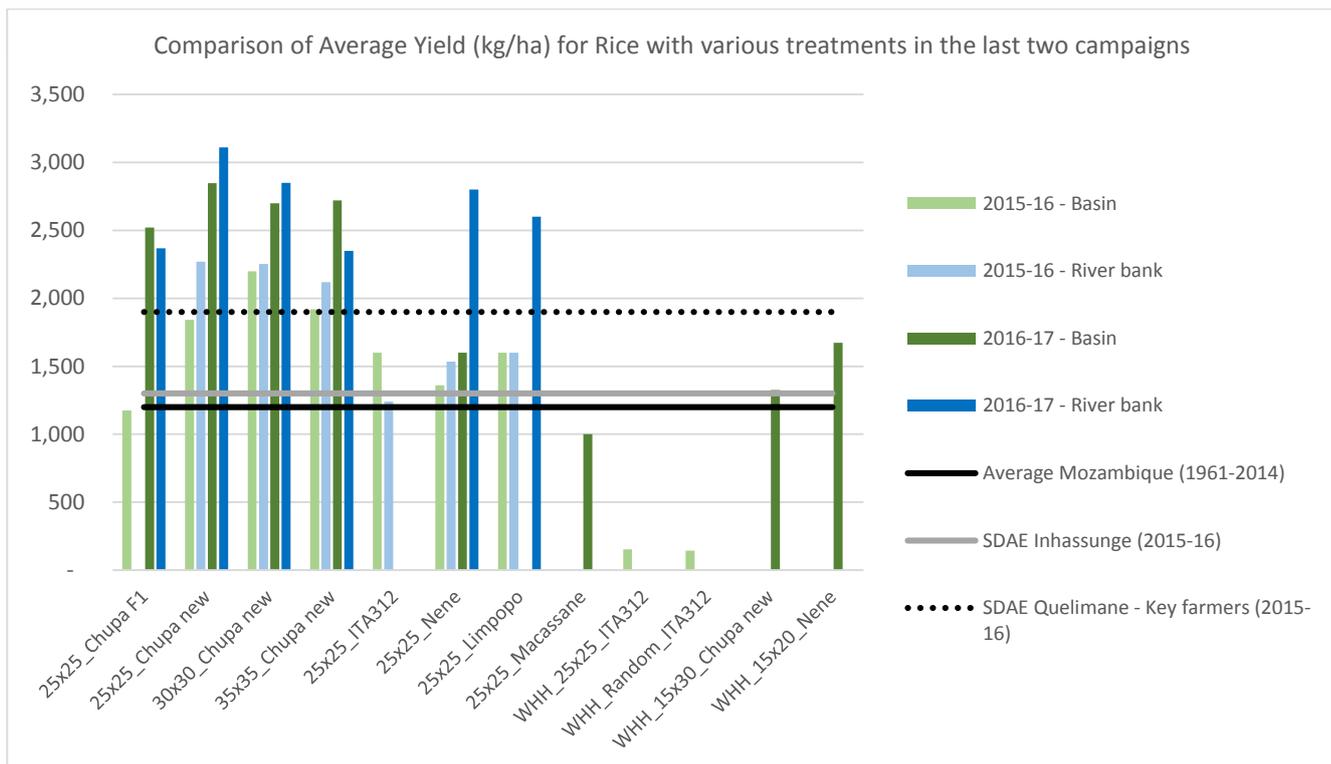
The project established an applied research protocol in order to measure the performance (generated yield) of various planting methods in the demonstration and learning plots (DLP) of the FFS’ where members were encouraged to test various sowing techniques and densities for rice and sesame.

With rice, farmers obtained yields equivalent to an average of 2,270 kg/ha<sup>4</sup> in DLPs in the 2015-16 campaign, which is 89% higher than the average yield in Mozambique<sup>5</sup>. Furthermore, in the 2016-17 campaign, farmers obtained yields equivalent to 3,109 kg/ha<sup>6</sup> in DLPs, which is 159% higher than the average yield in Mozambique. A few FFS members also ran tests to compare yields obtained from growing their own seeds of Chupa variety (here named “F1”, kept from previous harvest) and certified seeds of the same variety (donated by the project), both applying same sowing densities and growing conditions. In both campaigns, and systems (basin and river bank) the average yield generated by F1 Chupa seeds was lower than yield from new Chupa seeds. Due to low number of tests, the difference in yield did not appear to be statistically significant, however loss in yield with F1 was reported by through several FGDs. The charts below shows the performances of different rice varieties grown in various conditions when improved farming practices were applied during the past two agricultural campaigns. Overall, the project succeeded in supporting farmers testing and identifying more productive sowing techniques for rice.

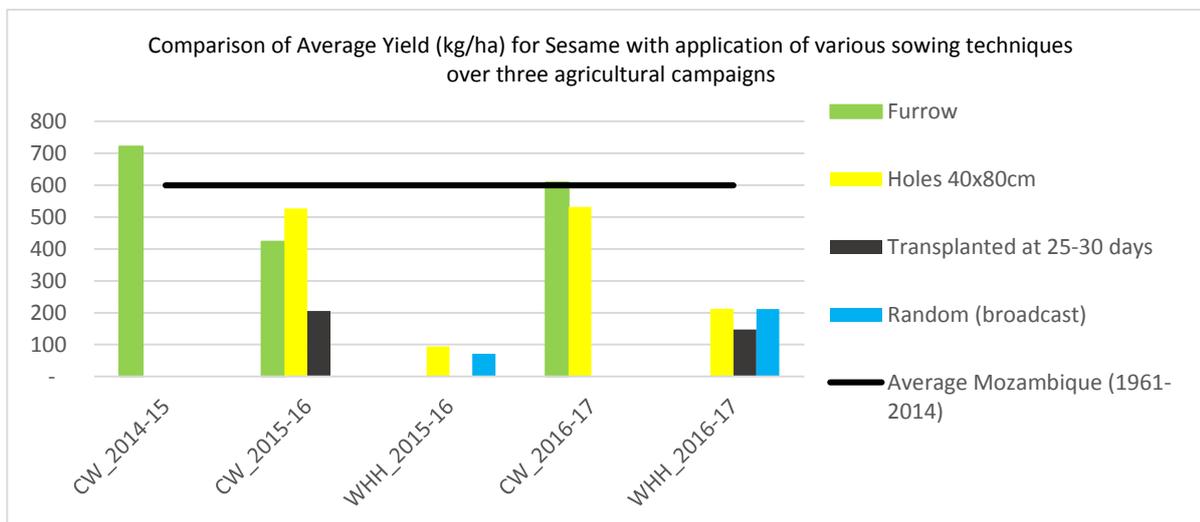
<sup>4</sup> Source: CWW & WHH monitoring data. Average yield from four different DLPs in CW area with Chupa variety sowed at a density of 25x25cm in River bank area.

<sup>5</sup> Source: [www.totogeo.org](http://www.totogeo.org). Average yield for rice in Mozambique (1961-2014) based on FAO data.

<sup>6</sup> Source: CWW & WHH monitoring data. Average yield from eleven different DLPs in CW area with Chupa variety sowed at a density of 25x25cm in River bank area.



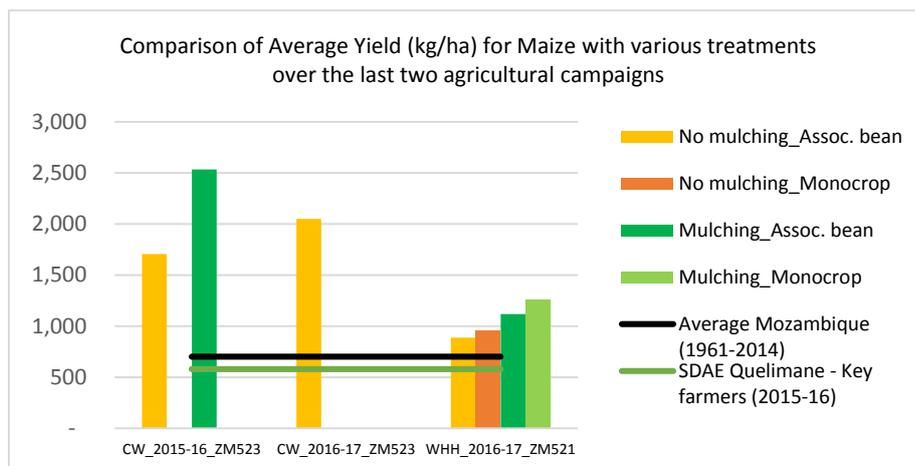
With sesame, the results of the project are more mixed, with the best average yield obtained by farmers in DLPs during the 2014-15 campaign, where sesame was sown in furrows (721 kg/ha, which is 20% higher than the average yield in Mozambique<sup>7</sup>). The last two agricultural campaigns resulted in lower than the average yields, except in the 2016-17 in rural (CWW) areas, again on plots sowed in furrows (609 kg/ha). The lowest average yield recorded was in WHH area where sesame was sown randomly broadcasted (71 kg/ha), although overall results in peri-urban (WHH) areas appeared to be very low for each sowing technique applied. The chart below shows the performances of sesame varieties with various sowing techniques applied for the last three seasons. The limited results are probably the consequence of the low level of rain and high presence of pests.



<sup>7</sup> Source: [www.totogeo.org](http://www.totogeo.org). Average yield for sesame in Mozambique (1961-2014) based on FAO data.

## Application of Conservation Agriculture principles led to increased yields

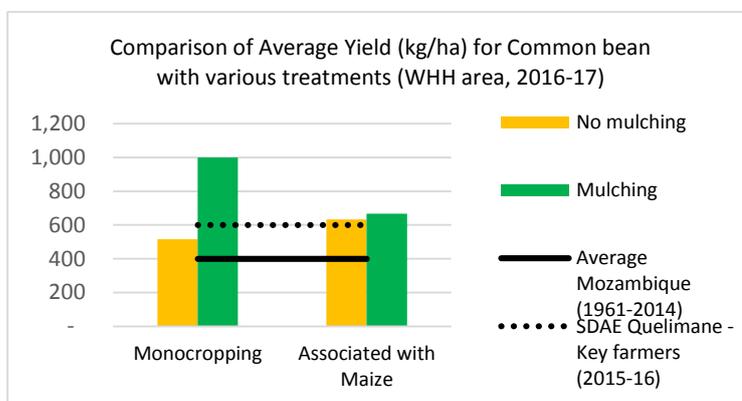
FFS members also set up a series of tests to measure the impact of mulching on the performance (yield) of maize, common bean and soybean.



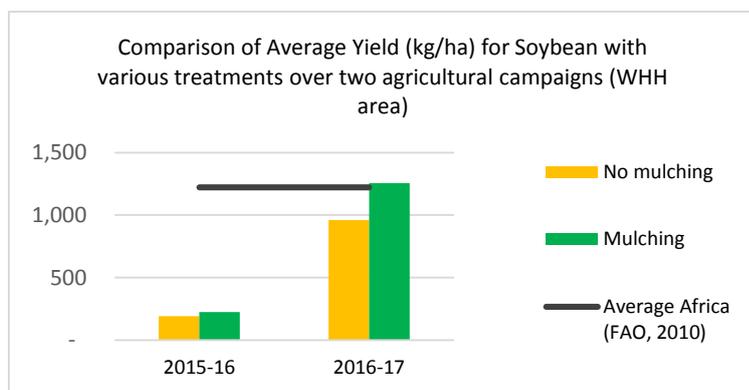
On **maize**, FFS members in rural areas obtained an average yield of 2,532 kg/ha<sup>8</sup> in the 2015-16 campaign, which is more than double the national average. They also observed that the yield obtained in the plots where mulching had been applied was up to 49% greater than the yield in plots with no mulching<sup>9</sup>. In the last campaign in peri-urban areas, average yield

was also greater when mulching had been applied (up to 79%). In both CWW and WHH areas, differences in yields appeared to be statistically significant<sup>10</sup>, which demonstrates the positive impact of mulching on the yield of maize.

With regard to the **common bean**, during the 2016-17 campaign, FFS members in peri-urban areas observed that the average yield obtained in the plots where mulching had been applied was up to 94% greater than the average yield in plots with no mulching, where it was grown as a single crop<sup>11</sup>. In both systems (mono-cropping and association), differences in yields appeared to be statistically significant<sup>12</sup>, which also strongly demonstrates the positive impact of mulching on common bean.



In terms of **soybean**, during the 2016-17 campaign, FFS members in peri-urban areas observed that the yield obtained in the plots where mulching had been applied was on average 31% greater than the yield in plots with no mulching<sup>13</sup>. The difference in mean yield observed between the two treatments “With mulching” and “No mulching” during the last campaign (2016-17) was statistically significant.



<sup>8</sup> Source: CWW & WHH monitoring data. Average yield from eleven different DLPs in CW area with Maize ZM523 variety sowed in line 90x40cm with application of mulching.

<sup>9</sup> Source: CWW & WHH monitoring data. Average yield from ten different DLPs in CW area with Maize ZM523 variety sowed in line 90x40cm without application of mulching.

<sup>10</sup> Differences in maize mean yield observed between the two treatments “With mulching\_Monocropping” and “No mulching\_Monocropping” (independent samples t-Test): 2015-16 campaign in CWW areas:  $t = -4.86208$ ;  $df = 20$ ;  $p < 0.001$ ; 2016-17 campaign in WHH areas:  $t = -5.093$ ;  $df = 110$ ;  $p < 0.001$ .

<sup>11</sup> Source: CWW & WHH monitoring data. Average yields from 56 different DLPs in WHH area with Common bean of Butter bean variety with application of mulching and 56 other plots in same conditions with no application of mulching.

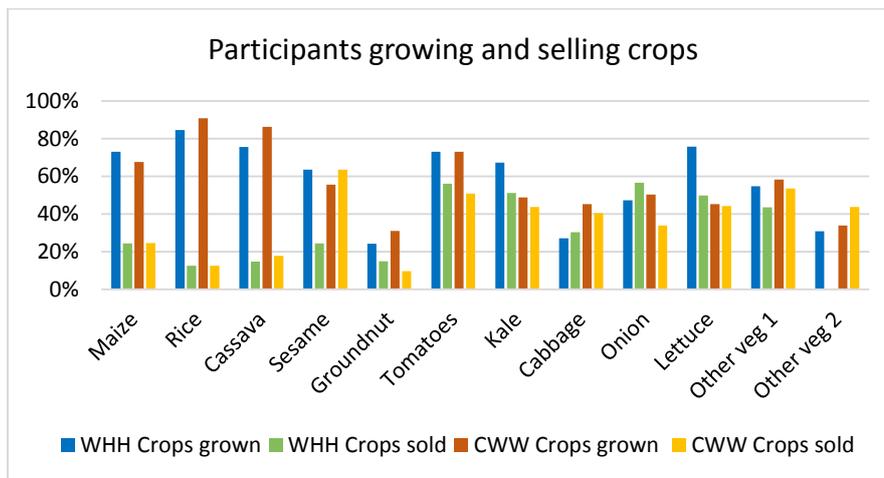
<sup>12</sup> Difference in common bean mean yield observed between the two treatments “With mulching\_Monocropping” and “No mulching\_Monocropping” (independent samples t-Test): 2016-17 campaign:  $t = -32.5975$ ;  $df = 109$ ;  $p < 0.001$ ; And between the two treatments “With mulching\_Associated” and “No mulching\_Associated”:  $t = -2.49237$ ;  $df = 91$ ;  $p = 0.007$ .

<sup>13</sup> Source: CWW & WHH monitoring data. Average yields from 56 different DLPs in WHH area with Soybean Serenade variety sowed in line 50x30cm with application of mulching and 56 other plots in same conditions with no application of mulching.

Both quantitative and qualitative data suggest that the conservation agriculture principles promoted by the project were effective in increasing yields of maize, common bean and soybean despite the unfavourable weather conditions encountered.

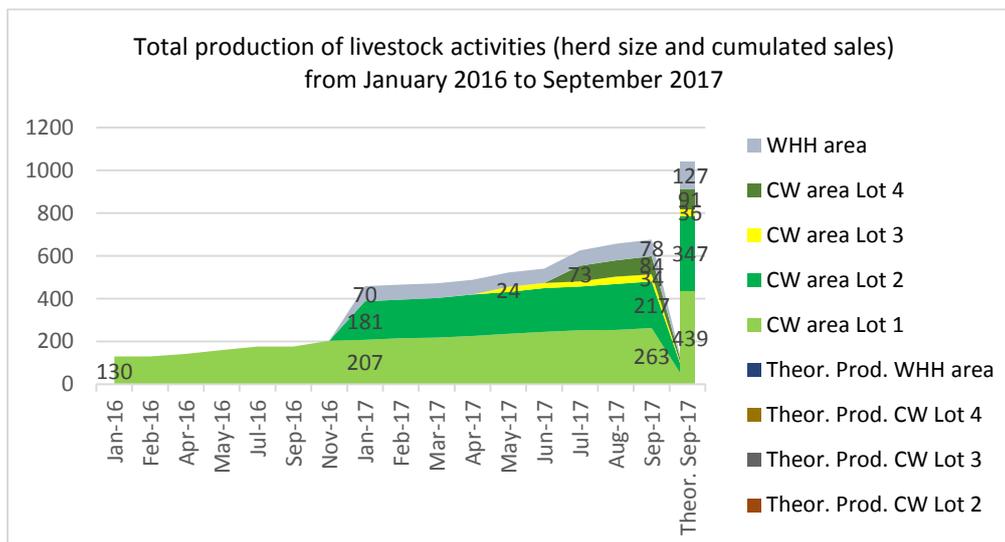
### Introduction of New Crops

While the project aimed to strengthen the production of key crops as is indicated above, the simultaneous introduction of new crops received mixed responses. However participants unanimously agreed that the introduction of a variety of vegetable crops was a much needed addition to their production cycle. One reason for this was the fact that new production techniques and access to improved irrigation systems allowed FFS members to produce in the cool, dry season (outside the main agricultural season), quickly generate income and access to nutrient rich food. As one participant stated, “even if there is a drought we can irrigate and grow vegetables”. Indeed as endline data shows about half the farmer’s earnings come from the vegetable production contributing notably to the 126% increase in average earnings across peri-urban and rural areas.



### Small Livestock: Herds Spared by the Drought

As mentioned earlier, a component of the project was the introduction of goat rearing as a complementary activity to cropping. Given that respectively 8% and 2% owned any goats at baseline in rural and peri-urban areas the livestock component was an innovation for most FFS members and was seen as one of the most relevant actions. Animals were transferred in various rounds from January 2016 to September 2017, to a total of 48 farmers’ groups across the five target districts. In rural areas a flock of twelve mature animals was donated to each group consisting of two males and ten females while in peri-urban area, donated flock was made of five animals consisting of one male and four females. While FFS members revealed that animals started to give birth late and a number of death of newborn were also recorded, especially in peri-urban areas, the participants indicated that the animals coped well during the drought periods and claimed that they would become a profitable activity for the groups once the animals start multiplying more steadily. Farmers were positive that access to pasture was not a major issue and did not report any conflict with land users.



## Lessons learned:

### *Farmer Field Schools and Demonstration and Learning Plots*

The two models proved to be **efficient and sustainable platforms** to trial and extend new, more resilient farming practices. Indeed, more than half of the groups cited the training in improved agricultural practices among the most relevant project interventions alongside the introduction of vegetable cultivation. All the groups recognized that the application of these techniques was leading to improved yields, saving seeds, facilitating control (e.g. in case of theft or germination failure) and making weeding and harvest easier. They also stated that mulching on vegetable crops reduced the need for irrigation, which saves labour as well as water in the long term. All the visited groups demonstrated high levels of cohesion and were exercising a number of collective activities (e.g. maintenance of vegetable crops, keeping cash box or saving and loan system, renting of land for main crops, sending goats to pasture) on a regular basis without further invitation or incentive from the project. This model should be replicated. Combining Agricultural and Nutrition related activities for each farmers group increase the coherency and efficiency of the program. In effect, farmers groups in WHH area seem to have higher awareness level in nutrition and ways to control risk of malnutrition, taking more advantage of the holistic approach of the program. In rural areas, where FFS and Care Groups (CG) often localized in different communities - were receiving separate packages until the integration was done during the last months of the project, farmers groups indicated poorer exchange of knowledge between FFS and CG members and both men and women demanding more nutrition awareness.

### *Introducing Brand New Crops*

The project was **very ambitious** to this regard given the implementation period **only covered two agricultural campaigns**, also in a context that is particularly vulnerable to climatic shocks. While new vegetable crops, including the orange fleshed sweet potato were seen to be very useful for most groups across all locations other crops did not take so easily. Sesame was introduced in rural areas as a cash crop with notable success whereby 64% of sesame producing farmers sold at least part of their crop earning on average 950.23 meticaïs. Whilst it was a relatively new crop but had been introduced in the same districts few years back through a previous intervention by Concern. As such, the **rural areas already benefited from local “seed banks” and a few buyers were already used to collecting produce** there. This created a favourable environment for FFS groups to produce and trade sesame in the longer term. Meanwhile in peri-urban areas both sesame and soybean were introduced as new crops. Participants expressed mixed feelings about soybean, whereby some participants were very enthusiastic about its nutritional benefits, while others were disappointed by the poor yield and absence of market for this very new crop. The **absence of other soybean producers, seeds suppliers and buyers are notable constraints for the target groups continuing the production of soybean in the future**, as their number and combined production capacity might not be sufficient to attract the attention of other value chain actors.

### *Experimenting with Improved Seeds*

The fact that the promoted **rice varieties** had been **successfully trialled** in the previous intervention was a **key factor** for the strong adherence of the participants (to both the varieties and the innovative planting methods). Participants praised the “Chupa” variety of rice for its taste and great yields, while “Nene” was appreciated for its shorter cycle. Farmers recognized that the introduced variety of sweet cassava was a convenient, shorter cycle and good yielding crop compared with the previously grown variety of (bitter) cassava. In parallel, the project engaged in other actions that were not considered useful by the farmers, such as the introduction of improved variety of maize (likely because it is not considered to be a major crop) and cowpea (very prone to pests). Similarly, efforts to introduce pigeon pea as a following crop to sesame (encouraging rotation and enhancing soil fertility) were unsuccessful, not because the idea was wrong, but because the proposed variety was of low quality and not suitable.

### *Livestock Rearing*

Adding this intervention at the second stage of the project, for FFS' that had proven their capacity to collectively manage assets, was a wise strategy given that these groups were generally able to maintain the number of animals with varying levels of growth. In theory a healthy female goat at reproductive age could give birth to an average of 1.75 kids per year<sup>14</sup> but when using this measure against the project context it is clear that this level was not achieved, as the table below indicates<sup>15</sup>. The low birth rates were explained by participants in WHH areas by the fact that “the animals were too small”, (not yet at reproductive age) when they were received by these groups, this could also be the reason for a high number of deaths of newborns. Although the overall lower than the normal birth rate could also be due to deficiencies in feeding. However, knowing that the vast majority of the animals'

<sup>14</sup> FAO. Small ruminant production and the small ruminant genetic resource in tropical Africa. 1991.

<sup>15</sup> CW and WHH data. Monitoring of goat herds among 48 farmers groups. Results presented in the table refers to end-September 2017 for CW area and to the end of October 2017 for WHH area.

recipients were caring animals for the first time, the performance of the livestock production seems satisfactory, particularly given the motivation the participants have to continue to work together to grow their herds.

	CWW Lot 1	CWW Lot 2	CWW Lot 3	CWW Lot 4	WHH Lot 1 Nicoadala	WHH Lot 1 Quelimane
No. of female	106	142	20	61	28	28
No. of male	24	39	4	12	7	7
Duration of husbandry (month)	20	8	4	2	9	9
Theoretical Total no. of animals	439	347	36	91	72	72
Actual no. of animals	263	217	34	84	30	52
Herd size average monthly growth rate (%)	5.1%	2.5%	10.4%	7.5%	-1.6%	5.4%
Theor. Herd size monthly growth rate	12%	11%	12%	12%	12%	12%
<b>Ventilation of recipient groups per level of performance</b>						
Very low (<4%)	4	9	0	1	6	1
Low [4-6%[	3	3	2	2	1	3
Average [6-8%[	2	2	0	0	0	1
High (>=8%)	2	1	0	3	0	2
No. of recipient groups	11	15	2	6	7	7

Overall, **small livestock rearing is a promising livelihood opportunity** in areas where frequent drought episodes put cropping at risk. It is worth noting that basic animal health kits were only transferred to participants late in their time caring for the animals in rural areas, while it seems groups in peri-urban areas were not equipped with basic animal health kits at all. This in turn engendered a dependency on the technician and indeed, participants admitted lacking skills to care for the animals independently. **The provision of mature animals, respect of quarantine and capacity building of groups prior to transfer are necessary to reduce risk of failure of the activity.**

### **Newcastle Disease**

The significant loss of chickens on a yearly basis due to the **Newcastle disease (ND) is a disaster** that deprives households from an alternative and complementary source of income and nutrients, especially in the event of crop failure. Further action is required to facilitate the effective conduction of the vaccination campaigns reaching everyone. Given remoteness of communities in target rural areas and the low density of extension workers on the territory, a fee-based system should ideally be facilitated to allow trained local vaccinators to provide the service in the long term. Ironically, the project had planned to transfer chickens to several FFS groups in WHH area but the action was cancelled after all the birds died in quarantine, very likely because of the Newcastle disease, while a prevention plan had been set-up beforehand in partnership with the DPA<sup>16</sup>. To compensate this loss, WHH supported 20 FFS for the introduction of duck rearing. **In the near future, Community Animal Health Workers who were trained in ND vaccination could be trained is providing basic animal health services and linked to communities raising goats for ensuring longer term protection of the herds.**

### **Bio-pesticides and Improved Storage Facilities**

Most groups reported having benefitted from training in preparing and applying bio-pesticide products although the level of adoption of the practice was not easily evaluated, rising only slightly from 2% to 11% between 2016 and 2017. However, farmers claimed to have access to the ingredients (natural products) required to the preparation of the bio-pesticide, which are only applied to vegetable production. Some participants in WHH area recognized that “natural pesticides are not as effective as pesticide from the shop (chemical) but they help”. The construction of improved storage facilities required very significant effort from the project and the participants given the logistical challenges. However, in the end the level of utilization was low. This may be partly explained by low harvests but this could also be down to a lack of mobilization or trust. The project would potentially have saved resources and made a greater impact in this area, had buy-in been sought from participants at the start by inviting communities to propose solutions for pest management.

<sup>16</sup> Provincial Agriculture Direction, that has a livestock and poultry directorate



## Conclusion

The results show that the DRR techniques were welcome and much needed interventions for the participating farmers who otherwise suffer from very limited access to information, support and quality materials such as seeds that are relevant for the context they live in. The project addressed all but one key concern for farmers, but it is also clear that the introduction of new practices and crops takes time additional interventions to enable participant-buy in for long-term uptake. It is important to note that changing a production system to make it more resilient is a process that exceeds the typical duration of a project. Moreover, as indicated previously, repeated unfavourable weather conditions in the course of the XCSEL project hindered the observation of tangible results on several crops. Thus, although a period of three years should have been reasonable in normal times, most target farmers experienced abnormal cropping conditions during a part of the whole of the project duration. A further action should seek to address land tenure issues (the newly established Farmers Associations may appear to be a levy for that in the near future), access to quality seeds, for example working with the most experienced groups or with few local more capable farmers for them to multiply basic seeds. This would entail working more closely with stakeholders who fall outside of the typical selection criteria.

## Annex 1: The likelihood of the different results lasting over time.

	Practice	Positive internal and external factors	Negative and limiting factors
<p style="text-align: center;"><b>High</b></p> 	Horticulture	<p>The most appreciated project's intervention for surveyed farmers.</p> <p>Profitable crop (high demand from local communities makes it easy to sell).</p> <p>Participants also appreciate consuming the production and awareness level on health benefit was high (especially in WHH area where nutrition awareness was conducted thoroughly in each FFS).</p> <p>All participants declared future ability to purchase seeds and knowing where / how to procure seeds. The light weight of the horticulture seeds make them relatively easy to transport to remote locations.</p> <p>All met groups were maintaining a cash box where a part of the money generated by sales from FFS plot was kept (allowing to purchase seeds in the future).</p>	<p>When asked, very few participants admitted having already managed to purchase horticulture seeds (because using seeds donated by the project).</p> <p>Profitability of horticulture is tightly linked to irrigation capacity. However several groups (WHH area) lack improved irrigation assets and others received pumps but not all seem able to ensure repair / maintenance when required.</p>
	Small livestock rearing	<p>The most desired asset transferred by the project. All recipients confirmed willing to expand the activity and groups seem to have made plans for that. All met groups had a roving system in place for taking the animals to pasture and no conflict with other land users was ever reported. Members confirmed local demand for goat meat. Appropriation level is high. Several groups used income generated by sales of horticulture products to purchased construction materials for building the corral.</p>	<p>Lack of capacity to address animal health issues within farmers groups (especially WHH area) and outside. Poor linking with agricultural extension workers also represents a threat in case disease or complications occur further to project end as most respondents (WHH area) indicated they would liaise with project staff if needed and did not know any alternative.</p>
	Cropping improved rice varieties	<p>Rice is the most important crop across project area. Although not tested on the DLPs, all surveyed farmers reckoned that introduced rice varieties yielded way more than local varieties.</p> <p>Farmers appreciated the benefit to crop two different varieties of rice with complementary properties. For example some participants explained that they need to keep both Nene (short cycle, but grain breaks easily, which can lower the price) and Chupa (longer cycle, but higher yield, "it helps to fight hunger in the months of October &amp; November").</p>	<p>In the medium and long term farmers will need to renew their seeds, and access to certified seeds will become crucial in order to allow farmers continue cropping these improved varieties.</p> <p>Given the low reliability of many usual suppliers to deliver quality, certified seeds experienced by the project, there is no guaranty that the target farmers (in extremely remote area) will succeed.</p>
	Cropping sesame	<p>With the shrinking of the coconut industry, sesame became the favourite alternative cash crop in high land areas. All groups in CWW area confirmed their interest in the crop, will and capacity to continue growing and trading it in the future.</p>	<p>Participants in WHH area are not likely to continue cropping sesame. Yields in DLPs appeared very low and not competitive given the pressure on land in peri-urban area. Most FFS members in WHH area were growing it for the first time and got support only for one season which was not enough to connect them with market.</p>



Conservation Agriculture	Farmers have observed the impact of mulching (as opposed to burning residues) on soil fertility and production and they well understood the effect on soil properties.	Little promotion of crop rotation was done and the practice was mentioned at really few occasions by met farmers. The fact that farmers seem to be forced to frequently change the location of their plot for land tenure issues made it almost impossible for the project to demonstrate the impact of crop rotation on soil, yields and pest management.
Improved sowing techniques	<p>All met participants appeared very enthusiastic about the various benefits of sowing in lines and apply adequate planting, especially with rice (the main cash and food crop) but also with other crops.</p> <p>Although all farmers admitted encountering difficulties in sowing rice in lines during the first year (installation of ropes being found laborious), most agreed that the method was becoming easier with practice and the majority declared applying the practice on a portion of their own plot from the second year and that the proportion of the plot sowed in line was increasing over time.</p>	In areas where men and women from the same household crop their own plot (besides the main household plot), some participants (male and female) indicated that women encounter more difficulties in sowing the rice in lines and are much less likely to apply the practice on their own.
Cropping orange flesh sweet potato (OFSP)	<p>A majority of the groups succeeded in maintaining planting material (vines) alive despite the drought and are multiplying it (“we were taught by Concern that in dry weather we should transfer the branch to low zone, and in the rainy season to transfer to the high zone so as not to lose the branch”).</p> <p>All recognized it has largely superior taste qualities and nutritional characteristics compared with local (white) varieties of sweet potato (especially in WHH area: “Before we did not know the importance of OFSP. Now we use it to prepare porridge and donuts for the children”).</p> <p>All are satisfied with its tolerance to disease and yield. OFSP generated high interest among participants.</p>	OFSP is a very new crop in project area and planting material is very scarce yet. The project faced great challenges to procure quality seedlings and transport the material to target population. As a result, several groups surveyed declared having received seedlings in poor condition and failed to keep the material alive.
Cropping pigeon pea	<p>As a drought resilient, low demanding and leguminous crop, pigeon pea was in theory a suitable crop to grow in high land areas in rotation with sesame.</p> <p>Few members who received good quality seeds from the project named pigeon pea among the crops they will keep growing in the future for they were satisfied with the yield.</p>	The project faced great challenges to source quality seeds: delivered variety was not short but long cycle and several batches provided very poor yield. As a result the great majority of met farmers (and all farmers in CWW area) were disappointed with the crop and declared no intention to continue growing it.
Cropping soybean	Some participants (especially female) demonstrated a high interest for the new crop and its nutritional benefits.	<p>Lack of access to certified seeds: All participants mentioned that the yield was dropping massively when using own seeds from the previous harvest.</p> <p>As soybean is a very new crop in the province there are no seeds suppliers and the overall number of soybean</p>



 <b>Low</b>			<p>producers is very small as limited to the project participants in WHH area. The lack of market was pointed out.</p> <p>Some participants also pointed that soybean is not drought tolerant and tests in DLPs resulted in very low, uncompetitive yields.</p>
	Cropping improved cowpea varieties	As a short cycle leguminous crop, cowpea was indicated to be a good potential crop for low area / second cropping season in succession of rice.	<p>The project faced great challenges to source quality seeds.</p> <p>Several participants mentioned that cowpea is very sensitive to pests.</p> <p>With consecutive crops failures the availability of seeds reduced a lot and farmers did not indicate capacity to continue growing introduced varieties in the future.</p>