FIELD WORK REPORT

Mapping farmer seed varieties in Manica, Mozambique: Report on initial investigations into agricultural biodiversity

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Contents

On 7 April 2015 the African Centre for Biosafety officially changed its name to the African Centre for Biodiversity (ACB). This name change was agreed to by consultation within the ACB, to reflect the expanded scope of our work over the past few years. All ACB publications prior to this date will remain under our old name of African Centre for Biosafety and should continue to be referenced as such. We remain committed to dismantling inequalities in the food and agriculture systems in Africa and to our belief in peoples' rights to healthy and culturally appropriate food, produced through ecologically sound and sustainable methods, and to define their own food and agriculture systems.

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Abbreviations

ACB	African Centre for Biodiversity
ARC	Agricultural Research Council
CIMMYT	International Center for the Improvement of Maize and Wheat
CMM	Conselho de Ministros de Moçambique/Council of Ministers
DPA	Direcção Provincial de Agricultura/Provincial Directorate of Agriculture
DTMA	Drought Tolerant Maize for Africa
FGD	Focus group discussion
FMSS	Farmer-managed seed systems
IARC	International agricultural research centre
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IIAM	Instituto de Investigação Agrária de Moçambique/Mozambique Agricultural Research Institute
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research institute
IPR	Intellectual property rights
K2	Kapa Dos/Klein Karoo Seed Marketing.
MPA	Movimento de Pequenos Agricultores/Movement of Small Farmers, Brazil
MSV	Maize Streak Virus
NNFU	Namibian National Farmers Union
OPV	Open-pollinated variety
PVP	Plant variety protection
SACAU	Southern African Confederation of Agricultural Unions
SDAE	Serviços Distritais das Actividades Económicas/District Services of Economic Activities
SDC	Swiss Agency for Development and Cooperation
SIMLESA	Sustainable Intensification of Maize-Legume Systems for Food Security in Eastern and Southern Africa
UCAMA	União Provincial de Camponeses de Manica/Provincial Farmers' Union of Manica
UDAC	District farmer association
UNAC	União Nacional de Camponeses/National Farmers' Union
ZIMSOFF	Zimbabwe Smallholder Organic Farmers' Forum

Introduction/ background

This report is a continuation of work the African Centre for Biodiversity (ACB) started in Mozambique in 2014. ACB partnered with the national farmers' union União Nacional de Camponeses (UNAC) and its provincial unions União Provincial de Camponeses de Manica (UCAMA) and União Provincial de Camponeses de Sofala (UPC Sofala); Kaleidoscopio, an independent research organisation; and Acção Académica para o Desenvolvimento das Comunidades Rurais[1] (ADECRU).

The farmer seed system is a concept under development. We currently use it to refer to systems of seed development, production and distribution that are not part of the commercial, formal seed system. When considering farmer seed systems we may look at a range of aspects, including: plant breeding and the role of farmers in this; sources of public sector germplasm and farmer access; seed selection, enhancement and production in the field; seed storage, seed banks, in situ conservation; indigenous knowledge, farmer and indigenous varieties and resuscitation and building of seed diversity; social networks and protocols around seed exchange and management; intersections with formal seed systems and possible benefits and threats to farmer seed systems; and the role of extension services and farmer organisations in supporting and strengthening farmer seed practices.

This phase of the research is intended primarily as a scoping exercise to deepen our understanding of the current context of seed use, main crops and varieties in the research localities, as well as initial identification of relationships and local support institutions with regard to farmer seed systems. The objective is to gather evidence of the ongoing importance of farmer seed systems in the agricultural practices and livelihoods of smallholder farmers, to identify cases of biodiversity loss and to use this information to build the case for the importance of protecting and supporting farmer-managed seed systems (FMSS) on the continent.

Objectives:

1. Start mapping a picture of farmer seed systems and varieties in collaboration with UNAC, UCAMA and participating farmers in Manica province.
2. Gather information and reflect on past local projects or programmes aimed at promoting farmer seed systems, such as the community seed banks, why they emerged, what impact they had and farmer reflections.
3. Identify other local farmers, organisations, institutions and networks that are supporting or involved with aspects of farmer seed systems.
4. Identify priority areas for possible further work in conjunction with participating farmers, UNAC and UCAMA.

Key findings

- National agricultural and seed policies in Mozambique, as in the rest of the region, promote Green Revolution technologies, such as hybrid and improved, certified seed and synthetic fertiliser use as the only path to achieving increased productivity. Yet, paradoxically, these policies refer to sustainability, diversity, food and nutrition security, water and soil conservation and farmer participation as policy goals.
- Green Revolution approaches tend to conflict with these long-term policy goals, especially when farmer activities in the maintenance and diversity of seed varieties – which play an essential role in local food and nutrition security and agricultural biodiversity – are marginalised and even criminalised by Green Revolution seed and plant variety protection laws and policies.
- Increasing productivity is taken as the guiding principle at provincial and local level.
- There is some research on improved seed in Manica province and in the three districts where our research was conducted

1. Academic Action for the Development of Rural Communities

(Sussundenga, Manica and Gondola), mainly by the Instituto de Investigação Agrária de Moçambique (IIAM), especially through the Sustainable Intensification of Maize-Legume Systems for Food Security in Eastern and Southern Africa (SIMLESA) programme being coordinated by the International Center for the Improvement of Maize and Wheat (CIMMYT), and through other activities, with technical support being provided by various other institutes of the Consultative Group for International Agricultural Research (CGIAR). But very little, if any, research is being done on farmer varieties or seed practices.

- At district level, the extension services are stretched and unable to reach all farmers. District agriculture, economic development and extension services recognise the important role played by farmers, and the significance of farmer varieties.
- At provincial and local levels government departments and public sector institutions are open to participating in partnerships with farmers and civil society organisations to look in greater detail at farmer seed systems with a view to identifying areas of support and further work.
- Officials have indicated the possibility of making demonstration plots available for such work in partnership with farmers, farmer associations and other civil society organisations.
- UNAC and UCAMA have a number of programmes between them to support farmer seed systems, including technical support for variety enhancement and farmer-to-farmer exchanges.
- 67 varieties of the seven most popular crops (maize, millet and beans, followed by sesame, peanuts, sorghum and tubers) were grown in the research sites, and farmers also recorded 36 different vegetable/fruit crops.
- Maize had the most varieties (20), followed by beans with 16 varieties, and tubers with 13 varieties.
- Maize was the only crop in which certified varieties outnumbered local varieties; however, local maize varieties were most popular in all sites.
- Key maize traits for farmers are short cycle, grain/cob size, consumption/use qualities, and drought tolerance.
- For millet, only one out of nine varieties was certified seed, but there is a definite decline in millet use and varieties available. This is of concern from an agricultural biodiversity and local nutrition diversity point of view.
- Almost all beans were farmer varieties, with only one certified variety in use. Consumption traits and yield were the main priorities for farmers.
- Farmers are keen to work on in situ improvements of their own varieties, especially maize. Aside from demonstration plots used for government programmes, farmers also have their own demonstration plots and/or land available to do this work.
- There are farmers in each site who are maintaining a number of varieties, including focal points for UCAMA conservation agriculture work in these areas. These farmers are willing to operate as anchors for experimentation on farmer seed varieties.
- IIAM, Department of Agriculture and extension services have all offered advice on how to take forward further investigation on farmer seed systems and varieties, and are willing to consider partnerships with civil society organisations and farmers.

Why farmer-managed seed systems?

Farmer-managed seed systems (FMSS) are important for a range of reasons. First and foremost, farmer seed varieties are the basis of genetic diversity on the continent. The Green Revolution approach has been deployed on the continent for over 60 years but has only really entrenched itself in maize seed and some smaller cash crops, such as cotton and tobacco. Smallholder farmers continue to nurture and maintain the vast majority of crops and varieties, without which hunger and suffering would be much deeper than they already are. Under the stewardship of farmers, these varieties are constantly evolving; adapting to dynamic socio-ecological conditions.

Green Revolution seed improvements tend to focus on increasing yields, but this often comes at the cost of other desirable traits. Maintaining a diversity of farmer varieties ensures that these other traits – such as pest or disease resistance, drought tolerance, taste and aroma, storability and many more – are not lost (Jarvis et al., 2016). Farmer varieties have been selected and adapted to harsh production conditions, especially limited water availability. In the context of climate change, these varieties form a crucial genetic base for future variety development. Farmer varieties are more often preferred over improved certified varieties for household consumption and in local markets. This also signifies possible economic benefits for meeting localised demand for specific traits.

A wide diversity of crops and varieties ensures a diversity of nutrients in the diet, especially micro-nutrients, which are found in varying types and amounts in different crops and varieties. Loss of seed diversity means loss of nutrient diversity. Farmer direct control over seed supplies strengthens seed security by ensuring seed is available locally when required, and eliminating the need to pay for seed.

As indicated in earlier ACB publications (ACB, 2014; ACB, 2015), Mozambique's agricultural and seed policies are aligned with the agricultural modernisation, commercialisation and Green Revolution agenda as framed by the Comprehensive African Agricultural Development Programme (CAADP). As part of the G8 New Alliance on Food Security and Nutrition (NAFSN), Mozambique has committed to restructuring its seed system to enable the production and distribution of certified improved seeds, with a particular emphasis on hybrid seed, in efforts to increase agricultural yields.

The official interpretation is that agricultural sustainability and food and nutrition security are best met by Green Revolution approaches, which will allow farmers to earn income and thus to be more food secure. The logic is that farmers will buy inputs (which may be subsidised for a few seasons at the beginning to kick-start the process), which will enable them to generate higher yields that can be sold for a profit, which, in turn, will produce sufficient income, both to purchase their food needs until the next season and to buy inputs for further production. In reality, it does not work this way, and only a small group can benefit from such policies, for a number of reasons:

- There is a chronic problem with access to Green Revolution technologies;
- The commercial markets to absorb the surpluses are intermittent or non-existent;
- Many farmers will struggle to meet the volume, quality and standardisation requirements to sell into large-scale commercial markets;
- Product prices are very low, especially at harvest time, so farmers seldom make much of a profit on the sale of surplus products;
- Farming households will hold back a portion of the crop for their own consumption, but this ends up being inferior quality (from a human consumption point of view), with resultant decline in nutrition standards.

Government and the public sector encourage the expansion of certified seed – whether hybrid or improved open-pollinated variety (OPV) – as part of its modernisation agenda, and all government programmes use certified seed. Interviews confirmed this orientation.[2] Demonstration plots tend to use improved varieties but could be tailored to accommodate farmer varieties. In some areas it is not the

Green Revolution soybean intervention, Manica

most appropriate, though farmers are open to experimentation. However, government input and farmer support programmes could conceivably be adapted for research and development work on farmer varieties. Agro-ecology is an alternative way of realising the positive aspects of government policy, such as the recognition of the urgent need for climate change adaptation, sustainable agriculture, water conservation and maintenance and improvement of soil health and fertility. Moves in this direction are growing, but are also confronting a well-resourced and entrenched corporate agenda (see ACB, 2015 for such developments in the Beira Corridor).

Seed laws and regulations were put in place in the early 1990s. The main law was the Seed Act (Decree 41/1994), which regulated the approval and registration of new varieties and defined the rules for seed production, inspection and commercialisation. The Act did not mention the informal or farmer-managed seed systems, despite their overwhelming importance in Mozambique. Farmer-saved seed currently constitutes an estimated 70% of total seed used, with 20% coming from informal exchange and no more than 10% of seed obtained through the commercial sector (public and private) (Marapusse et al., 2014). Regulations in 2001 (Republic of Mozambique, 2001) created an exclusive seed market for certified, improved, commercial varieties of seed; excluded farmers' varieties from the market; and made it impossible for these varieties to be officially recognised and registered. The regulations also criminalise farmer sales of seed that have not gone through the formal certification process.

For most of the time that a commercial seed sector has existed, the public sector has been responsible for plant breeding, in collaboration with the international agricultural research centres (IARCs). Otherwise, private companies imported seed varieties bred outside Mozambique. Germplasm inside Mozambique is mostly held by the state, in collaboration with the IARCs. More recently, efforts are being oriented towards opening up breeding to the private sector. Since 2000, seed companies have also become involved in breeding, mainly in maize. The new Plant Variety Protection (PVP) law lays out regulations on the protection of new plant varieties, which is seen as a key private sector requirement for investment.

2. Interview, Gondola Department of Agriculture technician, 23/5/2016, Gondola

The law is based on the protection of private ownership through intellectual property protection for breeders.

The current PVP law prohibits farmers from multiplying seeds to be shared with other farmers or selling seeds from a protected variety without the consent of the rights holder. The provisions dealing with the exclusive rights granted to plant breeders and the exceptions to those rights render illegal the centuries-old African farmers' practices of freely using, exchanging and selling seeds or propagating material. The PVP law even forbids farmers from freely exchanging or selling farm-saved seed and propagating material in circumstances where breeders' interests are not adversely affected, for example, in small amounts or for local trade (ACB, 2014).

These seed and PVP laws have significant negative implications for any official efforts to work with farmers to maintain and develop their varieties. First, all government resources are committed to the path of commercialisation, certification and protection of intellectual property. Second, even if government recognises the importance of farmer varieties for biodiversity, food security and nutrition, the laws constrain the available space to develop programmes to support seed that does not abide strictly by these laws. Efforts to protect industry interests for a narrow range of crops and varieties have the effect of threatening the entire food supply in the country.

The research carried out here indicates the ongoing relevance and importance of farmer varieties. But, in the current policy and legal frameworks, it will be difficult to channel sustainable support to these varieties and the farmer-managed systems that ensure their reproduction. Key tasks for advocacy are, therefore, to ensure, first, that spaces are created in the policy and legal framework to protect farmers' rights to save and exchange seed, and, second, that more flexible and appropriate quality control mechanisms are developed – together with farmers and their organisations – that can serve the needs of farmers to support the maintenance and development of the majority of the seed they use from one season to another.

Support for farmer seed maintenance and production

Provincial government

A provincial government representative in Manica[3] indicated that seed is a big challenge in the province. He acknowledged that seed is the most important part of the value chain because this is where production comes from. Farmers tend to focus on maize in the province, and there is need to improve local varieties. However, no work has been done in Manica to date on FMSS. The provincial government is mostly aware of certified OPVs from IIAM, such as Matuba. The provincial government representative indicated that Manica's climate can also accommodate hybrids. Most hybrids in use in the area are still imported and are privately produced. In the past, companies have recruited community members to produce fully certified seed for them. There is work being done on releasing adapted varieties; however there is nothing on FMSS so far. For example, Ximanica (a local variety) was widely used, but without any improvement, and, as a result, it had low productivity compared with other local varieties. No research has been done on this variety to date.

IIAM, the national agricultural research institute, has regional offices in Chimoio and a laboratory in Sussundenga. An IIAM technician[4] said he was aware of seed research done in IIAM in 2011 and 2012, and a report was done on maize, specifically. There are also other sectors in IIAM that may have other activities,

3. Interview, Manica Provincial Department of Agriculture and Food Security, 27/5/2016, Chimoio
4. Discussion, IIAM technician, 27/5/16, Chimoio

such as vegetables. The technician noted that it was possible to repatriate germplasm to its areas of origin, in cooperation with farmers. He indicated that Matuba and Susuma (a maize variety we did not encounter in our discussions with farmers) were varieties that disappeared and then were reworked and reintroduced. ZM309 is another improved variety[5] similar to Matuba. It would be possible to bring the original seed back, clean it and distribute it to farmers. IIAM has one hectare for improved Matuba seed in Manica for use by companies. The IIAM technician said farmer associations could be involved in certified seed production of improved varieties. This research and development model could be adapted to participatory farmer seed production outside the formal certification system, especially for local and indigenous varieties.

IIAM has released four improved varieties of beans and four of peanuts, but they need partners to produce and disseminate these. They have a package and can train someone at UCAMA or in farmer associations to support production in plots; they can also do demonstration plots. IIAM noted that the idea was not to eliminate local varieties but to help to improve them. The IIAM technician we spoke to observed that in the demonstration plots they always reserve some space for local varieties. This is currently up to one fifth of the area, but it could be adjusted, depending on the varieties in the experiment. He said that, as long as farmers choose which varieties they want to try, IIAM is willing to work with them: "Anything working with farmers, we are willing to work on".

At this stage, IIAM is working with OPVs and not hybrids. According to the technician we interviewed, the policy is to increase productivity and local varieties have lower productivity. Seed improvements aim to take into account traits of local varieties. He explained that some varieties may no longer be fit for improvement because of climate change and drier conditions. IIAM will be releasing two new maize varieties in the near future.

A project in evidence in the research sites is the Sustainable Intensification of Maize-Legume Systems for Food Security in Eastern and Southern Africa (SIMLESA) project, being implemented in Ethiopia, Kenya, Malawi, Mozambique and Tanzania. The International Maize and Wheat Improvement Center (CIMMYT) leads SIMLESA in partnership with other organisations,[6] with Australian funding. The project started in 2010 and is currently in its second phase. The aim of the project is to increase productivity amongst smallholder farmers and decrease production risk. Activities include agronomic support for improved crop production practices (with a focus on conservation agriculture), introduction of stress tolerant maize and legume varieties, business services, access to markets and some credit provision (CIMMYT, 2015).

In Mozambique SIMLESA is working in Manica, Sofala and Tete provinces and has an active partnership, including with IIAM, UNAC, *Direcção Provincial de Agricultura* (DPA) extension services, various non-governmental organisations, private seed producers, agro-dealers and others (CIMMYT, 2015:9). A number of interview respondents indicated that IIAM, with SIMLESA, did a study on some cereal and vegetable varieties in 2011, although they said they didn't have access to the report at this stage. The IIAM study is ongoing at Matica in Sussundenga (regional centre).[7]

IIAM-SIMLESA is doing tests on adapting and developing improved seeds, although the provincial directorship does not have a report on the results yet.[8] Improved OPV maize,

5. ZM-labelled seed comes from crossing local varieties with germplasm from the International Center for the Improvement of Maize and Wheat (CIMMYT).
6. University of Queensland in Australia, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), the Agricultural Research Council (ARC) of South Africa, the International Livestock Research institute (ILRI) and the International Center for Tropical Agriculture (CIAT)
7. Interview, SDAE Sussundenga, 25/5/16, Sussendenga
8. Interview, Manica Provincial Department of Agriculture, 27/5/16, Chimoio

Seed storage, Sussundenga

beans, cowpeas/nyemba, soya, groundnuts, pigeon peas/ndodzi, and peanuts have been distributed to date. There was some evidence of SIMLESA and CIMMYT activities in our research sites, for example, improved cowpea varieties in Gondola.

Some benefits are apparent (notably yield) but farmers do not want these varieties to replace their own varieties, and would rather use them as a supplement; generally external varieties require too many other inputs, are geared towards markets for industrial processing and are thus not good for farmers' own use and for local markets. For example, issues of soft versus hard grains and associated storage issues came up frequently. Generally, farmers' varieties are not taken into account in development work, except as a genetic base that is taken from farmers for development elsewhere and then reintroduced at a price or through subsidy programmes.

District government/public sector

At the time of writing there were 13 extension workers for Sussundenga district, and they intended to add another five. The district has around 26,000 households and 9,000 individual farmers but the information is old, so it could be more. There are two extension divisions in the district.

A government representative from Gondola noted that there are no FMSS activities in the district at this stage, but they would be keen to work on it. In over six years this was the first time an initiative like this had been proposed.[9] He said most farmers are focusing on a single crop (maize) but if they diversified there would be greater benefit. The majority of farmers use local varieties so the district would like to work on enhancement activities for these varieties.

Another local government representative in Manica noted that the majority of farmers in the district do not have the resources to buy improved seed.[10] The district is divided into three localities. The extension services have information on who produces seeds in each locality. SDAE can also provide technical support through the extension services. One officer noted that there is no database for improvement of local varieties. IIAM may have

9. Interview, Gondola Department of Agriculture technician, 23/5/2016, Gondola
10. Interview, SDAE Manica, 24/5/2016, Manica

done some work, but he was unaware of it. He said there is a need to improve local varieties because this will also improve productivity, so this kind of research is also important for the SDAE. Local officers had no awareness of any institution that has done work on local varieties and were pleased the research team had chosen Manica to work in. They expressed a keenness to see a report from the research.

An extension supervisor in Manica[11] district said Ximanica is the main maize seed used. The extension services are training farmers, introducing new technologies, including improved seed. Although there are extension workers in all localities, there are only 14 extension workers for an estimated 25,000 farmers, and they end up assisting around only 7,000 farmers. Extension services tend to push improved seed where they have reach, but in other areas, such as Messica, farmers still use local maize varieties, and in Mavonde 60 per cent of farmers use local maize.

More broadly, some work on biodiversity has been done in Manica. The SDAE has worked with non-governmental organisations, for example, SIMLESA in Maridza in 2010 on soil conservation, the Southern African Confederation of Agricultural Unions (SACAU) in 2012 and Promac in the whole district in 2012. One of the officers noted that these projects promote use of synthetic fertilisers to build biomass in the first season, but the aim to phase this out and move to organic methods over the period of the project. There are demonstration plots but farmers are still using organic techniques and not synthetic fertilisers in their own fields. Promac uses organic materials; no synthetics. Most farmers cannot afford to buy synthetic fertiliser, so the idea is an initial boost to fertility and then to phase out.

Given the emphasis on improved seed and certification through the formal system, no work has been done to date on farmer seed systems or varieties. Work of this nature could start off with mapping the varieties and the structure and mechanisms of the farmer-managed system to support the maintenance and reproduction of these varieties. There was recognition from officials that such information is lacking. Beyond this, work could identify priority varieties and traits for development and improvement in a participatory manner, using methods appropriate for the context, and with an emphasis on agricultural biodiversity. All districts indicated they are prepared to work further on farmer seed, together with the research team.

UNAC

UNAC is part of Mozambique's National Seed Platform. The mission in this forum is to defend the interests of farmers and bringing alternatives in research and seed distribution processes. UNAC attempts to use this space to present alternatives and make the case for farmers to produce their own seeds, and to promote the view that this should be considered a normal process. However, private companies that promote hybrid and certified seed are also part of the forum. Besides the National Seed Platform, UNAC is also a member of the National Seed Committee and Subcommittee on Registration and Seed Liberalisation. Peasants may use these spaces to influence policy. UNAC's work on rescuing local seed is linked to lobbying and advocacy because UNAC believes that concrete evidence and practice is necessary to inform policy. UNAC is committed to safeguarding certain principles that are beneficial to farmers.

UNAC has held regional meetings (South, Central and North) on local seed, disseminated legal tools and shared information with peasants on current government trends on seed. UNAC is also working with academic institutions to bring evidence in support of farmer seed systems.

Since UNAC's establishment, local seeds have always been a big challenge for farmers. Initially work was done to raise farmers' awareness to improve seed quality through training on *in situ* selection and seed conservation, as well as to provide farmers

11. Interview, SDAE Manica, 24/5/2016, Manica

with support for the construction of granaries. With market liberalisation and entry of large agricultural projects, the situation has become increasingly worrisome as multinational companies selling seeds and chemicals began to gain ground. As a result, in 2003 UNAC held a large national reflection event attended by peasant leaders throughout the country, as well as representatives of civil society organizations (CSOs). Thanks to the synergies with other peasant movements and CSOs, through contacts with Movimento dos Sem Terra[12] (MST), new horizons opened up.

UNAC met Brazilian farmer movements with extensive experience in the areas of rescue, multiplication, conservation and distribution of creole (local) seeds and seedlings. From then, contacts were initiated with Movimento de Pequenos Agricultores[13] (Movement of Small Farmers, MPA), followed by farmer exchanges between Mozambique and Brazil. Following these initial exchanges, it was agreed that further theoretical and practical work was required in Mozambique. A volunteer from MPA worked with the UNAC-aligned District Farmer's Union of Marracuene to support capacity building amongst farmers and to establish local seed rescue fields. Members worked with local maize, groundnut, cassava and cowpea varieties. After almost four years of work, there have been concrete results in Marracuene. UNAC believes these activities can be replicated elsewhere in Mozambique.

In parallel, UNAC has benefited from a programme involving four countries, which included movement members from: UNAC – Mozambique; Trust for Community Outreach and Education (TCOE) – South Africa; the Namibian National Farmers Union (NNFU); the Peasant Popular Movement (MCP) – Brazil; and the Rural Women's Movement (MMC) – Brazil. The programme was based on farmer and movement exchanges, with theoretical training guided by Brazilian activists in Mozambique and South Africa. Namibia did not move forward with the process because the NNFU withdrew from the project. UNAC was able to replicate the knowledge acquired in small programmes in Maputo, Zambezia, Nampula and Cabo Delgado.

UCAMA

UCAMA is working with SACAU on a conservation agriculture project called Facilitating Farmer-led Scaling-up of Conservation Agriculture in Southern Africa, sponsored by the Norwegian Agency for Development Cooperation (NORAD).The project aims to support the expansion of conservation agriculture methodologies, including minimum tillage, intercropping, crop rotation and maintaining soil cover to retain water by mulching or the use of cover crops; but it also incorporates the promotion of certified seed, synthetic fertiliser and herbicides (SACAU, 2016). The project operates in six sites in Zimbabwe, in partnership with the Zimbabwe Farmers' Union (ZFU), plus Manica, Barue and Sussundenga in Manica province in Mozambique. The project has included farmer-to-farmer exchanges across sites in the two countries. UCAMA selected our research sites to coincide with this project.

UCAMA has also participated in a farmer exchange to Zimbabwe to share experiences on drought tolerant local varieties. UCAMA in Gondola and Manica worked with the Zimbabwe Smallholder Organic Farmers' Forum (ZIMSOFF) to share genetic materials and knowledge on local varieties of maize, millet, groundnuts and cowpeas (LVC, 2016). Cost and familiarity are factors supporting farmer use of these varieties.[14] Exchanges and horizontal learning between farmers in eastern Zimbabwe and Manica province in Mozambique formed the basis to develop a pilot collaborative programme on smallholder farmer-managed seed systems (LVC, 2016). This is a very good point of intersection between our current research and existing activities by farmers and their associations.

Individual farmers in Manica and Gondola are producing certified seed or are waiting

12. Landless Movement of Brazil
13. Movement of Small Farmers
14. Discussion, Domingos Marteme, Vice President of Gondola UDAC, 23/5/2016, Gondola

Focus group, Sussundenga

for certification. Domingos Marteme, Vice President of Gondola district farmer association (UDAC)[15] has done training on certified seed production. He produces local (uncertified) maize, millet, vegetables, peanuts and beans, mainly through an on-farm selection process. He normally separates the seed in the field and hasn't done *in situ* crossing himself yet, although he would be interested in experimenting. He is keen to work on improvements, especially on maize varieties. Marteme identified conservation (storability) as one of the main challenges they are facing. He is interested in bringing organic farming into the association. He said there is lots of land available, so space is not an issue. UDAC members have their own plots, and he is the only one producing certified seed at the moment (maize and two varieties of beans (sweet beans/manteiga).

Marteme sells hybrid or improved seed he has produced, but for his own consumption he opts for local seed, because it is better for conservation (storability) and taste. However, while local seed varieties are good when rain is normal, they may not be so good if there is limited rain. He gets Matuba OPV maize seed from IIAM and K2 (Kapa Dos/Klein Karoo) and produces on behalf of IIAM, which pays him for production, and then he sells the seed. Generally there is no technical support for seed production, although K2 provides support when it is their seed. The public extension service comes intermittently.

Both UNAC and UCAMA find themselves in a situation where they are working in the Green Revolution space – for example, working on improved, certified seed production and dissemination with partners who are engaged in a variety of other Green Revolution programmes (such as CIMMYT and SACAU) – as well as doing work to support the development of farmer seed systems. This illustrates the tensions African farmer associations face in their efforts to balance resource mobilisation, meet the pressing needs of farmers and find ways to develop alternative pathways of development, based on food sovereignty and agro-ecology. These tensions are likely to persist for some time.

15. Discussion, Domingos Marteme, Vice President of Gondola UDAC, 23/5/2016, Gondola

Methodology

The approach to the research was to try out seed mapping methodologies developed by Bioversity International, using matrix ranking as a starting point (Jarvis, 2000; Sthapit et al., 2006). In this method, farmers list all their crops and varieties, rank them according to extent of use in the area (Rank 1), and then list positive traits (Rank 2). The positive traits were weighted according to number of times mentioned in focus group discussions (FGDs) in relation to different varieties (with some grouping into broader categories). Appendix 1 provides further detail on the methodology and Appendix 2 provides full lists of the crop and variety rankings.

We did the matrix ranking with farmers in FGDs – two in Manica district (which we labelled Manica site 1 and Manica site 2 to distinguish them), and one each in Gondola and Sussundenga districts. Three UNAC-aligned district farmer associations (UDACs) participated, with 83 farmers representing 15 local associations. There were 39 women participants (47%) and 39% of participants were 35 years old or younger. (We did not get record the ages of participants in the first Manica group, but captured this information from the second group onwards.) UCAMA selected the sites based on an existing conservation agriculture programme they are participating in (discussed below). In one group (Manica site 1) only women spoke, although the traditional leader and other men were present. The other groups were mixed but women did participate actively. More work needs to be done on who grows which crops, to make sure women are involved in the process, with their specific priorities shaping the agenda. An orientation towards crops mostly grown by women can contribute to active participation of women farmers. The number of young participants is encouraging, and we will aim to further increase youth participation as active members in the project and research team.

The research team also met with provincial and district levels of the Ministério da Agricultura e Seguranca Alimentar[16] (MASA), Serviços Distritais das Actividades Económicas[17] (SDAE) and district extension services, and had discussions with individual farmers. Executive members of the UDACs accompanied the research team on interviews and FGDs.

Background to sites

Figure 1: Map of Manica province and its districts

Source: http://www.mozecotours.com/manica-province-districtProfiles.html

Manica, Gondola and Sussundenga are the three central districts of Manica Province, on the main route from Zimbabwe to Beira port in Mozambique (the spine of the Beira Corridor) (Figure 1). Manica and Sussundenga border on Manicaland province in Zimbabwe. Chimoio,

16. Ministry of Agriculture and Food Security
17. District Services of Economic Activities

the provincial capital, is located in Gondola district. These sites are in Agro-ecological Region 4, with medium altitude (200–1,000m above sea level), mostly sub-humid with a narrow band of humid highlands on the border with Zimbabwe. Main crops grown in this zone are maize, sorghum and millet (Maria and Yost, 2006:903), and some cassava and cowpeas.[18]

Agricultural production was severely disrupted during the internal war until 1992, and farming households and communities were forcibly displaced. At the end of the war, financing was contingent on structural adjustment and agricultural liberalisation. More recently, the Beira Agricultural Growth Corridor (BAGC) initiative was launched, based on a Green Revolution modernisation model (ACB, 2015). Manica has a concentration of conservation agriculture activities (Grabowski *et al*., 2013).

Initial scan of crops and varieties

The key crops and varieties are discussed in the next section. The ranks are composites across the sites, but there are local variations, as is to be expected with biodiversity. These pockets of local variety can form an important base for farmer exchanges of materials and knowledge. There are also many broad similarities across the four sites.

Overview of process and results

Maize, millet and beans were common across all or most sites (Table 1) followed by sesame, peanuts, sorghum and tubers (mainly cassava), grown in two sites each. In Manica site 1 we looked at varieties of all crops, without selecting the top four.

Maize and beans had a high number of varieties. Beyond those two, there are many crops (36 vegetables and fruits), but, from what we could pick up so far, especially from detailed variety information in Manica site 1, it appears that very few varieties per crop are used in any locality. However, growing a large number of crops is also significant for biodiversity.

For now, for fruit and vegetables, we have a list of the total number of crops (see Appendix 3) which includes "Western" fruits and vegetables (for example, onions, tomatoes, lettuce), and traditional/indigenous crops. There were between one and five varieties (five varieties of bananas) for all fruit and vegetable crops in Manica site 1. We did not gather information on vegetables for Sussundenga, as we were in the

Table 1: Main crops by site

	Varieties recorded	Ranking: Manica 1	Ranking: Gondola	Ranking: Sussundenga	Ranking: Manica 2	Points*
Maize/magwere	20	1	1	1	1	40
Millet[19]/mafunde/mapira/ rekweza/njera	7	2	2	2	2	36
Beans/chibamba	18	3	3	-	4	23
Sesame/utwiro	3	4	-	3	-	15
Peanuts	4	4	-	-	3	15
Sorghum/mhunga	4	4	-	4	-	14
Cassava/mandioca/sweet potato/yam	13	4	4	-	-	14
Vegetables and fruits**	36	15	27	no data	26	

*1=10 points, 2=9 pts, 3=8 pts, 4=7 pts (see Appendix 1); ** This reflects the number of crops, not varieties.

18. http://slideplayer.com/slide/3527249/
19. https://sn.wikipedia.org/wiki/Njera

Tubers and gourds for sale at informal market, Sussundenga

process of adjusting the methodology. In the other three sites, farmers planted 17 types of vegetable crops and 19 types of fruit crops, with three medicinal crops recorded (Appendix 3). Farmers in Manica site 1 said they all have small plots where they plant vegetables for their own consumption. These plots are bigger where there is some basic irrigation. Where rainfall is not high, farmers diversify their crops and varieties to ensure food supply.

The next sections of this report go into more detail on individual crops, with a lot of emphasis on maize, since this is clearly the most important single crop for farmers. Having said that, it is important to understand that multi-cropping is essential for diversity. We should also recognise that farmers are corralled into focusing on one or two main crops as part of agricultural modernisation processes, and more work needs to be done to resuscitate the importance of diversity of other crops. So, even if maize is a priority for farmers – both as a cheap, relatively robust source of energy, and as an income source – the wider diversity of crops must also receive attention.

Maize

Maize was the major crop across all sites. Twenty varieties were in use across the four sites (8 local, 13 certified[20]), with 7–13 varieties in use per site (Appendix 2, Table 1). There is greater maize variety in Manica site 1 and Sussundenga, and less variety in Manica site 2 and Gondola. The most important traits ranked by farmers are: short cycle/maturation, productivity, consumption/use, drought resistance, and storage and pest resistance. These traits are discussed in further detail later, but we start with an introduction to the main varieties in use.

Sourcing of seed followed a familiar pattern, with local/farmer varieties being recycled and exchanged between farmers, while certified seed (both OPV and hybrid) is mostly purchased from shops, with some recycling for a season or two. Onerous and punitive plant variety protection (PVP) laws and regulations that criminalise recycling and saving of protected seed varieties at farm and local level indicate too much regulation and are inappropriate for

20. Participating farmers considered Kanjere/Kanjerejere (local) and Matuba (certified) to be more or less the same variety so they are merged and counted as both local and certified.

these conditions. Such laws and regulations will do nothing for farmers except reduce seed availability and increase seed insecurity.

Varieties

Based on the ranking as described in the methodology and presented in Appendix 2 (Table 2), the top maize variety in use is Kanjere/Kanjerejere (local)/Matuba (certified OPV).[21] Kanjere/Matuba is followed by Ximanica local variety, which is also considered very similar to Kanjere in Manica site. These are followed by PAN53 and PAN67 hybrids (Pannar/Pioneer Hi-Bred) and then Kenha, a local yellow variety.

In Manica site 2, Kanjere is considered a fairly recent seed, compared with Ximanica. The cob is heavy but the grains are small and it has a long cycle. In Manica site 1, Kanjere is also considered to have small grains. In both Manica sites, farmers said Matuba has a big cob but small grains. In Gondola, Kanjere is being replaced by Matuba, although farmers do not always have money to buy Matuba. According to farmers in Gondola, the main problem with Kanjere is its long cycle. They say Matuba has a short cycle and doesn't have to grow tall before it produces. In Gondola, the only problem farmers have with Matuba is that it can only be recycled for two seasons before fresh seed must be purchased.

Ximanica is ranked highly in both Manica sites, with lesser use in Sussundenga, and the variety is not in use in Gondola. In Sussundenga, Ximanica seed is considered good, without any problems. However, in Manica site 2 farmers said Ximanica is losing its characteristics over time, due to crossing. There is an external market for the product because the grain is heavy and produces good yields. But it doesn't perform well in dry conditions.

These varieties are followed by two Pannar hybrid varieties, PAN53 and PAN67. PAN53 is a medium maturity hybrid resistant to Grey Leaf Spot and Northern Corn Leaf Blight and tolerant to Maize Streak Virus (MSV), with heat and drought stress tolerance. It is used across all sites (it ranked third in Gondola and Manica site 2 and fourth in Manica site 1 and Sussundenga) and farmers ranked it in five of the six trait categories (see the section below on traits), which signifies good adaptation to the socio-ecological context, even if it is a hybrid. Farmers ranked it particularly highly on short cycle and drought resistance, and also (though slightly lower) on yield, consumption/use and grain/cob.

In Gondola, PAN53 grains are bigger than Matuba. The main problems with the variety are that the cob opens at the top in the field, making it susceptible to pest (insect, bird) and moisture damage; the seed suffers from weight loss in storage; there are weevil problems in storage, necessitating pesticide use; farmers have to buy the seed and it is expensive; and it needs fertiliser to perform well. While some argue that the variety tolerates drought stress, women participants in Sussundenga said it needs a lot of water. The PAN67 hybrid is very similar to PAN53, but its cob is smaller (Manica site 2). It also suffers from weevil damage and cob opening at the top in the field.

Kenha, the fifth-ranked maize variety, is a local yellow variety used across all sites. It was ranked unexpectedly highly, because in the FGDs farmers tended to point to its negative features, specifically the need to plant it separately or at a different time to avoid cross pollination. When Kenha is mixed with other varieties, no-one buys it at the market because of the yellow colour. This was an issue in Sussundenga, Gondola and Manica site 2. Farmers indicated it is hard to find pure seed because of crossing. At the same time, farmers said they had no problem with consuming Kenha at home, and indicated a number of positive traits that brought its rank to the

21. Kanjere/Matuba: Kanjere translates from Shona as wisdom. Matuba is an improved OPV version of Kanjere/Kanjerejere, produced by IIAM. The varieties are discussed as one here: in Manica site 1 Kanjere and Matuba are used interchangeably; in Gondola they are recognisably distinct varieties (Kanjerejere, with Matuba produced by K2) but are still considered to be very similar; while in Manica site 2 the farmers considered Kanjere to be very similar to Ximanica, the next highest ranked maize seed. There is, thus, some overlap of definition between these three varieties, signifying local adaptation and intermixing of these varieties, with varieties losing their specific traits.

Local maize varieties, Manica

fifth most popular variety: it has a hard grain, preventing weevil damage, and there are no other major issues. Certified versions of Kenha in use in Gondola are PAN110 for animal feed, and PAN5 and PAN12 for human consumption.

After the top five maize varieties, there are four local varieties that are ranked highly but only in one site each. The main locally important farmer varieties are Raposta and Xinyamwana, with similar traits (ranked first and second, respectively, in Sussundenga); and Mukadzi u Saenda and Xitonga, with similar traits (ranked second and third, respectively, in Manica site 1). Another local variety used in the province but not in our sites is Xitewe/Ndau (used in Dondo).

Raposta is the most popular variety in Sussundenga, the only site in which it is in use. The variety is ranked highly for pest resistance and consumption/use, and good for recycling. But it also has weaknesses: long maturation (four months compared with three months for other varieties); it is a very tall plant and falls over when the wind blows; and grain size could be increased. According to an official at Sussundenga SDAE, Raposta is a crossed variety. Farmers say Xinyamwana is the same as Raposta. The size is similar to Matuba but the grains are bigger. "Red maize" was mentioned in Manica site 1 as good treatment for bilharzia, but is not in much use anymore.

Along with Ximanica, all these local varieties must be nurtured. While they are valued highly in small, geographically contained pockets, they are not widespread. If a local variety works in one area it could possibly work in another, so wider distribution of these varieties represents opportunities for farmer exchange, shared learning and experimentation.

Another 10 lesser used varieties of certified maize were also recorded in the sites (Appendix 2, Table 2). The main ones are PRIS601 and ZM523. PRIS601 is a hybrid that originated from Pristine Seed Co, a Zimbabwean company which no longer appears to exist. It was released in 2013 by CIMMYT's Drought Tolerant Maize for Africa (DTMA) initiative.[22] There is some connection between PRIS601 and experiments with K2 in Gondola. The Instituto Superior Politécnico de Manica[23] (ISPM) introduced the seed, with demonstration plots and seed from Zimbabwe. Farmers in Gondola say they are still studying the features of the seed.

ZM523, an OPV released in 2011, is also the product of DTMA. All ZM seeds are CIMMYT varieties (Setimela *et al*., 2013). ZM523 is currently commercially produced by Capstone Seed in South Africa for export.[24] Both PRIS601 and ZM523 are bred for MSV resistance, and ZM523 is also valued for early maturing and for

22. DTMA Mozambique contact, David Mariote, mariotedavid@hotmail.com (former partner of Peter Waziweyi of Nzara Yapera)
23. Manica Polytech
24. http://www.capstoneseeds.com/capstone-catalogue/maize-seed/white-open-pollinated-maize/zm523

dry climates. To date, DTMA has released five maize hybrids and four OPVs in Mozambique.[25] Farmers in Manica site 1 and Gondola say the cobs of ZM523 (and ZM521) and PRIS601 open at the end in the field, resulting in damage because they are attacked by weevil and other insects.

Maize traits

The maize trait ranking is based on 96 responses on maize for 20 varieties in the three districts (detailed breakdowns in Appendix 2, Table 2). A weighting was given, based on the importance of the trait to participating farmers in FGDs and using the methodology as discussed above. Certain traits appeared as significant in this ranking system, with the five key traits for maize in order of importance being: short cycle/short maturation; "productivity" (which includes cob/grain size and high yield); consumption/use; drought resistance; and storage and pest resistance.

Short cycle/maturation definitely came out as the top trait in the FGDs. The most popular varieties indicate that farmers are interested in varieties with a shorter cycle. This may be linked to the need for drought resistance (see below) since shorter cycles can accommodate shorter rain periods, one symptom of climate change in the region. Kanjere/Matuba came out top in terms of short cycle/maturation, rated as an important trait for this variety across all sites. This trait also ranked highly for three certified varieties, PAN53 and PAN67 hybrids and ZM523 OPV, in two sites each.

Short cycle/maturation was also ranked highly for eight other local and certified varieties (but only in one site each). Local varieties ranked for this trait are Makadzi u Saenda (used in Manica site 1) and Kenha. The former is widely used, but only in one area, suggesting possible sharing of materials and experimentation for short cycle improvements. Kenha is used in all sites, and although it is falling out of favour for market reasons, as indicated above, farmers quite like it for their own consumption.

The next trait category, "***productivity***", covers specific qualities of the cob related to size and weight, as well as market-specific yield considerations. Cob quality was the more important of these two, with farmers mentioning big, heavy or hard grains; many lines on the cob; big cobs; and two cobs clustered together. Kanjere/Matuba was the top variety for this trait and was ranked highly across all the sites. Ximanica was next, followed by ZM523 (certified OPV), Xitonga and Mukadzi u Saenda (both local); all ranked highly for this trait in two sites each. These were followed by Raposta and Kenha (local) and PAN53, PRIS601 and ZM521 (certified); each ranked highly in one site.

High yield is a smaller category within productivity. It may be related to cob quality but the farmer emphasis here was on markets for surpluses. This leans towards production of standardised outputs for trade in external markets (for example, certified maize varieties, especially private sector varieties). Farmers indicated that new varieties were introduced to them with the promise to buy surpluses, but this did not materialise and they were left with surpluses of varieties they did not necessarily want to consume at home. Sometimes introduced varieties or crops are not historically consumed locally and therefore require an external market to flourish. Displacement of local varieties is evident in these sites, although it can be quite a slow process, especially when access to introduced varieties is limited. Ximanica, a local variety, was ranked for yields in three sites (it is not used by participating farmers in Gondola): it was ranked highly in two sites and as a lesser trait in the third. PAN513 ranked highly on yields in two sites, but only when used with fertiliser. PAN67, Kanjere/Matuba, PAN53 and ZM601 ranked highly for yields in one site each.

The next largest category of traits is farmers' ***own consumption/use***. There is a gender aspect to this, with women tending to emphasise consumption and use issues, although there was not an absolute division in responses. Issues raised here included maize that cooks

25. http://dtma.cimmyt.org/index.php/varieties/dt-maize-varieties

quickly, is soft and tasty for eating, has good aroma, and grain that doesn't fragment when pounded. Kanjere/Matuba was again top ranked on this trait in all sites. The next four in line were all local varieties: Kenha, Ximanica (in three sites each), Xinyamwana and Raposta (in two sites each), and then PAN53 (in one site). This further indicates a preference for local varieties for consumption. These consumption traits are often the ones that get lost when varieties are adapted for higher yields.

Drought resistance, which could be linked to short cycle varieties mentioned above, was the next highest trait farmers ranked. Top varieties for this trait are Kanjere/Matuba, followed by PAN67 and PAN53. Of other local varieties, Ximanica was also ranked on drought resistance in one site.

Storage and pest resistance in the field and store was the next most important trait category, considering seed that is good for storing, displays pest resistance in storage and the field, and/or maintains a closed top in the field. There is a link here to grain hardness and dimensions of consumption/use (for example, poundability). Ximanica was the top ranked variety on pest and disease resistance, followed by Kanjere/Matuba, and PAN53 was mentioned in two sites (although in other sites farmers had a negative assessment of PAN53 on this trait). Other local varieties ranked on this trait in one site each were Raposta, Kenha and Xinyamwana, with Raposta and Xinyamwana only in use in one site at present.

Other positive traits that were mentioned once or twice (only three out of 96 responses) were no chemicals required in field, and seed good for recycling.

Farmer activities and areas for maize improvement

To date farmers have not done systematic or deliberate work on *in situ* breeding. They do sometimes mix the seed of the most important varieties if they run out. According to participating farmers, *in situ* conservation is very important because seed is starting to disappear (Sussundenga). In Sussundenga, three of the participating farmers (two men, one woman) had more than five maize varieties in storage at the time of the field work. These farmers are focal points for UCAMA's demonstration plots in the conservation agriculture project. In Manica site 2, seven participants were using at least four different maize varieties. Farmers in this site also expressed interest in improving local varieties (participating farmers started clapping when we were discussing this). They say they would prefer only to produce Ximanica and leave the hybrids because these are destroyed in the field by weevils, even when there are good rains. Farmers also indicated limited technical assistance with introduced varieties, for example, 1kg of Tsangano is distributed to demonstration plots, but there is no further assistance for farmers to bring these varieties into their fields. In Manica site 1, all participating farmers are planting many varieties, and they have two demonstration plots in the association.

In summary, farmer priorities for maize improvement and selection are:

- Kanjere – to reduce the cycle from 4–5 months to 2–3 months, and to reduce height (Manica site 2, Gondola)
- Ximanica – to produce more grains on the cob and develop drought tolerance (Manica site 2)
- Raposta – to increase grain size and reduce plant height (Sussundenga)
- Xinyamwana – to reduce plant height and develop a shorter cycle (Sussundenga)

Millet

Millet/njera/mexoeira/mafunde/mapira/rekweza was the second most widespread crop after maize, used in all sites. Only seven varieties were recorded across all the sites (Appendix 2, Table 3), with no two sites indicating the same specific varieties, except generic red and white. Red is more popular in Manica and white is more popular in Sussundenga. More information is needed on the top varieties in Gondola, where colour was not specified. All millet varieties in use are local varieties with seed recycled and shared, except the little-used Macia hybrid in Gondola which is purchased at the shop. Consumption/use was the main consideration for farmers. Other traits mentioned, but not widely, included yield, short cycle and hard grain. Farmers did not spend a lot of time on millet.

Beans/feijão/chibama/nyemba

This group was translated as beans. There are 16 bean varieties across the sites – 15 local and one certified (Appendix 2, Table 4). Two cowpea varieties are included in the table and discussed below. Manica site 1 has the widest diversity of bean varieties, with 12 varieties. In Sussundenga beans were not ranked in the top four so we did not gather detailed data on bean varieties there. There are four varieties grown in two sites: Katarina/Sweet (may be different varieties but both referred to as "sweet"), Mazanda a Timba (name to be confirmed), Khaki and Fumisai. These are all local varieties, as are the next two in the rank, Manteiga (white) and Ndozi. Key positive traits farmers identified for beans are consumption/use, productivity (yield/sales) and short cycle.

Two cowpea hybrids – IT18 and IT16 – were also being used in Gondola. These are improved varieties using International Institute of Tropical Agriculture (IITA) material. IT18 is produced by Seed Co (amongst others) and can be used for fodder (early planting) or grain (normal planting with rain).[26] The seed is used as part of SIMLESA maize-legume integration (see Dias and Nyagumbo, 2014). These hybrids are included in the bean variety list in Appendix 2, Table 4, for comparison purposes.

Irrigated plots, Gondola2

Other crops

We did not gather detailed information for other crop varieties, except in Manica site 1. Sesame/gergelime/utwiro; sorghum/mhunga; and cassava/mandioca/sweet potato/yam/madumbe are grown in all sites. Rice was mentioned in the two Manica sites, and sunflower and soya are grown in Manica site 2, but not as main crops. See Appendix 3 for a list of fruit and vegetable and indigenous crop varieties. Thirty-six different crops were identified (with no data for Sussundenga, as we were adjusting the methodology). Garlic, onion and pumpkin were grown in the three other sites, and a number of other crops were grown in two of the sites. Gondola farmers (1 de Maio Association) have a functioning irrigation scheme, where they grow vegetables and fruit for their own consumption and markets. A range of fruit is quite widely grown in all three sites, including avocado, mango, litchi, papaya and strawberries, and a number of other fruit is grown in the remaining two sites.

26. http://seeds.seedco.co/cowpeas

Conclusion

Overall, the fieldwork has found that farmers are producing a large variety of crops and that for some main crops there are a fairly significant number of varieties in current use. As expected, given the historical focus of Green Revolution activities, maize is the only crop where certified varieties outnumber farmer varieties. However, it is very clear that farmers favour their own varieties for their own consumption, and certified varieties tend to be used for production for sale. The most popular maize varieties are OPVs, even if some of these are certified. Farmers indicate their main requirements of maize varieties are shorter maturation cycles, followed by quality of grain/cob (mainly based on own use criteria), and then drought resistance. Farmers are very interested in experimenting with local varieties for *in situ* enhancement and have indicated availability of plots to do such work. There are pockets of local diversity and farmer exchanges could facilitate sharing of genetic materials and knowledge on these varieties.

The research indicates that, beyond maize, diversity within crops drops off rapidly. This is a concern for agricultural biodiversity and local nutrition. The fact that farmers emphasise maize does signify the centrality of the crop to existing farming systems in this area of Mozambique, but it also shows the long-term effects of the Green Revolution's single-minded attention to maize yields. Farmers did indicate concern about the loss of diversity of crops and varieties being produced, and they recalled previous varieties that they no longer used or which were disappearing. Activity around farmer seed systems does not just involve farmers saying what crops they are using and the enhancements they want to make to those crops, but also involves reviving memories of previous varieties and their benefits, and reattaching value to those ignored crops and varieties.

Participants expressed interest in cooperating on seed activities with farmer varieties. Government departments and public sector services are channelled into supporting Green Revolution technologies. But in discussion they readily acknowledge the ongoing importance of diversity and the role of farmers in maintaining genetic diversity. As long as activities are geared towards supporting productivity and diversity, and involve farmers as active participants, there is a willingness to work on different options. This is a positive strand that has emerged from this initial research.

Current seed and PVP laws and policies pose an obstacle to efforts to promote and develop farmer seed, despite the centrality of these seeds to food security in Mozambique. Revisions to these laws and policies are needed to create space for systematic work on farmer varieties without requiring their incorporation into the narrowly defined formal system. Such revisions could include: securing farmers' rights to save and exchange seed in their possession; developing flexible quality controls that give farmers (as producers and users of seed) greater power in shaping standards to suit their conditions; exemptions on PVP regulations for smallholder farmers; and a policy emphasis, backed up by funded programmes, on supporting farmer activities in maintaining and developing diverse crops and varieties with local demand.

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Appendix 1: Details on method

A points system emerged from the ranking process as follows. The quantification of points is based on an arbitrary weighting but the principle is that higher ranked varieties and traits get more points than those ranked lower. First farmers listed all the varieties of a particular crop, and then they ranked those varieties according to how widespread their use was in the locality. Points were allocated for rank in each site (1=10 points to 10=1 point), and then the points were added across all sites to get a total rank for a variety. This system favours varieties grown in multiple sites and which participating farmers ranked highly (Rank 1). The same points system was applied to the key positive traits for each variety listed by farmers in the FGDs (Rank 2). For maize there were 96 discrete responses with information on one variety and one trait. Each of these was given a score based on when it had been mentioned in the discussion in relation to other varieties, with first mention considered most important. This method may not be perfect but it does offer some indication, because farmers often quickly voiced why they thought a variety was important, but towards the end of a list of traits, they had to scratch their heads to think of other positive traits. Rank 1 results were adjusted to accommodate Rank 2 results and, in addition, minor subjective alterations were made, based on observations of the interactions in the FGDs. There was no prompting of farmers to name crops, varieties or traits, so all of the information came from the farmers.

Appendix 2: Detailed variety tables of selected crops

M1 – Manica site 1; M2 – Manica site 2; G – Gondola; S – Sussundenga

Table 2: Maize varieties in use, rank and key positive traits

Variety	Local or certified	Rank				Key positive traits in order of importance (rank of variety based on methodology above)					
		M1	M2	G	S	Short cycle/ maturation	Grain/ cob	Consumption/ use	Drought resistance	Storage and pest resistance	High yield
Kanjere/Matuba OPV*	L/C	7	2/5	1/2	8	1	1	1	1	2	4
Ximanica	L	1	1		7		2	3	7	1	1
PAN53 hybrid	C	4	3	3	4	2	8	6	3		5
PAN67 hybrid	C	6	4	4	10	2			2		3
Kenha (yellow)	L	12	8	5	3	5	8	2			
Raposta	L				1		6	5			
Mukadzi u Saenda	L	2				5	4				
Xitonga	L	3				5	4				
Xinyamwana	L				2			4			
PRIS601 hybrid	C	5		7			6				6
ZM523 OPV	C	9			5	2	3				
PAN513	C			6	12	11					2
Mbizi hybrid	C		6			5			6		
ZM601	C				6	10			4		
Tsangano	C		7		11	12			4		
ZM521 OPV	C	8				5	8				

Variety	Local or certified	Rank				Key positive traits in order of importance (rank of variety based on methodology above)					
		M1	M2	G	S	Short cycle/ maturation	Grain/ cob	Consumption/ use	Drought resistance	Storage and pest resistance	High yield
PG61	C	10									
PG63	C	11									
Red maize	L	13									

*Two rankings given in Manica site 2 and Gondola because farmers ranked the two varieties separately

Table 3: Millet/mapira/mafunde/njera/rekweza varieties in use, rank and key positive traits

Variety	Local or certified	Rank				Key positive traits in order of importance (rank of variety based on methodology above)			
		M1	M2	G	S	Consumption/use	Yield/sales	Short cycle	Hard grain
Red	L	1	1			1			
Gokomba white	L				1	2			
Xikombe white	L				2		2	1	
White	L	2	2			3			
Mundwoje	L			1		4			1
Gwembwere	L			2		4		1	
Muhangwe white	L				3		1		
Macia hybrid	C			3					
Zende reddish	L				4				

Table 4: Bean/chibamba/nyemba/feijão varieties in use, rank and key positive traits

Variety	Local or certified	Rank				Key positive traits in order of importance (rank of variety based on methodology above)			
		M1	M2	G	S*	Consumption/use	Yield/sales	Short cycle	Drought resistant
Katarina/Sweet	L	1		1		2	3	5	
Mazanda a Timba	L	3	1			2	2	7	
Khaki	L	5	3			1		1	
Fumisai	L	2	2			10	1		
Manteiga (white)	L			2		12	4		
Ndozi	L	3				4			
IT18 hybrid (cowpea)	C			3			6	1	
IT16 hybrid (cowpea)	C			4			6	1	
Karingonda	L		4			6			
Dambarara	L			5					
Manteiga (black)	L			6				1	
Uhuru OPV	L	6				10	5	5	
Uhuru hybrid	C	7							1
Makhaphe	L	8				6			
Makungudzi	L	9							
Masengere/green bean	L	10				6	6		
Nyimo	L	11				6			
Ndaro	L	12				4			

*Beans were not one of the top four crops in Sussundenga, so no information on bean varieties is provided for this site.

Appendix 3: List of other crops in use

Table 6: List of other crops in use

	M1	M2	G
Vegetables*			
Garlic/alio	1	1	1
Onion	1	1	1
Pumpkin/ab'obora/matikiti/matanga	1	1 (leaves)	1
Cabbage	1	1	
Tomatoes	1	1	
Chilli/piri piri/mosabora	1		1
Carrots	1	1	
Lettuce	1	1	
Cucumber/makaka		1	1
Beetroot/mabiri nzara**		1	1
Tsunga		1	1
Kiyabo/dwerere (legume)		1	1
Mazanje		1	1
Mandui			1
Ngaka			1
Peppers	1		
Pea		1	
Fruit			
Avocado	1	1	1
Mango	1	1	1
Litchi	1	1	1
Papaya	1	1	1
Strawberries/morango	1	1	1
Banana	1	1	
Guava		1	1
Naartjie		1	1
Grapefruit/toranga		1	1
Pineapple		1	1
Sugar cane/musare		1	1
Peach			1
Orange			1
Lemon			1
Lime			1
Watermelon/makebe			1
Mafrungu			1
Ate		1	
Marakweja		1	

	M1	M2	G
Medicinal			
Moringa			1
Ushakata			1
Bashamba			1
Oilseed			
Sunflower		1	
Soya		1	

*Data not gathered at Sussundenga; **Mabiri nzara translates from Shona as 'famine ceremony'

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