Local seed varieties are essential for sustainable food systems … but face challenges

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Smallholder farmers in Mozambique want access to a diversity of quality seed, but not exclusively from the formal sector. Farmers highly value their own varieties and want to work on enhancing these, too. These strong messages came out of a dialogue held between smallholder farmers, government officials and research institutions in Chimoio, Manica Province in central Mozambique in March 2017.

The National Farmers' Union of Mozambique (UNAC), its provincial affiliate in Manica (UCAMA) and the African Centre for Biodiversity (ACB) co-hosted the dialogue to share research findings on mapping farmer seed varieties in Sussundenga, Manica and Gondola districts in Manica. Smallholder farmers – women and men – from UNAC-affiliated district farmer associations in Manica, Sofala, Zambezia and Nampula in Mozambique and from the Zimbabwe Smallholder Organic Farmer Forum (Zimsoff) participated. They raised a number of very interesting issues and challenges in relation to maintenance and enhancement of farmer seed varieties, in dialogue with provincial and district government representatives from Manica, and with representatives from research institutions and regulators.

The issues the farmers raised, alongside researchers, breeders and officials, provide a challenge for those of us working in the seed movement. Farmers highly value their local varieties, but these are under pressure from many sides.

Farmers, researchers and officials all raised climate change as a key concern; farmers bear the brunt of drought, generally drier conditions, and greater climatic and seasonal uncertainty. While some farmers said their local varieties, especially grains, are more drought tolerant than certified improved varieties produced through formal channels, others said their local varieties failed them in the drought-stricken season of 2016-17.

Farmers are concerned about availability of seed. They also recognise that their own varieties are not perfect and may need improvements or enhancements. At the dialogue, farmers called for improvements to their own seeds, as well as being able to participate in the work of improving varieties to suit their specific requirements.

Researchers, breeders and officials raised a number of economic and technical challenges that must be considered when deciding what improvements to make to the seed, i.e., which varieties to select and what characteristics to breed for. Governments in Africa have fairly limited resources at their disposal. Ideally they will seek to derive maximum social and public benefit in the deployment of these resources (although this may not be entirely true in practice). The Director of Agriculture in Manica Province argued that improving local seeds in a particular place does not solve the problem that many farmers do not have any access to seed. So, how do you balance wide coverage with context-specific needs? How does government justify the expenditure of public resources that reach only a few beneficiaries, rather than a much wider number of farmers, even if not perfectly?

With this in mind, the Mozambican government and other governments in the region have opted to promote commercial agriculture as the solution. This is part of an African Union continental plan enshrined in the Comprehensive African Agricultural Development Plan (CAADP) – government and public sector resources must generate increased income from agriculture in order to justify investments. However, promoting commercial production and use of certified seed is a very difficult decision for governments to take, because it also means they decide not to support agriculture in more marginal areas or by resource-poor producers (who are the overwhelming majority on the continent). It also means they choose to neglect the conservation and strengthening of a diverse genetic base, which is essential for the future of food production globally.

There are also technical challenges to take into account when making decisions about improving or enhancing varieties. Some farmer practices make sense in their specific conditions but may also militate against more formalised breeding work.

For example, farmers will often mix many varieties in their fields, which results in the generation of seed adapted to those specific conditions of production, through a guided form of 'natural' selection. A structured version of this is known as evolutionary plant breeding [hyperlink http://www.iao.florence.it/ojs/index.php/JAEID/article/view/28] which smallholder farmers successfully practise in Iran, Syria and countries in North Africa. The farmers select which varieties they want to mix, but it is left to evolution to winnow out those that are not effective in local conditions, and to popularise those that are. This allows for plasticity and the ability of diverse seed to adapt to dynamic conditions from season to season.

However, breeders at the dialogue explained that mixing of varieties in the field can also lead to loss of specific characteristics and it may become impossible to identify specific varieties. For conventional breeding this is a problem. In order to use a variety as the basis for deliberate improvements, the characteristics of that variety first need to be stable. For example, if you want to breed for short cycle, you need to start with a variety that is known to have this as a stable characteristic. Otherwise, you cannot be certain this characteristic will reappear in the following season and your deliberate efforts to breed this characteristic into a new variety may fail. In this way, farmer practices can become an obstacle to the success of more formal breeding techniques. On the other hand, it would be a mistake to denigrate these farmer practices, because they are tried and tested methods of producing in diverse and dynamic agro-ecological conditions.

Another technical challenge to farmer work on plant breeding relates to land size. If plots are too small, it is not possible to separate out the varieties you are trying to breed. They will be affected by cross pollination or other forms of mixing that need to be controlled when developing a new variety. Because breeding is a scientific process of experimentation by altering one characteristic at a time and controlling for others, resource-poor farmers, with access only to smaller plots of land may be excluded from breeding processes on their own land, even though they may be the ones most in need of seed improvements.

There are plenty of trade-offs in selection and experimentation and plant breeders and researchers at the dialogue provided a number of examples: a shorter maize plant that does not fall over may have smaller cobs; increasing the

yield of rice varieties may reduce aromatic qualities; a maize variety bred for softer grains to make milling easier may be more susceptible to pests in storage; a greater edible yield may reduce the non-edible biomass yield that may be used for stock feed, fuel and soil fertility. In the same way, there are trade-offs at a more macro-scale. For example, the introduction of uniform, higher-yielding varieties can reduce diversity, with long-term implications for nutrition and food security.

Farmers are not the only ones to highlight the importance of local varieties. Breeders from the Mozambique Institute of Agricultural Research (IIAM) made the point that there is no plant breeding if there is no local seed; local varieties are the genetic base for formal breeding and must be conserved and protected. But, in practice, there is limited support for the conservation and maintenance of agricultural biodiversity. This is a contradictory response because, while on the one hand, a diverse base is essential for future plant breeding activities, on the other hand, the crops and varieties that constitute this base are denigrated as inferior and not worth saving. The biggest trade-off of all is that farmers have an immediate need for increased productivity and access to markets to sell their surplus, to earn incomes from their economic activity. But when this short-term imperative involves adoption of fewer crops and varieties, it comes into conflict with the longer-term imperative of maintaining and widening the genetic base.

Farmers are seeking choice and diversity in available seed and the smallholder farmers in these discussions were quite clear that they do see value in the introduction of certified varieties from outside that are well adapted to their specific contexts. They mentioned some specific popular varieties available commercially, which they save because they can adapt them with the local context over time.

While plant breeders are a useful technical resource with knowledge that can be shared with farmers, this does not mean we should not raise relevant issues about how conventional plant breeding is conducted. The issue is not about whether or not to make commercial seeds available; it is about not limiting breeding to a few varieties and traits, with an over-emphasis on uniformity and yield at the expense of multiple other quality concerns from farmers and consumers alike.

Although improved seed coming from conventional breeding programmes must pass tests to make sure it is productive in a range of agro-ecological conditions, these tests are mostly performed at research stations. At the dialogue, farmers, researchers and breeders alike recognised that at the research stations, certified varieties undergoing testing are fed copious amounts of fertiliser, irrigated, sprayed with pesticides and otherwise maintained in conditions where they can reach their peak performance. But these conditions are nothing like those resource-poor smallholder farmers face in marginal ecological conditions, with poor or uneven soils, limited water and lack of access to the inputs that are part of the certified seed ‘package’. This is especially the case for hybrids.

Also very important is the current context of intellectual property rights and plant variety protection (PVP) laws. African countries are currently adopting stringent PVP laws that are inappropriate for a context where most seed is of local varieties. Who will own the improved certified varieties that are generated from the genetic diversity that smallholder farmers maintain? In a situation where a farmer has done all the genetic work, and a private breeder decides to make

improvements to a farmer variety, this ‘new’ variety can be privatised with exclusive ownership rights for 25 years or more. This results in loss of collective ownership over seed to private companies. There was much discussion on this point, with some farmers suggesting a model based on access and benefit-sharing. In this system, farmers’ contributions would be somehow quantified and they would receive a portion of royalty benefits from the use or sale of varieties, based on farmer genetic materials.

So, there are some widely recognised limits to conventional plant breeding and the certified seed that eventually emerges from these processes. This raises questions about how to integrate farmers into decision-making processes in breeding and in practical work, even for certified seed. In some countries, farmer involvement in variety selection (although at a relatively late stage in the process) is a statutory requirement. There is a decades-long history of participatory plant breeding globally, including in Africa, where farmers are involved from the earliest stages of defining the objectives of a breeding programme, are active participants in the selection and testing of genetic material, and also actively participate in the multiplication and distribution of new varieties developed in the process.

Smallholder farmers at the dialogue called for advocacy to protect and promote farmer seed varieties. At the same time, there was ready acknowledgement that farmer seed and maintenance systems are not perfect, and farmers called for partnerships between themselves, researchers and breeders to strengthen these systems. Maintaining a strong and diverse base of genetic materials for agriculture is beneficial to everyone. This need not be posed as an alternative to formal breeding programmes, but as an essential synchronous activity.