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SEED SPECIAL WINTER 2017

Farmers gain access to and control over seeds

Open source seed systems
*looking for solutions to the
intellectual property controversy*

Seed alone is not a silver bullet
aid and trade fair in Kenya

Farmers producing and selling seed
in Uganda

Blending public and private
in Indonesia's vegetable sector

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Seeds of change

Tomatoes in six different sizes, orange, yellow and red, mini cucumbers and purple Brussels sprouts; our great grandparents wouldn't believe their eyes if they could see the vast range of fruit and vegetables on offer in our supermarkets today. Every year new fruit and vegetables are introduced to our markets and that is not just the result of world trade. New varieties are the hard work of plant breeders. Farmers, plant scientists and specialized breeding companies select, cross and combine varieties with preferred traits to breed new varieties. These form the basis of our diets, and of food security worldwide. Biotechnology has spurred the development of new varieties.

At first glance diversity seems to be constantly on the increase. But, as we will see in this special edition of Vice Versa, not everybody agrees with this. A number of farmers' groups and civil society organizations worry that the expensive technology will remain in the hands of a few companies and that national and international policy limits the use and spread of farmers' seeds and knowledge: developments that affect diversity negatively. Others, however, believe that modern technology is key for developing resilient varieties rapidly enough to cope with the fast changing climate and population growth. Yet others argue that we need more and better connection between the so-called informal and formal sectors. Ways to do this would include linking farmers' knowledge with modern technology, and local farmers' seed production with the work of national and international breeding research institutes and commercial seed companies.

For this special edition we spoke to policymakers, development workers, farmers and private companies on how farmers can gain access to good seeds and contribute to biodiversity. What are the roles of the different actors? How can farmers' knowledge be valued and farmers become involved in seed production? What is the role of government and what is the position of the private sector? During field visits in Indonesia, Uganda and Kenya we spoke with farmers about where they obtain their seeds. Whoever we spoke to about seeds, we discovered that nearly all of them believe that farmers' access to quality seeds, and their wider choice and greater autonomy in producing or using seeds are key to change.

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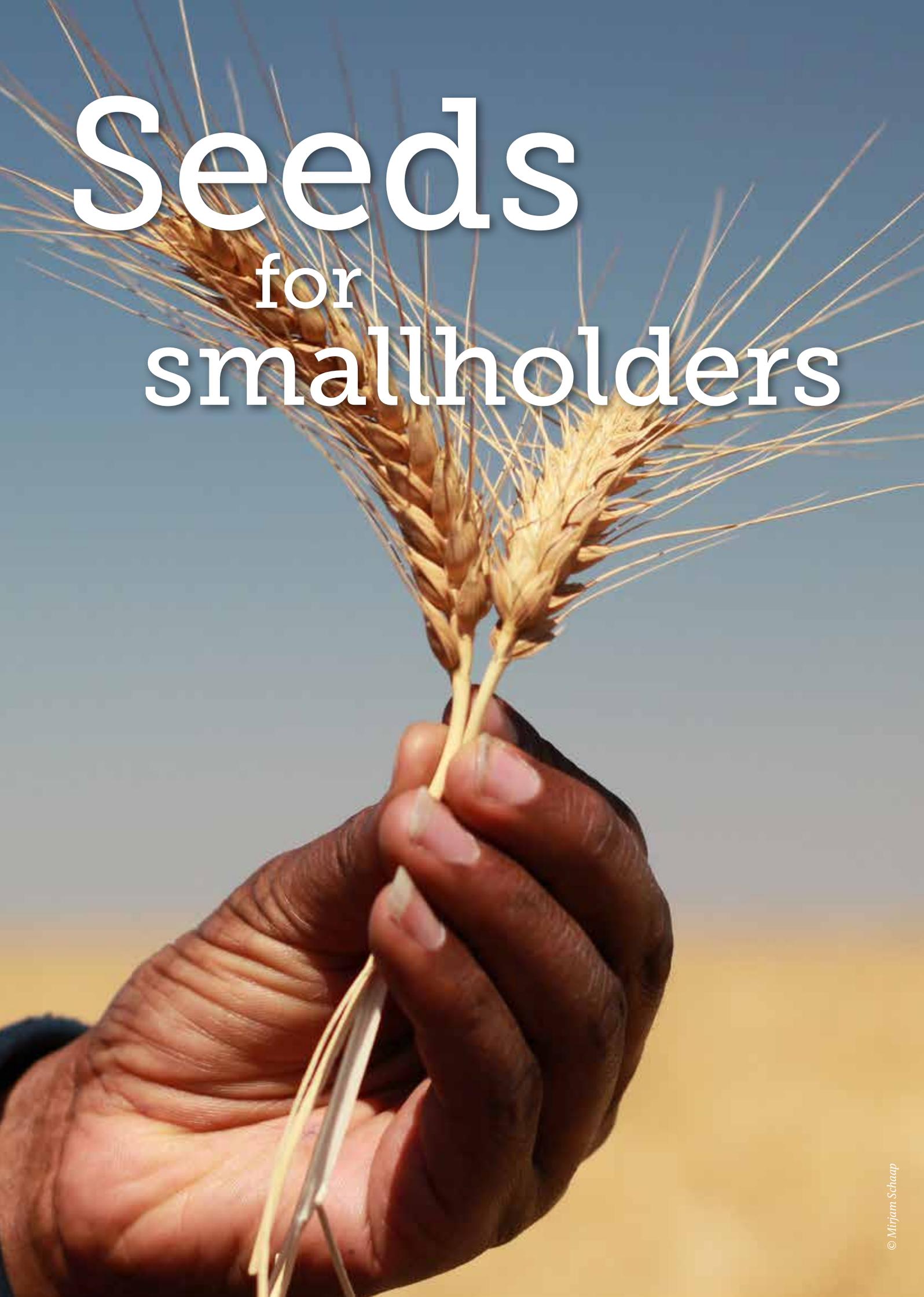
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Seeds for smallholders

Improved seeds can contribute to good harvests and better food security. Opinions are divided however on how farmers should obtain improved seed, and who should develop it. Some want farmers to be able to exchange seeds; others see high-tech breeding as the way forward. But for farmers the distinction between the informal and formal sector is beside the point: they get their seeds where it suits them best.

Author: Joris Tielens

Seeds are the wonderful bearers of the characteristics of plants and trees. Packages of genetic information, which are brought to life under the right conditions. Seeds are tiny time capsules: they tide over the period between one growing season and the next, but can also be stored for the more distant future. Seeds are an easy way to move plants, and therefore also to trade them.

Germinating seeds are often seen as a symbol of development. And rightly so: farmers in Africa, Asia or Latin America would earn much more if they had access to quality seeds. And sowing seed for healthy vegetables, or crops enriched with vitamins or minerals represent solutions to malnutrition. Seeds of crops that are drought tolerant or have a shorter growing season can be an answer to climate change.

Seeds would seem to be a panacea for achieving several goals: more food and nutritional security, higher incomes for smallholders, more food so countries will be able to feed the growing number of mouths worldwide. But they are a panacea that needs to be sown and nurtured, for without good cultivation, storage and marketing channels good seeds are worthless.

Seeds are also business. One kilogram of tomato seed today is worth more than a kilogram of gold. The global commercial seed sector is worth 45 billion dollars a year, and the trend is towards consolidation among companies at the top of the sector. In September the multinational Bayer announced its planned 66-billion-dollar takeover of seed giant Monsanto. DuPont and Dow Chemical are to merge, as are ChemChina and Syngenta. Once the Monsanto takeover has been completed, nearly two-thirds of the market for seed and pesticides will be in the hands of just three companies. The Netherlands is an important player in this market: it is the top vegetable seed producer in the world.

In developing countries many small farmers are self sufficient for at least part of their sowing seed. They use seed from the previous year's harvest or exchange seed with neighbours and family. By selecting the best seed over the years, they have developed varieties that are well adapted to local conditions. But these seeds are often not very productive. And they are not always resilient to fast-changing climate conditions. If you want improved or adapted varieties you have to breed and select plants. International seed companies have their own breeding programmes, but for Africa these are limited to a small number of crops. For most crops farmers

in Africa and Asia have to rely on the breeding done by public agricultural research institutes. Governments and donors invest large amounts of money in these, and make use of genetic material that is stored in seed banks, like the Centre for Genetic Resources, the Netherlands, in Wageningen. Seed banks conserve genetic diversity for the future. The Netherlands (together with other countries) also finances a project in which seeds are stored in an international gene bank, the Svalbard Global Seed Vault, under the ice on the island of Spitsbergen.

Seeds: bearers of information and tiny time capsules

Traditionally, breeding is done by crossing plants. And that is still the way most breeding is done, although genetic modification techniques are now also used (see page 32, breeding). Those opposed to genetic modification regard the techniques as dangerous; those in favour see it as a goldmine. In the United States there are fields full of GM soya and GM cotton, but there are almost none in the EU. The combination of GM and the power of multinationals has given the technology a bad name. The suicides of farmers in India have been partly ascribed to the indebtedness they incurred as a result of buying expensive cottonseed from Monsanto. In the controversy, Monsanto has become the symbol of the technology, and the resistance against Monsanto the symbol of the opponents. Last October activists organized a Monsanto tribunal, a trial with no legal status, but in which the company was accused of ecocide by eminent judges.

Whatever methods are used, developing new plant varieties costs a lot of money. And breeders want recompense. To safeguard this various forms of intellectual property rights exist, all hotly debated by businesses, governments, NGOs and activists. The US and the big multinationals favour patents. These give a company temporary ownership of plants with patented traits. Smaller companies prefer

not to work with patents because it involves a lot of legal expertise, and filing for a patent is very expensive; only the biggest companies can afford to do so. The EU, including the Netherlands and many smaller Dutch companies, favours breeders' rights. These rights are not as far-reaching as a patent and grant other breeders the right to do further breeding with protected varieties. In November 2016 the EU adopted a clarifying notice, in which it makes clear that it does not intend to provide patent protection for plant properties obtained by traditional breeding methods. Bionext, the organic agriculture sector organization, campaigns against the patenting of biological properties of plants and called the EU's announcement a breakthrough. Niels Louwaars, director of Plantum, the Dutch association for the plant reproduction material sector, said: 'If this vision is adopted by the European patents office, it will be an important step towards balancing plant breeders' rights and patent legislation.'

Farmers bridge the gap between the informal and the formal sector.

The promise of quality seed is a very attractive proposition in the world of development cooperation. Governments, NGOs, private companies and international donors run many plant material projects and programmes in Africa and Asia. Between 2007 and 2012 the World Bank financed 513 million dollars' worth of projects in the seed sector, including government programmes for distributing free seeds, especially of field crops like maize, to farmers. In the same period, the Alliance for a Green Revolution in Africa (AGRA) spent 35 million dollars on seed projects, the aim of which was to stimulate local investments in planting material production, in particular hybrid maize seed.

Under the minister for overseas development's 'aid and trade' agenda, the Dutch government supports a number of public-private

seed projects, especially those involving Dutch vegetable seed companies. Companies such as East-West Seed and Rijk Zwaan train farmers in the cultivation methods needed to ensure that high quality vegetable seeds yield good harvests. This is partly to give farmers access to better seed, but it is also in their interest to develop as big a market as possible for their own products. One of the few private plant breeding companies in Africa is in Arusha, Tanzania. Afrisem is a daughter company of Rijk Zwaan, which, together with East-West Seed, breeds specifically African vegetables like African aubergine and *sukuma wiki*, a local kale. In the public-private SEVIA project farmers are trained in the use of Afrisem seeds. And in Indonesia the company Ewindo, a joint venture of East-West Seed and ENZA seeds, is training farmers on vegetable production (see page 26).

Together with the Bill & Melinda Gates Foundation, the Dutch government finances the Access to Seeds Index, a list in which companies are ranked according to their efforts to make quality seed available to smallholder farmers (see page 34, article on Access to Seeds Index).

2.4 percent of seed from companies

All these interventions are aimed at the formal sector, and involve international companies, national seed breeding companies and government support. But research published in January 2016 shows that the formal seed sector only reaches a small number of farmers. Shawn McGuire and Louise Sterling asked almost ten thousand farmers in five countries in Africa, and Haiti, how many kilograms of seed they obtained and where they got it from, and concluded that only 2.4 percent of their seed comes from certified companies. And the seed involved is often hybrid maize, rice and hybrid vegetables. Note: some of the countries included in the study are countries in crisis, such as South Sudan and Haiti, where a formal seed sector hardly exists. On the other hand, Kenya was also one of the countries studied.

That is why many NGOs focus on the informal sector and farmer-saved and community-based seed systems. Farmers select, gather, test and propagate seeds themselves from their own fields and store these to use the following year, and also sell them to neighbours, friends and families and at local markets. We're talking about landraces here, but also varieties developed by companies or research institutes for farmers to breed and reuse themselves. Projects include setting up community seed banks, where seeds bred by farmers'

Wheat seed production in Oromia, Ethiopia



Quality teff seed in Ethiopia



Netherlands top seed country

The Netherlands is one of the biggest players in the seed market. With exports amounting almost two and half billion euros a year, the country is the world's biggest exporter of plant breeding material. The Netherlands is also the top vegetable seed producer, with several large companies throughout the country. Some of these are family businesses which have grown into large, global enterprises. The Netherlands is also big in seed potatoes, grass and flaxseed, and seed and cuttings for flowers and plants. These are increasingly exported over the whole world, including potatoes to (North) Africa and the Middle East. Niels Louwaars, director of Plantum, the Dutch association for the plant reproduction material sector: 'The strength of the sector is based on entrepreneurship and the solid tradition for scientific research on plant breeding in, among other places, Wageningen. On top of that, collaboration between the sector and the government for quality control, breeders' rights and the implementation of phytosanitary regulations is an important basis of the success.'

© Mirjam Schaap

Seed potato store in Ethiopia

groups give farmers direct access to good quality sowing seed. There have also been many participatory plant breeding projects, in which groups of farmers cross crops to select for characteristics of their choice. It is becoming increasingly important to find crops that are resilient to climate change.

Because the free exchange of genetic material – seed – between farmers is of great importance to the informal seed system, NGOs are fighting to secure the right of farmers to do this, at national and international policy level. They are afraid that western countries and multinationals will pressure African governments to sign treaties giving commercial companies plant-variety property rights and thus limiting farmers' rights. The Dutch NGO HIVOS is working on an advocacy programme to develop open access seed arrangements together with farmers, other NGOs and policymakers. Think collaborative undertakings in which farmers and plant breeders can freely exchange materials, such as community seed banks (see page 18, Ethiopia report).

Crop diversity is also important in this vision. By stimulating agro-biodiversity – the diversity of crops grown by farmers – varieties will be conserved for the future. And diversity makes farmers resilient to climate change. When only a few companies produce seed, there is great risk of uniformity. This is a criticism levelled at programmes and donors that encourage monocropping, such as AGRA and the Bill & Melinda Gates Foundation.

A recent example of a programme that focuses on the informal sector is Oxfam-Novib's Sowing Diversity Harvesting Security (SDHS). The programme supports 150,000 farmer field schools in five countries, where farmers are preserving the diversity of farm crops. In addition, SDHS is a programme that lobbies for seed, breeding and crop diversity policymaking at national and international level. The aim is to make the exchange of seeds and crops between small farmers as unhindered as possible.

51 percent from local market

While the informal sector is important, the stereotypical picture of

smallholder farmers in Africa being totally dependent on their own previous season's harvest for seed is also inaccurate. McGuire and Sterling's research shows that farmers obtain 31% of their seed from their own reserves, but half (51%) comes from the local market. And farmers pay cash for those seeds, so they are not exchanging. This means that the informal sector too, where farmers get ninety per cent of their seed, operates to a large extent on a commercial basis. Farmers only obtained seven percent of their seed for free – in the form of seed aid – from NGOs or government, and that was often under crisis or famine conditions.

The proponents of the two different sectors – formal or informal – seem to inhabit separate worlds and rarely work together. But for farmers both sowing seed systems are important, and also intertwined. Farmers get their planting material for different crops from different sources. Seed companies in Africa often specialize in – high-yielding – hybrid maize, for which farmers have to buy new seed each year if they are to be sure of getting good yields. Yet they keep their own sorghum seed from last year's field, and might buy bean seed from a farmers' cooperative, and vegetable seeds, such as tomato, from an international company. In practice it is the farmers who bridge the gap between the informal and the formal sector. For example they breed beans that they have bought from seed companies, or they take part in participatory variety selection programmes where they tell the researchers from national breeding institutes which crop characteristics they value so that breeders can concentrate on developing these.

Integrated Seed Sector Development (ISSD), an approach used by the Wageningen Centre for Development Innovation (CDI) and the Royal Tropical Institute (KIT), takes as its starting point that different seed systems exist alongside each other. Developed in Wageningen, the concept is based on years of experience in supporting sowing seed systems in Africa, Asia and Latin America, and on discussions with CDI course participants.

CDI and KIT combine action research and advisory work in their programmes in fourteen different countries, which will soon include

Myanmar. ISSD's vision is that the different systems all have their own value, and need to be strengthened and more integrated to create a vibrant and pluralistic seed sector. 'Integrating formal and informal systems can help to make better use of genetic material for developing new varieties, to develop new varieties that live up to farmers' requirements, and to give farmers better access to new varieties and quality sowing seed,' said Marja Thijssen, senior advisor and coordinator of the ISSD programmes at CDI. One of the ways to make good sowing seed more easily available to farmers is to set up local seed businesses, where farmers produce seed from varieties that perform well in the local farming system and environment, but have to conform to strict quality standards. In an ISSD programme in Uganda, these local seed businesses run by farmers' groups produce certified seeds: Quality Declared Seed. Under this scheme quality control is decentralized rather than taking place at national level, and is therefore cheaper. These farmers' groups form an intermediary seed system, between the formal and informal sector (see page 12). There are also ISSD programmes in Ethiopia and Burundi (see page 38). These programmes focus on strengthening entrepreneurship in the sector, and work with local, national and international sowing seed companies. The ISSD programmes are funded by Dutch embassies, the Dutch Ministry of Economic Affairs and the Bill & Melinda Gates Foundation.

Looking for solutions to the intellectual property controversy

In many countries the seed production chain – from breeder to seed company to farmer – does not function well either. National Agricultural Research Institutes (NARIs) do breed good new varieties, but only a small number of these actually reach the farmers. One of the reasons is that breeders develop breeders' seed, but not larger quantities of seed of the next generation – called foundation seed – that seed companies need to be able to propagate on a commercial basis. This and other bottlenecks are being tackled by ISSD Africa, an overarching programme that brings seed experts, and related programmes and organizations in Africa together (see next article).

Researchers on the ISSD Africa project are also looking for solutions to the intellectual property controversy. Many African governments have signed international laws that protect breeders' rights, explained Bram de Jonge, who did research at the Law & Governance Group of Wageningen University for ISSD Africa, and now works for Oxfam Novib. South Africa, Kenya and Tanzania have all joined the International Union for the Protection of New Varieties of Plants (UPOV), a treaty that gives plant breeders breeding rights. Under UPOV farmers are not permitted to trade seeds of protected varieties or exchange protected varieties. Critics believe that the treaty criminalizes the vast majority of farmers who exchange seeds in the informal seed system. Supporters of UPOV hope that it will encourage the breeding and introduction of new varieties.

In November 2014 a rare meeting between supporters and critics of UPOV took place in Cape Town. It was the first time that representatives of the seed industry, farmers, civil society and UPOV came together to talk about how countries can protect breeders' rights and still preserve scope for smallholders and the informal seed system. 'I think the meeting was the first step towards a new, differentiated approach,' said De Jonge. Within UPOV it should be possible to draw up a national seed law that exempts small farmers so they can keep, exchange and sell seed freely. Ethiopia and Zambia have already done this.' There's no need to worry about missed earnings, in De Jonge's opinion, because only a small amount of Africa's total farming area is planted with commercial seed. Research has also shown that public breeding institutes earn very little income from intellectual property rights.

Intellectual property rights are important, but national seed laws regulating quality and sale of seed are much more of an obstacle to the integrated development of the seed sector, warned Michael Halewood of Bioversity, the CG institute for agro-biodiversity. Many seed laws forbid the sale or exchange of uncertified seed. Registration of farmer-derived varieties is difficult or too expensive for farmers. Changing national legislation is perhaps more important for small-scale farmers than adjusting international treaties that are subject to so much discussion. ●

Seed aid 'a waste of money'

Sometimes seeds are provided as emergency aid, so that farmers can still manage to sow their fields after a crisis or drought. But often seeds are part of structural aid, with which politicians hope to win votes. Peter Gildemacher, an advisor for KIT, is not happy about it: 'Seed is given away for free during meetings in villages where political support is sought. At these festive occasions women sing and there is lots of enthusiastic applause. But the seed has often been bought using loans, for example from the World Bank, that their children will have to repay.' Gildemacher calls this form of seed subsidy laundering of development funds, and a waste of money. 'The seed that's given away has sometimes been obtained via dubious tender procedures, and is often bad quality.

What's more, it disrupts the local sowing seed system.' There's no way a local seed producer – a business or a farmers' group – can compete with freely distributed seed. It also takes away the incentive for households to carefully keep and store their own seeds. Gildemacher: 'The challenge is to subsidize sowing seed use and production in an intelligent way that stimulates local entrepreneurship and competition in the seed sector. Or to encourage international companies to make long-term investments in the production and marketing of sowing seed in particular countries. There's also a case to be made for investing public funds in seed-sector development. But experience has shown that free hand outs of sowing seed hardly ever produce good results.'

How to change a sector



For farmers to get quality seed of varieties of their choice, bottlenecks in the seed sector need to be removed. Because these involve multiple stakeholders – farmers, seed companies, policy makers and research institutes – a sector-wide approach is needed to support structural changes in the seed sector.

Author: Joris Tielens
Photography: ISSD Africa



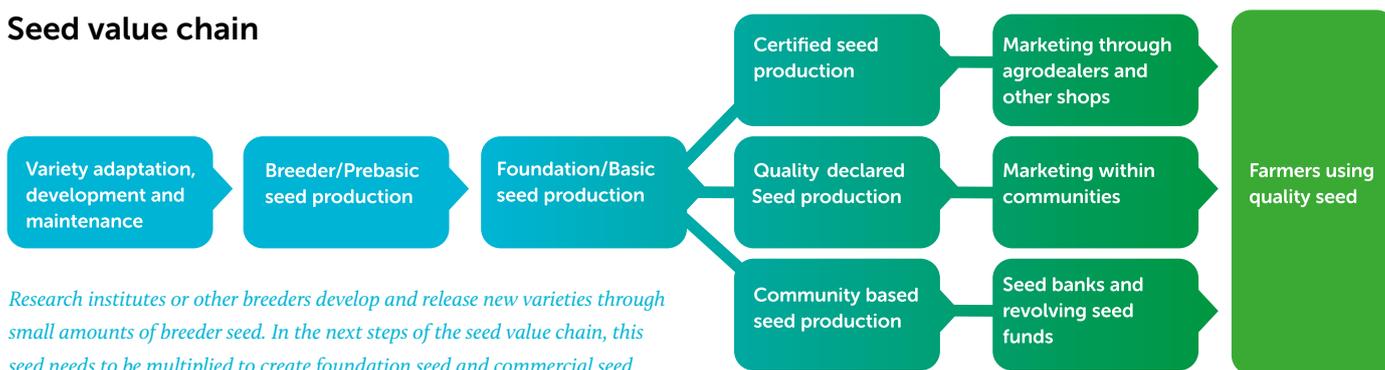
Participants at the ISSD Africa conference in Nairobi

It was a mixed party that gathered in September 2016 for a two-day meeting at the Radisson Blu, a hotel and conference centre in Nairobi. Nearly one hundred people from seventeen countries attended, representing over fifty organizations, including national and global research institutes, universities, government representatives, private companies, NGOs and development organizations. The one thing that all these people shared was their fascination for seed, seed systems and seed programmes. That was hardly surprising though, as the conference marked the conclusion of the two-year pilot phase of the Integrated Seed Sector Development Africa (ISSD Africa) project. ISSD Africa is a Community of Practice uniting African and global seed experts, aimed at increasing farmers' access to quality seed of varieties of their choice. An Africa-wide programme covering activities in 14 different countries, ISSD Africa was funded by the Bill & Melinda Gates foundation and the Dutch government. The programme has worked on promoting seed entrepreneurship, improving farmers' access to public varieties, assessing policies on access to plant genetic resources, and supporting seed sector

development under existing African policies.

'These people not only share an interest in seed,' said Marja Thijssen, coordinator of ISSD Africa at the Wageningen Centre for Development Innovation (CDI). 'They also have a clear vision on how the seed sector in Africa can be further strengthened.' Farmers in Africa get their seed from diverse sources in the formal, informal and intermediary seed systems. The vision of ISSD Africa is a pluralistic and vibrant seed sector, providing farmers with access to quality seed of varieties of their choice from multiple sources. The ISSD approach is farmer-focused and demand-driven, Thijssen continued. 'Solutions to key bottlenecks in the seed sector may differ from country to country and from crop to crop. The idea of ISSD Africa is that seed experts and others involved can share experiences and learn from each other, and use these lessons for tailored solutions.' The challenge of getting quality seed to farmers requires a sector-wide approach; it cannot be solved through isolated projects. For many changes, a range of stakeholders in the sector need to cooperate, including seed companies, farmers and government.

Seed value chain



Research institutes or other breeders develop and release new varieties through small amounts of breeder seed. In the next steps of the seed value chain, this seed needs to be multiplied to create foundation seed and commercial seed.

Reaching farmers

One of the key challenges in the seed sector is how to get seed of improved varieties from public breeders to farmers. Governments and donors have invested billions in national and international research institutes that breed new varieties of agricultural crops. The problem is not that these breeders do a bad job. Analysis based on five case studies done under ISSD Africa shows that dozens of new varieties of crops like potato, rice, bean and sorghum have been released in the past five years in Kenya, Uganda, Mali and Zambia. The problem is that many of these varieties never reach the farmer, because the chain of seed production doesn't work. When a research institute releases a new variety, it produces only a limited amount of seed of that variety, which is called breeder seed. This seed then needs to be multiplied to obtain a larger amount. This next generation is called foundation seed. The foundation seed can then be used by companies to multiply the foundation seed into commercial seed: the product they sell to farmers.

Solutions to bottlenecks in the seed sector may differ from country to country and from crop to crop.

ISSD Africa studies show that the main bottleneck preventing public varieties from getting to farmers is the lack of foundation seed. In many countries it is still mostly public breeding institutes that are responsible for producing foundation seed, but they don't have the land, the resources or facilities to grow and multiply the breeder seed. 'It would be logical for seed producers to take over the role of producing foundation seed,' said Willem Heemskerk, seed specialist at the Royal Tropical Institute (KIT) in Amsterdam, which runs the ISSD Africa project together with CDI. In various countries ISSD Africa supported pilots with seed companies, decentralized research stations or local farmers' seed businesses producing foundation seed. The lesson from these experiences is that it is possible for farmers

or seed companies to produce foundation seed, but they may need technical training and capacity building. Growing foundation seed has to follow strict procedures to maintain quality, and is costly. 'All this needs planning and forecasting of demand. And to organize this requires coordination, which is done through meetings of stakeholders,' explained Heemskerk. This requires collaboration in the seed sector.

Making business

Another bottleneck in the seed sector of many countries is that it is sometimes difficult to make a business out of selling seed. One of the guiding principles of the ISSD approach is to promote entrepreneurship and market orientation, recognizing that profit is a strong incentive for sustaining a seed business. Experience shows that giving away seed for free, as is often done by NGOs and governments, is not sustainable. The free seed often doesn't meet the farmer's specific requirements, or it comes at the wrong time, and it makes the farmer dependent on the seed provider. But making a business out of seed is not always easy, especially for seed crops with a low profit margin. Farmers can easily recycle seed of certain crops, such as open-pollinated cereal crops, vegetatively propagated root and tuber crops, or beans, so they have little incentive to spend much money on these seeds. Yet replacing their seed stock and planting a new variety once in a while could give them much higher yields. Profit margins are low on the crops that farmers do not buy or use new seed for every year, as well as for crops with bulky seeds or with seed with low multiplication rates, and it is hard to make a profitable business out of these seed crops.

'The good news from our studies is that we found many examples of ways to make business out of low-profit-margin seed crops,' said Sam Kugbei at the ISSD Africa conference in Nairobi. Kugbei is a consultant with the Food and Agriculture Organization and has lifelong experience in the seed sector in Africa. One strategy is to integrate seed production into a well-organized agricultural chain. For example, producing quality cassava cuttings becomes more profitable if there is a factory producing cassava flour nearby, which demands high quality cassava. Another way would be for a small-scale seed producer to look for a local niche market that is not catered to by a larger seed company. Demonstration plots to promote produce can help too, or making sure to get first access to new varieties at research stations. Governments and NGOs have a role here as well, as they often buy seed in large quantities to distribute for free. Kugbei: 'Institutional buyers could ask producers of seed crops with low profit margins, well in advance, to organize themselves so that they are able to deliver a certain tonnage next year.' ●

'Experiment with varieties'

'Farmers don't read books or pamphlets. They want to see a crop in the field. They want to experiment with materials and see for themselves,' said Enock Maereka at the Nairobi ISSD conference, when asked why so few newly developed varieties find their way from the breeding station to farmers. Maereka, a researcher in Malawi with CIAT, the International Centre for Tropical Agriculture, works on the bean-breeding programme, and did research for ISSD Africa on the flow of variety information from breeders to farmers.

Farmers and seed companies lack information on the kinds of varieties that breeders are developing. 'To get farmers interested, the crops need to be shown on demonstration plots.' Also, breeders often don't know what kind of information is important for farmers. 'That's why it's important to have two-way communication,' told Maereka, 'To find out what farmers and seed producers want to know about the

new varieties.' Farmers should be involved in the process of evaluating bean varieties, Maereka explained. 'It is called participatory variety selection and it's a must. Farmers give feedback on what they like or dislike about a variety. This may be about yield or disease resistance, but also about culinary taste.' It also emerged from Maereka's studies that many farmers said that other farmers are their main source of information.

'Farmers learn from each other. We need to strengthen farmer-to-farmer extension, and link it to information exchange in the formal seed systems.'

One way to do that could be through text messages on mobile phones. Many farmers already use a service like Airtel 321, which sends text messages on how to grow a certain crop in a certain area, what amount of fertilizer to use, etc. Maereka: 'Now we are planning to use a similar platform to relay information on crop varieties, where to get them and how to use them.'



© Neil Palmer (CIAT)

Trials of drought tolerant beans in Malawi

'Climate change means better access is required to genetic resources'

Climate change is very real for African farmers. They need new crop varieties that are adapted to changing climate conditions, but the material needed to breed these new varieties is often not available within the country, according to Gloria Otieno and Michael Halewood of Bioversity International, who did research for ISSD Africa on the issue. International treaties offer opportunities for promoting international exchange of genetic resources.

In recent years, Otieno and Halewood worked with farmers in Zimbabwe, Zambia, Uganda and Rwanda. Through doing participatory exercises with the farmers, they found out what traits farmers need in crops to respond to climate changes, for example an early maturing variety with a shorter growth period. Otieno: 'Then we looked in national gene banks to see what genetic material is available that meets these needs.' The researchers discovered that the number of varieties of crops in national gene banks

that are likely to be useful for adapting to future climate change is decreasing. It will be necessary to look elsewhere to find varieties that can withstand climate change, concluded Halewood. 'In the gene banks and breeding programmes of neighbouring countries for example, but the problem is that none of these have digital records, so it's impossible to know what they have.'

More potentially suitable materials may be found in international collections, like those maintained by the CGIAR centres, or in countries with national programmes that share materials widely, like the USA, Germany or the Netherlands. 'Due to climate change, countries are becoming increasingly interdependent on genetic resources,' said Halewood.

Many countries have signed international treaties on access and benefit sharing that allow for exchange of these materials. So, in theory, exchange of these materials for climate change adaptation is possible. The most important treaty in this respect is the International Treaty for Plant Genetic Resources for Food and Agriculture (ITPGRFA),

which creates a system for sharing genetic resources of 64 crops and forages that are particularly important for food security. Also potentially helpful is the Nagoya Protocol, an international agreement on countries' rights to request compensation when genetic material is accessed from them. 'By ensuring benefit-sharing, the Nagoya Protocol will in theory create additional incentives to conserve and use genetic resources.'

But while many African governments have signed, neither agreement has yet been widely implemented. That means African governments don't have the systems in place to request and receive materials. The conclusion of the researchers is that programmes should be set up to create awareness on the positive opportunities that both treaties can provide, and to build the capacity to make use of them – not only of breeders and seed companies, but also of farmers and communities. Otieno: 'To develop the skills needed, farmers in the communities need to work together in projects with experts in climate science, in gene bank curation, and in plant breeding.'

A woman wearing a vibrant, multi-colored patterned dress and a matching headwrap is bent over, working in a lush green field of tall grass. The background is a soft-focus expanse of similar greenery.

Farmers produce and sell quality seed in Uganda

Tired of being palmed off with fake seed, farmers in Uganda started to produce and sell seed themselves. That was the start of a slowly growing intermediate seed system, which has its own quality assurance system. It took some time to convince all parties, but progress is now well under way.

Author: Joris Tielens



Members of Aye Medo Ngeca farmer group discuss their seed business

'In the past, we had no access to good seed in this community. We used to go to seed companies, but the seed we bought too often failed to germinate. We lost our trust in the seed companies. So that's why we started producing quality seed ourselves, and selling it to our customers.' Under a large mango tree that stands between the fields and grass-thatched huts of Amwoma village, Dokolo district, Northern Uganda, Elisabeth gets to her feet to talk. She is a proud African woman and one of the members of Aye Medo Ngeca local seed business farmer group. 'Our customers are our neighbours in the community. We know what kind of seed they want, and they trust us because we are neighbours.' The group had gathered under the tree to talk about their flourishing seed business. As a farmers group they have a long history, but only started specializing in growing seed in 2012.

Access to quality seed at an affordable price is a problem farmers face not only in Uganda, but all over Africa. Farmers get their seed from different sources. In Uganda they may get their maize seed for free from the government as part of the Operation Wealth Creation programme; buy sesame and groundnut from a local market; buy small packages of vegetable seeds from an international company; and get their cassava cuttings and sweet potato vine seed from their own previous season's crop. About 85% of Ugandan farmers depend on home-saved seed they have harvested and stored from the previous season. Yields are often low and the local seeds are not always able to withstand the effects of climate change. In some parts of the country all crops have failed due to drought. Farmers are being forced to seek better alternatives to survive.

To produce quality seed, seed companies propagate from varieties developed by research institutes, and inspected by government inspectors to ensure quality. The seed is then tested in a laboratory to ascertain its level of purity and viability, and certified by government. However, this certified seed often doesn't reach farmers, as it is more expensive and not widely available. Certified crops are only grown on an estimated 15% of the fields in Uganda, the most

common being maize, which has a high profit margin for seed companies. One reason for this is simply a lack of distribution channels that reach the farming communities in remote rural areas.

Fraud

Another reason farmers prefer home-saved seed, is widespread fraud. Seed sold as quality certified seed is often actually regular grain put in bags with an official label. Uganda has only three government field inspectors who oversee 23 registered seed companies, which in turn buy seeds from tens of thousands of individual farmers or seed producing cooperatives. Controlling these is practically impossible. Also, seed companies get large orders for seed – thousands of tonnes – from NGOs working in South Sudan or the

Uganda has only three government field inspectors to control tens of thousands of individual seed producers or seed producing cooperatives. This is practically impossible.

Ugandan, military-operated, government programme Operation Wealth Creation that distribute seeds for free. In her office in Gulu, Northern Uganda, Juliet Akumo of Equator Seeds, one of the largest seed companies in Uganda, acknowledged the issue. 'Yes it is a challenge to produce that amount, but we are able to deliver it.' Others doubt that, however, believing it's too tempting for seed companies to put lower quality seeds in the bags when orders exceed available supply.

Local seed businesses (LSB), like the one run by Aye Medo Ngeca farmer group, represent an alternative to the formal sector suppliers – where the problems are not enough seed, not enough crop diversity, or seed of dubious quality – and the informal sector, where it is difficult to improve and monitor quality. 'Think of this as an intermediate seed system,' said Geoffrey Otim, seed expert in the Integrated Seed Sector Development (ISSD) programme in Uganda. 'We initiated and support local seed businesses. We don't want them to compete with formal seed companies, but instead to complement them.' Local seed businesses specialize in food security crops, and crops that are bulky and have a low profit margin. These categories are not cost effective for seed companies to produce. Otim continued: 'The demand for quality seed is much greater than the current supply. We want to fill the gap by training farmers to produce seed.' ISSD-Uganda was a four-year project that started in 2012. The aims were ambitious: to increase smallholder farmers' access to affordable quality seeds, not only by developing the intermediate seed system through local seed businesses, but also by enhancing the capacity and efficiency of the formal sector, improving policy and seed regulations, and raising farmers' awareness on the importance of planting quality seed. ISSD-Uganda is managed by the Wageningen Centre for Development Innovation (CDI), part of Wageningen University and Research in the Netherlands, and was funded to the tune of five million euros by the Dutch embassy in Uganda. ISSD-Uganda is part of an Africa-wide ISSD learning platform. In Uganda, ISSD set up 30 local seed businesses that are now running. Another 70 seed businesses have been started by 'out-scaling part-

One of the farmers of Latyeng farmers group showing the accounts books and the seed box that members of the local seed business put money into each week, thus saving enough money to make investments.



© Geoffrey Otim

ners' – contracted NGOs. These are farmer groups, usually of about 25-30 farmers, that are making a business out of seed production.

Decentralized quality control

Besides setting up local seed businesses, ISSD also worked on formalizing a decentralized seed quality assurance system, the Quality Declared Seed system (QDS), which is now recognized by the Ugandan government as a new seed class, and a first in Africa. Seed producers aiming to get a government QDS-label need to comply with the same production procedures as certified seed, but the control is done by District Agricultural Officers instead of national inspectors from the capital Kampala. Controls are done twice instead of six times during the production cycle, reducing costs and thus making QDS affordable.

Ochen Angelous, the chairman of Aye Medo Ngeca, a local seed business in Dokolo, explained how seed production and quality control works in practice. 'First we collect money from the members so we can buy seed from the breeder. Then we plant it following standard guidelines, away from other fields to avoid contamination. We carefully remove any off-types, plants that are not of the same growth and vigour, or of a different variety.' The seed growers keep a record of the land used, seed germination, growth and yield, and share that data with the district agricultural officer. 'He comes to inspect twice. Sometimes we ask him to come more often, to be sure that things are done properly.' The seeds are dried and stored in bags, and samples are taken to the laboratory in Kampala for quality checking. 'Once all procedures have been completed, if all is well, we get a tamper-proof QDS label to put on the bags.'

A key factor in local seed business quality control is the internal control done by members of the group itself. 'We have a quality committee within our group,' Angelous said. 'The committee visit all members regularly to check that they are following the procedures. Those not complying are disqualified. And we are very strict about that; if we were to allow one of us to have a bad field, then all of us would fail,' he continued, explaining that after thorough checking the seeds of all members are mixed together and packaged. Does anyone question the procedures? 'No, the procedures are produced by the Ministry of Agriculture, so there's no discussion. And we are trained by ISSD on how to work. It's all very clear.'

Foundation seed

Next to Ochen Angelous' house is a large bag of groundnuts. It represents a major innovation, as these groundnuts are not for consumption, but are newly produced foundation seed. While breeders at national research centres do produce new and climate-adapted varieties of crops, they produce only small quantities of seed. A bottleneck is the scarcity of next-generation seed that seed companies need to produce certified and QDS, called foundation seed. As a pilot, Aye Medo Ngeca farmers group is growing groundnut and sesame foundation seed, which they sell to other local seed businesses and larger seed companies.

'When the breeder releases seed, we plant it under his close supervision. He comes twice each quarter year to instruct us, and ISSD staff trained us on growing foundation seed,' Angelous explained. Growing foundation seed demands much more dedication and accuracy than growing normal QDS or certified seed – it must remain pure and of high quality, as it is the basic material for other seeds. 'We also need more investment capital to be able to start this



The women of the Oryem Can Widow farmers group have set up their own seed business

business of growing foundation seed, as seed from breeders is very expensive.' On the other hand, the returns from selling foundation seed are much higher as well, which explains the twinkle in the eyes of the Aye Medo Ngeca women when they talk about foundation seed.

Local seed businesses may offer small farmers a solution to their lack of access to seed, and to the problems of fraud and low quantities of foundation seed in the sector. Yet the idea of farmers producing seeds, and even foundation seed, is new to many and some believe this business is better left to professionals in formal seed companies, or researchers at research institutes.

'Previously, government was not sure if farmers could produce seed. Now we have seen they can do it.'

Competition is good

Juliet Akumo is quality controller at Equator Seeds in Gulu, one of the largest seed companies in Uganda. Equator produces 8,000 tonnes of seed a year, of which 3,000 tonnes are hybrid maize for the government programme. Most production is through contract farming by farmer cooperatives, controlled by the company. Akumo is positive about QDS. 'There are challenges. Local seed businesses have their own quality committee so I believe they produce good seed. But there are some agro dealers who take advantage and sell

ordinary grain and call it QDS.' Local seed businesses are still only a small player in the seed market, but once their numbers grow, they will become a competitor of her company, Akumo admitted. 'That's okay. You can't shy away from competition. Competition is good. And in fields where local seed businesses are better, like in open-pollinated varieties, they deserve to win. We, on the other hand, have the capacity to produce large amounts of hybrid seed, and local seed businesses will not be able to produce those quantities.'

'There has been a change in mindset,' said Laben Turyagyenda, director of Ngetta Zonal Agricultural Research and Development Institute (ZARDI) in his office in Lira, one of nine regional agricultural research stations in Uganda, and part of the National Agricultural Research Organisation (NARO). 'Previously, government and others were not sure if farmers could produce seed. Now we have seen they can do it; they even produce foundation seed. Some local seed businesses' seeds are even better than certified seed from formal companies.' ZARDI is very committed to enabling the success of QDS, said Turyagyenda. Decentralization of government control to district level has resulted in a new local laboratory being built on the grounds of Ngetta ZARDI. The building is there, but some equipment still needs to be installed. Once ready, the lab will enable local seed testing and quality control for QDS, thus saving time and money now needed to send seeds to the national laboratory in Kampala. ZARDI agronomists and economists, together with ISSD trainers, are also helping to train the local seed businesses, and ZARDI provides offices for ISSD too.

Change in mindset

What's important, Turyagyenda added, is that farmers like the seeds from local seed businesses. They trust local seed businesses because they know the people personally. 'This has increased small farmers' access to quality seeds.' Turyagyenda believes that the success of the

local seed businesses has been an important factor in national policy makers at the Ministry of Agriculture and NARO accepting QDS as a new seed class.

Another important factor in the change in mindset in the seed sector is that ISSD is engaging closely with ZARDI and other government departments, and respects the authority of government. Turyagyenda: 'Right from the start we were involved and we do joint training, joint seed trials, joint field days to demonstrate this new class of seeds to farmers.' He helped draft the proposal for the ISSD-programme and is aware of the budgets available. 'That is a big difference with some other donors or NGOs who come in and may ask us to cooperate, but only so they can find their own way to farmers. We don't really know what they do, we don't know their budgets.'

To have QDS accepted in the national seed law and policies, various stakeholders had to agree on the need for this new seed class, said Astrid Mastenbroek of CDI and ISSD's chief of party in Uganda. Many multi-stakeholder meetings were organized with the Ministry of Agriculture, NARO, seed companies, the national association of seed companies, and farmer representatives, before the Ministry authorized the first QDS pilot. 'We had to provide evidence that local seed business do make a difference and that farmers like it,' Mastenbroek recalled. 'We documented the process through action research. We want to achieve change not by telling people what to do, but by showing the benefits of the alternative.' For ZARDI, the local seed businesses offer a new way of working with farmers. For breeders, they represent a new way of distributing their new varieties, something that donors who support breeders insist on. QDS was accepted in the draft national seed policy in 2014, and since then many involved at district level – local researchers, the district agricultural officer, and local seed businesses – have started working with it.

To have Quality Declared Seed accepted in the national seed law and policies, *various stakeholders had to agree on the need for this new seed class.*

New role for the District

At district level, multi-stakeholder meetings are held twice a year, said Christine Joyce Adong, agribusiness expert for ISSD. 'In Gulu, we meet with the district agricultural officer, the district commercial and production officers, agro dealers, representatives of LSBs, other farmers, NGOs, seed companies. The aim is to discuss issues

and problems, for example on how to maintain quality and how to combat counterfeit seed.'

'Farmers themselves are convinced that quality is very important. They even ask me to come more often to inspect,' said Jackson Lakor, District Agricultural Officer in Gulu, who came to a hotel garden in Gulu to share his views. After being trained by seed inspectors of the National Seed Certification Services (NSCS), he was authorized to inspect and certify seed producers. 'The perception that seeds need to be produced by seed companies has changed. Local seed businesses can do it as well. But more farmers need more information on quality seed.' A visit from the inspection officer is not for free. 'They pay 15 dollars per visit as a group.'

Entrepreneurial

Having to pay for this is new to many farmers and farmer groups, said Patrick Oyee, deputy chief of party of ISSD Uganda. 'We build capacity and link people to others, for example to breeders to get foundation seed, or to the lab for seed quality control.' A central idea in the ISSD approach is that farmer groups involved in seed production should be entrepreneurs and therefore able to invest and reinvest in their business, in order to make the seed production sustainable. The local seed businesses can get funding for larger investments, like a first storehouse for their seeds, but they need to co-fund 25% of the investment themselves. For some farmer groups this was a problem. 'Two out of 30 local seed businesses dropped out of our programme because these groups had social objectives and were not entrepreneurial,' Oyee said. 'Some farmers can't embrace entrepreneurship, because they are used to free hand-outs.' Part of the reason is that many NGOs and the government programme Operation Wealth Creation give away a lot of seed, accounting for half of the seed market. The other reason is the history of war and relief in Northern Uganda. The Lord's Resistance Army ravaged the North of Uganda for 20 years, leaving over one million people in internally displaced person camps. 'That changed many people's attitude.'

Finance

Because they need to invest, getting access to finance is an important issue for many local seed businesses. The women of the Oryem Can Widow farmers group, in the countryside close to the city of Lira, have set up their own seed business as well. They get support for this from Volunteer Effort for Development Concern (VEDCO), a Ugandan NGO that is one of ISSD's out-scaling partners. They have learned how to grow seeds and where to get the foundation seed, recounted Hellen, one of the members. But the amount of seeds they produce is limited, because they don't have a lot of land, and they don't have oxen to plough the fields. 'We borrow oxen from others, but that means we can only plough after the owner has used them, which is often too late in the season.' Their own savings were not enough to buy oxen, and VEDCO didn't hook the group up with a bank or microfinance institution – that would probably charge too high interest rates anyway.

By contrast, Latyeng farmers group, a large local seed business with over forty members in Bungatira just north of Gulu, has been more successful. Dozens of colourfully dressed women welcome the visitor with loud ululating. They produce large amounts of seeds for soybean, upland rice, sesame and beans, as well as certified maize seed, which they sell on contract to the Equator Seed company. 'But the QDS-seed that we produce are even better than certified seeds.'

Agro dealer Susan Lawoko

Seated at her desk in the shop she owns in Lira town, Susan Lawoko is surrounded by the agrochemicals and seed she sells. 'I got to know local seed businesses through ISSD and now I buy seed from them as well. They have good quality seed for some crops that seed companies don't have. The sesame from local seed businesses is the best.' Susan visits farmers to advise them on farming and the kind of seeds and fertilizer they need. 'The problem here is that most farmers don't know how to farm and use fertilizers. We are worried about the ones we leave out, which is the majority. They still live with the idea of farmer-saved seeds. Coming to the city is difficult for them.' When asked why she hasn't opened a shop in the countryside, she smiled broadly. 'Ah, that is very expensive. But sometimes I go to markets in villages. And I am planning on buying a vehicle.'



© Ngetta ZARDI

Yield are higher, because we get the best starting material from the research institute,' said the chairman, the only male member of the group.

Latyeng farmers group has recently constructed their own seed storage facility, a large stone building with a concrete floor and office space. ISSD co-financed the construction of the storehouse, but the group contributed 25% themselves. At the back of the storehouse the group keeps an iron box with two locks on it. It is called a seed box, although it contains money, not seed. Members of the local seed business have to put in some money each week, to reach a target set in advance, for example enough money to buy foundation seed for 20 acres of rice. Is everybody able to contribute? 'If you are in a local seed business, you are already better off. And we got training on how to do cost-benefit analysis, and to keep a record book. We have a donation book as well, for politicians coming by.'

The aim of the ISSD programme is that local seed businesses can exist independently and that the responsibility for maintaining the enabling environment is spread, explained Astrid Mastenbroek. 'Through NGOs being supportive of local seed businesses, ZARDI starting to invest from their own government budgets, NARO remaining involved, and with help from the private sector.' All contribute, according to Mastenbroek, because everyone shares the conviction that farmers are indeed able to produce seeds.

It is of course hard to say whether this applies to all farmers in Uganda trying this new way of business. But when asked whether they would be able to sustain this business in future without the help of ISSD or others, the women of Latyeng farmers group echoed the words of Barack Obama : 'Yes we can. Nobody will be able to stop us from here.' ●

Future

A new phase of the Integrated Seed Sector Development started recently, for the years 2016-2020. The programme, called ISSD+, has a new component focussing on increasing farmers' use of quality vegetable seeds. This part will be private-sector led, as the varieties are owned by seed companies, which is not the case for many food crops. The vegetable component will be implemented in collaboration with Dutch vegetable breeders and seed companies, many of whom have advanced

varieties that can benefit Ugandan farmers. Other components in the new project include addressing shortages of foundation seed for food crops, rolling out the QDS system and local seed businesses, and promotion of quality seed use by farmers. The latter includes seed from both seed companies and local seed businesses. The total budget from the Netherlands Ministry of Foreign Affairs is nearly 11 million euros, and other public and private-sector contributions will total close to 5 million euros.



The
future of seed:
sharing is
becoming
big business

'If we want to diversify our food, have more choice and a healthier diet, we need to ensure that breeders and farmers have access to seeds that enable them to develop and grow a wide variety of crops. Yet the current trend is taking us in the opposite direction.' These were the opening words at a three-day workshop in Ethiopia on open source seed systems. The aim of the passionate advocates for biodiversity attending the workshop: **'to contribute to reversing the current trend of diminishing diversity by promoting the freedom to use seeds and stimulate breeding, diversification and resilience.'**

Author: Ellen Mangnus

'The 1983 drought in Ethiopia was a moment of revelation,' said Melaku Worede, former head of the oldest and largest gene bank in sub-Saharan Africa, the Ethiopian gene bank. 'Many parts of Ethiopia were affected, people had nothing to eat and each day brought suffering. I was worried, my whole team was saying: "Our farmers are going to eat their own seeds and end up planting donated grain." We feared that in some cases donated cereal might even be GMO. Monsanto had an advantage now and farmers were over a barrel. Luckily the donated seeds were mainly hybrid seeds, not GMO. Nevertheless we still foresaw risks. If these hybrids were going to be introduced en masse, our countryside would become a breeding ground for diseases and pests, because our farmers did not know how to handle the hybrids. We decided upon the following action: we would trade the donated food grains for the original landraces the farmers had and store the latter in a big storage facility. After the drought we would give the landraces back to the farmer, so that farmers would have good quality input for the new season. So we stored the landrace, but then we realized: this is not enough. We should look at the long-term interest.' He continued: 'In 1976 we had set up a national gene bank; now we decided it was necessary to also set up local seed banks so farmers could access improved seeds and work directly on conservation themselves. All over the country we encouraged communities to set up seed banks. I am happy to be able to say that I see that this idea has taken root. Many of my colleagues believe in the principles and have started seed banks in other regions. Even the Ethiopian government recognizes the value of the community seed banks.'

We were sitting on an outdoor terrace, in fact a row of plastic chairs in a hotel car park. It's Worede's daily hangout. His paralyzed leg doesn't allow him to go far from his small apartment. He comes to the hotel every day for his coffee and newspaper. Worede is internationally renowned for his efforts to maintain and save Ethiopian landraces and for encouraging farmers to save seed.

Mainstream development

'For my PhD I had to locate a high lysine gene in cereal. I screened 4,000 accessions of cereals for protein and lysine content and four

varieties proved to have an exceptionally high content,' Worede explained. 'Three were from Ethiopia and one from Portugal. Then I detected that the one from Portugal also had its origins in Ethiopia. Can you imagine? We had landraces about which we knew very little. Landraces that were used by western scientists to breed new varieties that they could then gain ownership over. We were losing a pool of valuable genetic material without knowing it. From the beginning I was convinced that I should do something about it.'

When referring to ownership, Worede is talking about intellectual property rights (IPR). These are ownership rights granted to the person or organization that has invented a new tool, method or product. Intellectual property in plant breeding refers to ownership of a method, a newly bred variety or a detected gene combination. In return for "disclosure" of the invention, the IPR holder obtains the exclusive right to market the invented product for a specified period of time, usually 20-30 years, allowing them to realize returns on their investments. IPRs, and more specifically patents, are gaining in importance in plant breeding, as breeding is increasingly about detecting gene combinations that introduce a certain trait to a plant, for example resistance to a disease. To prevent others from earning money by using the same trait, companies apply for a patent. IPRs are also gaining ground in developing countries.

Breeders' rights

As international seed trade expanded, the need for international law on property rights grew. In 1961, the International Union for the Protection of New Varieties of Plants (UPOV) established the first international plant breeders' rights act – the UPOV Convention. The Convention protects plant breeders by granting the holder the exclusive right to reproduce and market the protected variety. However, there are two exceptions: the breeder's exemption and the farmer's privilege. The breeder's exemption allows other breeders (including farmers) to use a protected variety in their own breeding activities. The farmer's privilege allows farmers to use the product of the harvest of a protected variety for reproduction purposes on their own holding.

Many African governments now subscribe to UPOV because they

want to attract foreign seed companies that are only prepared to invest in a country when they can be sure that their inventions cannot be freely used by others. As a consequence, the African national property regimes are modelled on the UPOV convention.

So far African farmers have not really been confronted by the consequences of these intellectual property right regimes, as the majority (85%) still use their own seeds or IPR free seeds from local markets. However, civil society organizations are concerned about the future, because they believe the implemented regimes do not value farmers' knowledge and expertise. A 2015 study examined seed laws in 25 African countries and concluded that there is limited space for informal seed systems and little recognition of the need to supply seeds to smallholders.

Several international treaties and agreements have been developed to protect farmers' knowledge and farmers' access to seeds. Together these are referred to as the 'access and benefit sharing regime'. However, in practice these agreements are seldom implemented or complied with. Worldwide many civil society groups, farmer organizations and organic food movements are taking a stand against the trend of decreasing seed diversity as the largest seed companies increase their use patents. They feel that current intellectual property regimes eradicate seed saving and sharing practices, diminish the gene pool and are leading to decreased food security.

Current intellectual property regimes eradicate seed saving and sharing practices, diminish the gene pool and are leading to decreased food security.

Open source seed systems

'In the coming days we're going to practise a different way of interacting with each other. We are going to leave behind all the prejudices, assumptions and interpretation frames we carry with us. With an open mind, with the eyes of a child, and regardless of each of our backgrounds, we are going to connect with each other. The aim is to listen and to really understand each other's perspective and co-create alternative solutions.' Excitement filled the room at the opening words of Dineo Ndlanzi, of REOS, the moderator of the 'Open Source Seed Systems' workshop held at the beginning of October 2016. Organized by Hivos and Bioversity, 35 stakeholders gathered on the IFPRI campus in Addis Abeba, including policymak-

ers, NGO workers, leaders of the organic food movement and other advocates for seed sovereignty, from Ethiopia, Uganda, Kenya and Tanzania.

The aim of the workshop was to explore the concept of 'open source seed' and find out how this can help to reverse the current trend of diminishing diversity by promoting the freedom to use seeds, stimulate breeding diversification and resilience in countries in East Africa. As Willy Douma, one of the initiators of the workshop, explained: 'The discussion on seeds has reached a deadlock. We know that few African farmers have access to formal seed markets. We also know that 40% of the Ugandan seeds are fake. That is disastrous. Governments believe that seed development should go via the private sector or big companies. And NGOs encourage farmers to breed and save seeds. The different actors in the seed system are drifting apart. In this workshop we want to find out whether open source seed systems can mean something.'

'The term open source is derived from computer science. It refers to free and open access to computer source code,' explained Jack Kloppenburg, Professor of Community and Environmental Sociology at the University of Wisconsin Madison, in his presentation on an open source seed system in the USA. Open source developed as a response to the threat posed by IPRs to the free use and exchange of source code. IPRs also threaten the free use and exchange of seeds – mainly in the form of Plant Variety Protection and patents. The successful open source concept from computer programming could be transferred to agriculture, or more specifically to plant breeding. 'Open source is not the same as "open access", which is completely free and unlimited access. Essentially, open source ensures access to a common good by protecting it against privatization, and as such it is a regulated and "protected commons", said Kloppenburg.

Kloppenburg shared the case of the USA, where concentration and patenting has had a very negative impact on farmers. In his opinion, it is not increased yields that have induced farmers to accept GMOs, but a desire to simplify management in times of low prices and heavy pressure. Although a number of farmers would like to return to non-GMO, there are few alternative sources of seed. Kloppenburg refers to the Farmers' Yield Initiative, a coalition of private and public parties that enforces intellectual property rights and runs a tip-line where people can anonymously report farmers who 'illegally' re-use seeds. Particularly worrisome is the fact that universities, government seed banks and research foundations are also part of this coalition. Public breeders who want to serve the public face what Kloppenburg calls a tragedy of the anti-commons. He sees the original intentions of plant legislation becoming subverted, as monopoly power is being used to obstruct research and impede innovation.

'Copyleft'

In 2012, together with a group of plant breeders, seed companies, farmers and colleagues, Kloppenburg founded the Open Source Seed Initiative (OSSI) an agreement between public and farmers to exchange germplasm. OSSI works with plant breeders who commit to making one or more of their varieties available exclusively under the OSSI Pledge: you have the freedom to use these OSSI-Pledged seeds in any way you choose. In return, you pledge not to restrict others' use of these seeds or their derivatives by patents or other means, and to include this Pledge with any transfer of these seeds or their derivatives. This "copyleft" commitment ensures that the

Pledge is transmitted with any further distribution of the seed or the seed of any new varieties bred from it. In this way OSSI encourages the exchange of plant germplasm for breeding purposes and guarantees the rights of farmers and gardeners to save and replant seed. The pledge differs from the breeder's exemption in that OSSI breeders do not have ownership rights.

Kloppenburger explained: 'No, OSSI does not have property rights. The breeders themselves do not have property rights. They make money by people buying their seeds through the companies. Like Fair Trade would label a product 'fair', we label a seed as 'freed'. OSSI is selling something that is marketed as unique: freed seeds, OSSI seeds. It is an ethical community for people who care about seeds. The companies are owned by people who understand the problems with patents. We let people know what a freed seed is, where to go and get them. We do not own or gain anything. We send visitors to the websites of the companies, to help people get access to freed seeds.'

'OSSI is different from gene banks or community seed banks. Gene banks were based on the idea that everyone could use their genes. That is what you call an open source: they're accessible to everyone. However, in practice only professional breeders make use of them, farmers rarely do. Gene banks have provided an easy flow of information in the global north, in places where there is the scientific capacity to use genetic information, to analyse it and to process it. Our OSSI initiative brings freed seed to the farmer.' Kloppenburger is convinced that there's plenty of scope for open source seed initiatives in sub-Saharan Africa, where farmers are still very much engaged in breeding.

Putting farmers centre stage

Worede took up the story again: 'I remember one time I was out in the field, trying to collect different wheat varieties and I had difficulty finding what I was looking for. I asked a shepherd boy to help me. He collected far more, being intimately connected to the field. Farmers highlight the material they regard as valuable and that is the reason scientists have started working on this material. It is based on the knowledge of farmers.'

A worry shared by many advocates of open source seed is that when farmers are forced to purchase seed they will lose knowledge and resources and gradually also their independent capacity to adapt to new or changing environmental conditions. Worede believes that farmer breeders contribute to biodiversity: 'Conventional breeders throw away what they regard as not useful, but their criteria are very narrow, mostly focused on economic characteristics like productivity. Farmers, on the other hand, have a much broader array of criteria. Which is why farmers contribute to diversity. But that is not only to their own benefit. The world needs a contingent amount of diversity to meet future demand. We should worry about losing varieties that can be helpful in the future.' Worede continued: 'There is this technical word: 'plasticity', meaning the ability of a variety to grow in different places, under different conditions, in different seasons.'

Besides contributing to biodiversity, the farmer-bred seeds are also well adapted to local conditions. However, Worede sees a worrisome development: 'Introduced by multinational organizations, rice is expanding in West Africa. But rice is absolutely going to be a liability there. We are dealing with semi-deserts, where water is limited. For the paddy type of rice you have to irrigate a lot, and pools



of water form, which will be a breeding ground for malaria, bilharzia and other waterborne diseases. It will be a disaster for the people. The people introducing these crops think they're doing good, helping the poor. But I take it with a grain of salt. Philanthropy foundations like the Bill and Melinda Gates Foundation are trying to help, but are doing harm. They often don't have any idea of agriculture. For us it is putting the cat among the pigeons.' A key principle of the different open source seed initiatives is the recognition that farmers' knowledge is valuable, adapted to local context and should be protected.

Open source seed systems are value driven.

Climate change

"Climate is changing quickly, farmers are never able to breed new resilient varieties fast enough, climate change will overtake them, biotechnology is key for speeding up the breeding process." These are often-heard statements expressed by conventional breeders. Supporters of the open source seed arrangements do not agree. Wanjiru Kamau, leader of the Kenyan Organic Agricultural Network, believes that the key to resilience lies in diversity: 'If you have a small diversified farm, your productivity will be higher than it would be with monoculture. Moreover, soil fertility is a serious challenge in our countries, because of the continuous use of fertilizers. Studies show that in the first years of conversion to organic agriculture the yields are not so good, but after the soil has been restored, yields will be higher with lower input into the soil. Small farmers do not just grow maize; they grow lots of things like carrots, potatoes, indigenous vegetables.'

In Worede's view the solution lies with nature, rather than biotechnology: 'All farmers are in danger, including those in developing countries, because the changes in the world's climate are so radical. Even our own broad genetic-based materials may not be able to withstand these. But we have a choice, we should benefit from the wild genes, because the wild genes are much better at adapting than even the farmers landraces, right?'

Open source ≠ anti GM

However, open source does not necessarily mean 'anti-GM'.

Kloppenborg: 'We are not against GM as a technology, but we are convinced that at this moment the world does not have in place the social institutions that would allow for a just and sustainable use of the technology. We are not ready to manage such a powerful technology. It is for social reasons that we oppose it.' Kloppenberg: 'OSSI was asked by Bayer whether it would accept having one of their GM varieties labelled as OSSI-seed. It led to a fierce discussion within OSSI. The members concluded that they could not support the manner in which GMOs are being developed at present. If Bayer wanted to declare their GM open source why didn't they do so themselves? OSSI shouldn't have to do it for them. OSSI wants to work with people that see the world as we do.'

Kloppenborg went on to admit: 'Ironically, we are not sure what would happen if one of our members were to breed with a free GM variety. The patent of some old GMs has already expired; other GMs are produced at universities. An OSSI variety could be bred using a GM variety, and that would be an open source GMO variety.' However, other parties within the open source seed movement are against GMs. Carlos Faddarom of Bioversity International commented: 'GMO might bring opportunities, but I am convinced that at this moment we have not exhausted the opportunities that conventional plant breeding offers.'

Ethical communities

Kamau: 'The big corporate players do not have the same value system as people who promote open source seed systems. They are driven by profit. The people promoting open source seeds want to promote access to a biodiverse seed system. The corporate world wants to narrow down and specialize the system.'

One thing that becomes clear from all the examples shared in the workshop is that open source seed systems are value driven. They refer to more than just an arrangement encouraging farmers to breed and exchange seeds because the advocates believe that is the best way to contribute to food diversity. Above all, they are ethical communities of people sharing the idea that nature should not be owned, or commercialized.

The challenges experienced by the participants in the different countries and shared during the workshop convinced the participants that collaborative effort is needed to make it a powerful movement. As a first step, several actions were listed, such as the idea for building a global alliance of open source seed systems, or setting up a multi-stakeholder platform that contributes to change through open source seed systems. And other participants are willing to draw up an action plan on how to influence policymakers. If the workshop led to one thing, it was a shared faith that open source seed arrangements are a promising, if not the only, avenue for maintaining a biodiverse food system that is accessible to small-scale farmers. ●



Barley seed harvest in Tigray, Ethiopia



Seed alone is not a silver bullet

Good vegetable seed on its own is not enough to obtain higher yields and make more profit. Good soil and crop management and marketing are also needed. SNV, the Netherlands Development Organisation, and Kenya Highland Seed are working with a range of Dutch companies in Kenya to set up business cases that deliver the whole package and fulfil the potential of high-yielding seeds. Although only a small percentage of farmers are reached, cooperation between companies is here to stay.

Author: Joris Tielens
Photography: Elizabeth Kyengo

'For some of the vegetables we grow, we buy high-yielding hybrid seed from Kenya Highland Seed. But hybrid seeds are very expensive. The majority of the farmers can't afford them,' young farmers Catherine Mwangi and Mozes Ngatia commented as they strolled around the sunny Agribusiness Trade Fair just outside Eldoret in western Kenya. The two-day fair was held in late September 2016, on the grounds of the University of Eldoret. Hundreds of farmers visited the numerous white pavilion tents in which about a hundred companies presented their products to the visitors. Over half of the companies present were Dutch. This fair, supported by the Netherlands Embassy in Kenya, was a showcase for the aid and trade agenda of Dutch minister Lilianne Ploumen, who firmly believes that making a profit can go hand in hand with helping farmers. It's not often that such a large number of Dutch people have assembled on such a small area of the Kenyan countryside. Next to the Dutch fair, another fair had been organized by the Kenyan government. Apart from companies selling dairy systems, fertilizers, pest control and storage systems, most companies at the fair were seed companies. Obed Lamai Cheruiyot manned the

stand of the Kenya Seed Company, a parastatal in seeds and the biggest seed company in the country. A salesman for the company, Cheruiyot confirmed that the high price of hybrid seed, which can be up to ten or twenty times the price of non-hybrid seed, is the main reason for farmers not to use hybrid vegetable seeds.

With proper treatment, hybrid seed will give a profit that compensates for the higher price of the seed.

Jane Kamau firmly disagrees. ‘We have to change the argument and stop talking about the price of that seed. Instead we have to show that the higher yields and better disease resistance of hybrid seeds more than outweigh the higher price.’ Kamau is a senior advisor in agribusiness working with SNV’s horticulture programme HortIMPACT in Kenya, and she’s passionate about her work. SNV manages this programme, which runs from 2015 to 2019, together with Hivos, Solidaridad and Delphy. HortIMPACT has a budget of 6.7 million euros from the Netherlands Embassy.

Kamau is also responsible for one of the projects under HortIMPACT, which aims to promote the use of innovative technologies in vegetable production, focusing on hybrid seed, among small and medium-size farmers in nine counties in Kenya. ‘Project’ is in fact not the right term, as the way to bring about change is not simply for SNV to train the farmers, but to support private companies that can see business opportunities in including small and medium-scale farmers among their customers. That’s why Kamau prefers to talk about a business case, and not a project. ‘The idea for the business case comes from the company, and they are the ones to implement it.’

Package

However, the main innovation of the HortIMPACT programme, said Kamau, is not so much the involvement of seed companies, but that a range of companies participate, and that they work together in training farmers in a coordinated way. ‘Hybrid seed



Peter Francombe and Linnet Khisa in the greenhouse of Kenya Highland Seeds at the Eldoret agro fair

will only yield its potential when the seed comes in a package with other technologies,’ Kamau said. That means good soil care, using a greenhouse and irrigation, good planting, appropriate fertilizers and pest management, timely harvesting and grading, and marketing to the right market. With proper treatment, the hybrid seed will grow well, produce high yields and give the farmer a profit that compensates for the higher price of the seed. Kamau: ‘Offering all that together as a packet is the way to go.’

‘You can have the right seed, but if the farmers are not able to take care of the seed they will not get a good harvest. And we want farmers to come back to us. So we thought it would be good to do this business case with SNV,’ said Linnet Khisa, Assistant Technical Manager at Kenya Highland Seed (KHS) company, which specializes in vegetable seeds. KHS is not a breeding company, but like many other African vegetable seed companies it imports seed from the Netherlands, Italy or Japan, tests the seeds for the African climate, and markets and sells it. KHS is the distributor in Kenya for the Dutch seed company Rijk Zwaan. Its main customers are large farmers who produce vegetables for export, such as the green beans, sugar snaps and baby corn that can be found in European supermarkets, but also small and medium-size farmers who grow tomato, paprika and kale, branded as

Royal Seed.

Khisa sits down in one of the white pavilion tents at the Eldoret Agribusiness Trade Fair to talk together with her boss Peter Francombe, director of KHS, who was born and raised in Kenya. ‘As a company you can have a “push” strategy and try to force sales on agrovets, who sell our seeds.’ Agrovets are small shops where millions of farmers in Africa buy seeds and other agricultural and veterinary inputs. ‘We have also chosen to have a “pull” strategy. We train farmers so they can use seeds well, and so they will buy our seeds in future,’ Francombe said, adding that KHS invest 30% of their turnover in farmer training. In HortIMPACT, the costs are shared with SNV, with KHS covering 52% of them. The strategy is already paying off. ‘There has indeed been an increase in seed sales in areas where farmers were trained under HortIMPACT. Not necessarily in the greenhouse products on which we focus in the training, but other products, as the farmers were made aware of Royal Seed and all our products during the trainings and field days.’

Training series

Under HortIMPACT, groups of farmers get a series of four trainings at different growth stages of the crop, held on twelve demonstration farms. The demonstration farmer gets a greenhouse paid for by SNV

and KHS, and supplies the labour and land needed himself. At the demonstration site, groups of neighbouring farmers meet to get training from several companies at the same time. The first training session focuses on soil fertility, setting up the greenhouse, and planting seedlings. One of the companies delivering the training, together with KHS, is SoilCares, an innovative Dutch company that sells small mobile devices to test soil fertility. Information is then uploaded through a smartphone app and farmers get a detailed e-mail report on what nutrients are lacking in their soil, with tailored advice on what fertilizer to use. Present at the soil training are not only SoilCares and KHS, but also the company that supplied the greenhouse, and Koppert, a Dutch company with a Kenyan subsidiary that focuses on biological pest control. The following trainings will be on responsible use of fertilizers and chemicals, as well as biological control of pests. HortIMPACT hopes these will contribute to food safety, an issue of increasing concern among domestic consumers in Kenya. The last training will be on harvesting, grading, and finance and marketing, to make sure the product is sold to the right consumer at the right price, rather than being lost halfway along the process due to bad storage or a mismatch with market demand. Khisa: 'The good thing is that these trainings are very practical. Education levels in Kenya are not high. What sticks is what farmers can see.'

'I have had about 30 farmers at my farm during each training,' said Stanley Kimali, an old farmer from Uasin Gishu county and a demonstration farmer in the project. He

grows four different varieties of hybrid tomatoes in the new greenhouse he was given. 'And at the end of the season, all the farmers who had received training came back to my farm for a field day and to discuss what they had learned. There were 300 people.' Kimali said the price of hybrid seed is no longer a problem for him, as he now has the knowledge and the facilities to manage the crop well, and makes a profit when all is said and done. 'However, selling the product is still difficult sometimes. The prices fluctuate, and sometimes you are not sure what price you'll get.'

Trainings are very practical - what sticks is what farmers can see.

'Yes I think hybrid seeds are the way of the future,' said Francombe of KHS. 'At present, 60% of the seeds we sell are open-pollinated varieties, and 40% are hybrid. In future up to 80% of sales will be hybrids. Farmers are ready for it.'

Network of companies

Yet HortIMPACT doesn't reach the really poor farmers. 'We don't aim at the really small or subsistence farmers,' said Jane Kamau of SNV. Instead, the programme focuses on farmers who want to engage in professional horticulture to produce vegetables for the market. These farmers

need to have some land, money and time to invest in the business. Also, they need to have an entrepreneurial mindset, and only a few farmers have this. Kamau estimates that in the first year of this business case, HortIMPACT reached over 3,600 farmers, about 400 more than the target. 'And through reaching the top, we reach many more farmers. They are going to tell friends, neighbours and family members.'

The main result of HortIMPACT is not the group of farmers that has received training, but the network of companies that has been created and that works jointly to provide horticulture training to farmers. Kamau: 'Companies complement each other and have to cooperate, and it works. It is the first time that SNV's approach has been performed, at this scale and intensity of trainings.' Part of SNV's business approach is that the market should take over the work after its initial start up. 'We hope all the companies involved will keep working on this and scale it up. Right from the start it has been clear that SNV will leave the project, and that companies should take over.'

'We will continue to work with these farmers to ensure they continue and potentially expand,' confirmed Peter Francombe. 'We'll be following up with the farmers we trained through phone and SMS platforms to see if they take up the technology. If they do, we will offer our services to train them. Whilst training them we will then encourage other farmers to attend the trainings. We will invest the same amount of money in trainings as we did in the SNV project. The first phase is getting others to invest in the technology.' ●

Hundreds of farmers, as well as some school children, visited the numerous white pavilion tents of the Agribusiness Trade Fair just outside Eldoret in western Kenya





Blending public and private:

how Indonesia is developing its fresh vegetable sector

Author & Photography:
Ellen Mangnus

Deep in the lush forests of Lombok, surrounded by green hills and hidden from strangers' eyes, lies Madjid's farm. Here he cultivates curly chillis on his perfectly square plot, which is bounded by small dikes and canals. Climbing up a rack of bamboo is the latest source of his pride: the Tanamo F1, a hybrid variety of chilli that is resistant to the most prevalent diseases, Phytophthora blight and bacterial wilt.

Majid only started farming three years ago. Having grown up in the rice fields, at a young age he decided to pack his bags and try his luck in the capital of Lombok, Mataram City. For 12 years he made a living as a taxi driver. Then, on a visit back to his village, he met Nuralim, an extension worker, who promotes products for Ewindo Foundation Indonesia and offers several farmers in the village guidance with their chilli cultivation. Nuralim assured him that it's possible to make a good living by growing vegetables. Indeed, over the years horticulture has become a flourishing business with growing market demand. Lombok's tourist industry is expanding and demand for vegetables is increasing. Besides cultivating rice, many farmers in the village now also cultivate tomatoes or chillis for the market.

'Access to vegetable seeds is not a problem here,' said Arga Wisnu Pradana from East-West Seed Indonesia, Ewindo. 'The different seed companies present in Indonesia are competing to get farmers as their clients. Some companies offer seedling producers incentives like a television if they purchase 100 boxes of seed. This is not the case everywhere in Indonesia. In isolated areas farmers face enormous difficulties accessing good vegetable seed or at least a market where vegetables are valued. The majority of farmers still use their own seeds.'

'A problem everywhere is the quality of seed,' Arga explained. 'For small-scale farmers, price is one of the major criteria for selecting a brand. However, if the germination rate is low or the number of fruits per bush is small, the farmer is the one who pays in the end. For a company like ours it is therefore important to show a farmer that it pays off to invest in good seeds.'

The experimental fields and greenhouses of East-West Seed in Lembang



Together with the farmers, an extension officer of East-West seeds observes the results of a recently introduced chili variety

Setting an example

'Very important,' Arga continued, 'Are show-cases: farmers that inspire other farmers because of their innovativeness or success.' One such farmer is Japri. This 49-year-old father of three is one of the pioneers in urban farming and establishing local food chains. Having started his career as a young adult in the hotel business, he quickly changed to rice trading when he smelled business opportunities there. His customers were hotels and restaurants and that was how he discovered the challenges that recreation resorts faced in sourcing fresh vegetables. Twelve years ago he acquired a small plot on the outskirts of Mataram City. Nowadays he cultivates his two hectares intensively, growing leafy green vegetables like rucola, basil, spinach and twenty types of lettuce as well as tomatoes, melon and

yardlong beans. Japri has fixed contracts with numerous hotels, restaurants and food traders and maintains a network of farmers he buys from if he is not able to fulfil his contracts.

Farmers produce vegetables but do not know how to reach a high-value market.

Curious, enthusiastic and entrepreneurial are the words that spring to mind. Japri is a key farmer in Lombok for the vegetable seed companies, as he is always the first who is willing to try a new variety and provide the company with feedback. Moreover, he is very involved in training other farmers and his urban farm serves as a demonstration plot for both small and bigger farmers.

Private sector can disseminate knowledge

Success is not achieved by simply putting the seeds in the soil. Plant management and cultivation practices are important factors too, and a second challenge for the seed companies is to convince farmers that good seeds only thrive when treated well.

Arga explained: 'Farmers in Indonesia spray a lot of fertilizers; they consider



The correct spraying technique is important for effective control of plant diseases

them like medicine – the more the better. But what counts, of course, is the quantity applied of each specific nutrient. In our trainings we teach farmers how much nitrogen each crop requires, what quantity of ammonium they should apply and how much nitrate is needed. If they tailor the pesticide doses, farmers can save up to 60% of their costs.'

We are sitting in a kindergarten classroom in the village of Gunung Sari, and twenty farmers are squatting on the floor. All faces are directed to the front where extension worker Nuralim gives a presentation on pesticide use and spraying techniques. Strings of smoke circle skywards. Arga explained: 'Farmers everywhere in Indonesia smoke a lot, but especially in Lombok. A cigarette here is what a coffee is in Europe. Most farmers cultivate tobacco and smoke all day long. We urge them not to smoke when spraying pesticides, as this is really bad for their airways.'

The series of trainings on pesticide management is part of the Knowledge Transfer component of Veg-Impact, a four-year programme (2012-2016) financed by the Dutch Ministry of Foreign Affairs to improve vegetable production and marketing for small farmers in Indonesia. The project was set up in response to the observation that market demand is growing but vegetable production is lagging behind. In the case of Lombok this was due to the fact the farmers in some areas do not have access to commercial seed at all and in other areas

farmers produce vegetables but do not know how to reach a high-value market.

One of the aims being to prevent missed opportunities, the programme introduced improved farming practices and new techniques, and brought producers in touch with traders. The training modules on cultivation practices were developed by Wageningen University and Research in cooperation with the Indonesian Vegetable Research Institute, and were rolled out in the field by Ewindo product promoters. Participants in the market programme component are Fresh Dynamics Asia, national and international companies involved in vegetable production and marketing, local traders, supermarkets and processors. Dutch partners are East-West Seed company, Rijkzwaan ENZA, Bejo, De Groot en Slot, and HZPC.

Experience, not theory

Nuralim invites the group to go outside, to the trial field. A young farmer is asked to put on special protective gear and to pick up a back-spray. He is asked to demonstrate to the other participants what Nuralim has just explained in the lessons. Nuralim corrects him: to kill the pests the farmers should start spraying from the bottom up beneath the leaves, instead of spraying from the top down over the plant. The farmers gather round and discuss the reasons for this technique.

After years of working in the field the product promoters like Nuralim know only too well that theory lessons are not the way to get farmers to change their customs. Proven results and shared learning are much more effective. The farmer field schools, demonstration plots and exchanges that Ewindo uses as dissemination methods are typical of current-day thinking on extension, which is very much focused on 'experiencing in practice'.

In Lombok farming is only one source of income for many smallholders. Some work on their tomato fields early in the morning and drive a taxi in the afternoon. Others teach surfing in the tourist season and grow yardlong beans in the other months. The increasing diversity of farmers' livelihoods requires models of knowledge transfer that leave space for farmers themselves to select the information and practices most suited to their farming system. The farmer field schools, trainings in which there is ample space for sharing own experiences, and the tailored and personal guidance from the product promoters at the vegetable growers' farm all allow for this. And something even more tailored is in the offing: in 2017 Veg-Impact will be launching a fertilizer

Farmers receive training in good farming techniques through the Veg-Impact programme



app, that provides farmers with information on when and what to spray.

Public versus private

The training sessions that are part of the Veg-Impact knowledge transfer component are conducted by the Ewindo product promoters. Extension being channelled through the private sector instead of through the existing public extension administration is a trend that can be observed in many developing countries.

Consumers want sweeter, glossier or crisper vegetables.

All over the developing world the private sector is playing an increasing role in breeding and distribution of vegetable seeds and the accompanying extension services. In Asia today, only China and India retain sizeable public agricultural research and extension systems. The process from seed selection to planting and cultivation practices at farm level requires specialist knowledge, which is rarely available at the public extension agencies. With regard to vegetable farming, many public breeding institutions confine themselves to fundamental research in the germplasm development process, concentrating on genetic resource conservation and pre-breeding activities to produce basic germplasm that can be used as source material by commercial breeding programmes. They no longer participate directly in seed production and distribution, leaving that task to the private sector. In Indonesia, for example, the Research Institute for Maize and Other Cereals (RIMOC) sells parent seed of improved maize varieties, for seed multiplication and marketing, to parastatals and private seed companies.

Moreover, public breeding institutes in developing countries generally focus on staple crops. One reason for this is that their mandate is to maintain national food security. Another is that their financial and research capacity are limited. Most of the staple crops are open-pollinated varieties, meaning that they are pollinated naturally, by insects or wind for example. As there is no control over the pollination process, the resulting plants are more diverse. As



The success of a new variety of tomato was evident from the first greenhouse test

long as the pollen is shared within the same variety, the offspring seed will remain true to type. Vegetables on the other hand are increasingly what we call hybrids: pollination is done in a controlled manner by human intervention, where the aim is to breed a variety with a desired trait. Hybrids are more expensive to breed, but offer a company the possibility to license them and earn royalties. Moreover, as they do not stay true to type, farmers have to buy new seeds every year. It is also less interesting for public institutes to breed vegetables because the turnover of vegetable varieties is quick. A cabbage or tomato variety is un-

likely to remain marketable for longer than two years. Then consumers want sweeter, glossier or crisper vegetables. Vegetable seed companies tend to specialize in a number of crops. Primaseed, the distributor of Bejo-Zaden is in Indonesia known for its high quality broccoli seeds. And in Lombok farmers praise Ewindo for its chillis, tomatoes, *kangkong* (water spinach), eggplant, yardlong beans, cauliflower and increasingly also shallots.

Witono of the Indonesian Vegetable Research Institute would like to see more cooperation between private breeding companies and public research institutes. 'It



Upon arrival at the factory, the seeds are cleaned, sample tested and packaged

will be beneficial for us if we could collaborate more closely with the private sector,' he said. 'As a public research institute, when we develop a variety we don't have a budget for promoting it. This could be tackled by the private sector. What I have in mind is that instead of selling them the variety we sell the parental lines. In this way the germplasm remains public, but the companies can sell the hybrids.'

Variety development starts with a study of market demand and farmers' needs.

Achieving quality

Dozens of plastic tunnels, greenhouses, and endless rows of seedlings stretch out over 12 hectares. A hive of activity with people everywhere, in overalls, blouses or lab coats bearing the Indonesian version of the Ewindo label, Panah Merah (Red Arrow), we visited one of the three breeding stations of Ewindo company, in Puwakarta, a provin-

cial city two hours' drive from Jakarta.

Joko Sareh Utomo, Senior Plant Manager of Ewindo, welcomed us at the production plant. 'All our seed, from the far corners of the country, is collected here.' Pointing to the shop floor where several machines are running he explained: 'Here we clean the seeds, test the quality, sort, grade and package them. We work with 10,000 seed production farmers in different parts of Indonesia. From the moment of planting we start checking and monitoring the quality.' First specialized seed pollinators pollinate every single flower to assure the correct parental lines are crossed. The quality assurance team checks the field and later the harvest. Ewindo requires the seeds to have a minimum of 98% genetic purity/hybridity and a germination standard of 88%. Seeds that comply with these requirements are sent to the plant in Puwakarta, where they are cleaned and sorted. Then the seeds are tested again, for moisture content, germination rate, purity and seed health. Next the seeds are coated in bright colours: orange for cucumber seeds, yellow for pumpkin and so on. This coating not only makes the seed identifiable, it contains also a small amount of fungicide and pesticide to protect the seed until it is strong enough. The seeds are

packaged in aluminium with a UV protection layer. Twenty million small packages leave the factory every year.

Muryanto, manager of the biotechnology division, took us to the laboratories. 'We start variety development with a study of market demand and farmers' needs. Farmers, for example, might require a variety that is resistant to a certain pest, or withstands erratic rainfall. Or consumers are looking for sweeter peppers or hotter chillis. In our current research we are developing plants that can withstand heavy rainfall or droughts; we take into account the changing climate conditions.' He added: 'I foresee that in the future we will also consider nutrition needs and fortify vegetables, with extra vitamin C for example.'

The process of testing new varieties is lengthy. 'Here we poison the new chillis with viruses in order to check their resistance,' Muryanto explained, showing a box with chillis ranging from shiny red, to mouldy green. 'It takes three to four years to develop a new variety. However, before we started using biotechnology it would take eight to ten years.'

'We get the germplasm from universities and other institutes with whom we have a material transfer agreement, and of course

over time we have built our own germplasm repository,' Muryanto continued. 'We use biotechnology like molecular markers and screening, but we do not do genetic modification; we still find ample possibilities within the current supply of varieties. Also we are afraid that genetic modification contributes to monocultures, whereas our vision is that we should contribute to diversity.' Nevertheless, Muryanto foresees that biotechnology will become more and more important in breeding: 'In the future breeding will be based on genomic selection. Or where the genome is known, it might even be possible to move to what we call "breeding by design".'

Ewindo has the first private accredited laboratory in Indonesia and plays a key role in seed breeding in the country. Not all foreign seed companies have local breeding branches. Most of them breed the seeds in the Netherlands, multiply them in a location with a convenient climate and export them to Indonesia, where they distribute the seeds through networks of seed traders. An increasing number of seed companies are looking for local partners to register the seeds and start multiplication in Indonesia. One such example is the carrot variety developed and tested by the Dutch company

Bejo together with its partner Primaseed.

Future prospects

'The future for foreign seed companies in Indonesia is not guaranteed,' said Lucie Wassink, agricultural counsellor at the Dutch Embassy in Jakarta. 'Demand for vegetables is growing, and so is demand for quality seeds, but the current Indonesian government is protective and has imposed measures that make it difficult for foreign companies to do business,' she explained. For example, the registration of new varieties is a lengthy and bureaucratic process. The same goes for importing seeds. All imported hybrid seeds are only granted a two-year permit, after which the variety must be produced in Indonesia.

Wassink continued: 'Most limiting is a law that restricts the amount of foreign investment in a company to 30% maximum, meaning 70% has to be a local share. For companies that are already established in Indonesia that is a sword of Damocles. This law has not yet been implemented but is already putting off foreign investors. A company like Rijkzwaan for example does have breeding stations in China, but Indonesia is just too risky.'

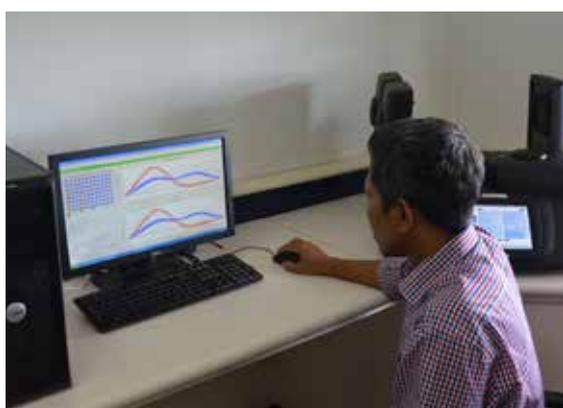
Some companies, like Bejo, have opted to

work through one or more representative Indonesian companies. In these cases, seed is imported into Indonesia and often re-packed locally under the brand name of the representative company, with only a small reference to the international source.

Biotechnology will become more and more important in breeding vegetables.

When asked whether foreign companies are impeding the development of a local seed industry, Wassink replied: 'I don't think so. Locally there are no breeding companies with the level of capacity and knowledge that Dutch companies have, the Netherlands being world leader in seed development. Moreover, if the varieties developed by foreign businesses are registered here, Indonesian companies are allowed to use the varieties for further breeding. And don't forget: most farmers still propagate their own seeds.' ●

Using modern techniques, new seeds are tested and developed





Better understanding of genetics shortens breeding time

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Local breeding in India

Seed companies are not particularly keen on genetic modification. Nevertheless breeding trajectories are being shortened thanks to increased understanding of the genetic material of plants.

Author: [Marianne Heselmans](#)

Genetic modification has been the subject of much discussion for thirty years now. And yet there are still only four genetically modified crops on the market: soya, cotton, maize and rapeseed. These commercial crops have all got two or three genes from bacteria, which have enabled big seed companies like Monsanto to make them resistant to a certain insect pest and herbicides such as glyphosate. Almost all soya and maize in the US and Latin America has been genetically modified in this way and nearly all cotton grown in India is genetically modified.

Universities and research institutes carry out hundreds of greenhouse and field trials with other genetically modified (GM) crops,

such as drought-tolerant maize, flood-tolerant rice, fungus-resistant potatoes, and virus-resistant apples. But because of strict legislation on genetic modification and because the subject remains sensitive in many countries, these GM crops get no further than the trial stage. In fact, in the past decade the number of field trials has actually decreased because companies have lost interest in trying to market genetically modified crops. Getting crops approved for sale is too expensive, and they are put off by the negative attitudes of consumers and NGOs.

Shorter breeding time

The technique that has changed the face of

plant breeding the most in the last decades is not genetic modification, but marker-assisted breeding. A crucial advantage of this technique is that companies no longer have to wait until the traits they want to select for (e.g. growth, sweetness or strength) show up in plants in the field. Marker-assisted breeding enables breeders to 'read' the DNA in the laboratory to see whether the plants are likely to have the desired traits, which can halve breeding trajectories. Using classical breeding methods, where selection only takes place in the field, it can take up to ten years to develop a new cultivar. DNA-based breeding can reduce the path to five or six years.

Marker-assisted breeding has come about because of the enormous amount of information on plant DNA that is now available in public and private databanks. The DNA sequence – the order of all the thousands of nucleotides that form DNA – of over eighty crops is now known. Gene maps are also continuously improving, so we know where the genes that are responsible for certain characteristics are located. Faster and faster DNA-analysis machines and improved software help companies to analyse each new seedling in the lab: what genes do they have

and what characteristics do these represent? The crosses and progeny with the best genes are then selected for further breeding.

Potatoes modified with potato genes

As our knowledge of plant DNA has deepened, methods for genetic modification have also become more advanced. And a new question has arisen: do these new methods constitute genetic modification or not? One of these is cisgenesis. Much of the research on this form of genetic modification in potatoes has been done at Wageningen University and Research in the Netherlands. The cisgenic potatoes there have been given three resistance genes from wild potatoes so that they do not get infected with the *Phytophthora* pathogen. The genes have not been introduced by crossing, but by first isolating the resistance gene in wild potatoes and then inserting it into the cultivated potatoes. A research institute can obtain a similar potato using classical cross-breeding techniques, but that will take a few years longer because all the unwanted genes from the wild variety have to be bred out.

Cisgenic plants only have genes introduced from the same species. This is not the case with 'transgenic' plants, where genes are introduced from other species. The GM soya, maize and cotton on the market are transgenic because they contain genes from bacteria. The strict EU legislation on genetic modification is based on transgenic modification. When it was introduced in 1994, cisgenic techniques had not even been developed. Hence present EU discussions as to whether a new law should be introduced to make approval for cisgenic plants less strict than for transgenic plant. As long as the law remains unchanged, companies will not invest in cisgenic potatoes or apples.

Molecular tweezers

The latest gene modification technique is CRISPR Cas. This gives biotechnologists virtual tiny tweezers that they can use to make very precise changes to a particular building block in a gene, such as deactivating it or making it more efficient. As a result, an apple or potato grows better or has a longer shelf life. This technique has sparked discussion too. Does it count as genetic modification or not? No exogenous genes are introduced; in fact, no genes are introduced at all. And looking at the end product, you can't tell that this technique has been used. Similar mutations in the

DNA could also have taken place naturally. A number of seed companies in the world have decided not to wait for the public debate, and have started marketing crops that have been modified using CRISPR Cas. The Swedish and US governments have also already granted market approval. So far no companies in the Netherlands have launched crops modified using CRISPR Cas and the Dutch government is waiting to see what emerges from EU discussions. Organic farmers have already indicated that they will not be using crops modified using cisgenic or CRISPR Cas techniques.

With open-pollinated varieties and hybrids available, farmers now have a choice.

Open-pollinated varieties or hybrids

Some organic farmers have started to return to open-pollinated varieties. These are varieties that produce fertile seeds, and that farmers can breed themselves by selecting the best plants each year. Eosat is a Dutch company that marketed the first open-pollinated paprika and tomato last summer under the name of Nature & More. These varieties, which were selected by the Louis Bolk Institute for sustainable agriculture, are now available in several organic food shops in the Netherlands and Germany. They result in more biodiversity and adaptation in the field than do the hybrids that most Western seed companies supply.

Hybrid varieties are crosses between two well-performing parent plants. To produce these, companies start with two parent plants which each have different but desirable traits (for example parent 1 is disease resistant and parent 2 is high yielding). These parent plants are first bred separately for several years using self-pollination until all progeny have acquired the desired traits. The progeny from the first cross between the two parent plants always inherit the desirable characteristics from both parents,



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Nearly all cotton in India is genetically modified. Cotton is one of the few crops in which genetic modification is applied.

and so the seed from this cross is sold. Hybrids therefore always yield more per hectare than open-pollinated varieties. But the seeds that the hybrids themselves produce are worthless because they no longer have the desirable traits of the grandparent plants. So a farmer or horticulturalist has to buy new seed every year.

In the 1950s big grain seed companies like Pioneer Hy-bred developed the first high-performance hybrid maize seeds. Dutch vegetable seed companies followed soon after with hybrid vegetable seeds. At present, hybrid rice varieties are superseding open-pollinated rice varieties as more commercial seed companies enter the rice market. And hybrid seeds are big business now that multinational seed companies are operating in more and more developing countries. With open-pollinated varieties and hybrids available, farmers now have a choice: buying hybrids for higher yields, or doing their own selection with open-pollinated varieties that may yield less but are adapted to local diseases and drought. ●

Room for improvement: new index ranks seed companies' efforts for small farmers



The Access to Seeds Index gives an indication of how much effort seed companies are making to reach poor farmers. The first Index was published nearly a year ago and the initiators looked back: 'Seed companies do more than we thought.'

Author: Marianne Heselmans



Extension services, Mali

The American multinational DuPont Pioneer breeds maize seed with properties that are attractive for small farmers in Africa and Latin America, such as drought resistance and salt tolerance. The company's aim is to have helped three million small farmers to improve their income with these seeds by 2020. Kenya Seed Company breeds crops consumed in East Africa such as sorghum, millet, black-eyed beans and amaranth. The company also has a good distribution network through which it sells these seeds to small farmers – most of whom are women. The Thai company East-West Seed trains small farmers in South-East Asia to produce seeds, and at the same time provides them with other products such as fertilizer and plastic sheeting to cover their crops.

These are three examples from the Access to Seeds Index, a ranking list that compares seed companies' efforts to make adapted varieties available to small farmers. The Index was published in February 2016. A clearly written 200-page report, it describes which seed companies are doing well on which aspects. The companies are also benchmarked and compared to each other: DuPont Pioneer was ranked top of seven multinational arable seed companies. East-West Seed tops the list of ten multinational vegetable seed companies, as well as the list of 17 seed companies active in East Africa.

'Seed companies are doing more than we thought to reach small farmers,' said Ido Verhagen, director of the Access to Seeds Index. 'When we started our research in 2015 we thought that few seed companies were active in developing countries. But it wasn't that bad. Seed companies are present in nearly all developing countries, except for a few West African countries. And they're not just working with maize, but also with local staple crops such as millet and sorghum and local vegetables.'

Inspiration

The Access to Seeds Index is funded by the Dutch government and the Bill & Melinda Gates Foundation – they jointly put up one and a half million euros for the first two years, and talks are now underway on a follow-up. 'We are satisfied with the results,' said Johan

Gatsonides, a member of the food security management team at the Ministry of Economic Affairs. 'This Access to Seeds Index is very promising.'

The Index was inspired by the Access to Medicine Index, which is funded by the British and Dutch governments and the Gates Foundation. For the first seed-sector Index, independent researchers were hired by the small Access to Seeds Foundation to compare companies' policies on paper for a period of two years. They looked at what the companies are doing to breed adapted varieties, at their marketing and distribution, and training of farmers in good practices. They gathered the data for the Index from annual reports and company websites, and from a questionnaire they sent to the companies. The researchers also talked with farmers to find out what they want from the seed industry.

'We came across some really interesting innovations,' said Coosje Hoogendoorn, head of research for the Access to Seeds Index. 'Innovations where companies have really looked at what small farmers want.' These include a simple insurance system for poor farmers developed by Syngenta. In the seed packets that the farmers buy there's a small card with a code. The farmers can send a free text message to Syngenta with the code, which also transmits their location coordinates. These are used to collect data from weather stations and satellite images. If it turns out that the farmer's field was too wet or too dry in the first two weeks after sowing, the farmer automatically gets his or her money back.

Initial scepticism

Many companies were initially sceptical about the Index. They weren't sure what the point was. But after the results were published Verhagen spoke to all the seed companies: 'And I started to notice that people appreciated the exercise,' he said. 'Some people use the report internally to get a discussion going. Why aren't we doing more of this? Others used their high score to get more internal funding for a project. Although, of course, there were also companies that said they wouldn't be making more effort because of

the report.’

‘The report confirmed the good things we are already doing to reach small farmers,’ said Maaïke Groot, the Europe representative for East West Seed. ‘It makes us proud, and that encourages us to do even more. In 2015 we trained 28,000 farmers to train other farmers. And now we’re going to double that figure by the end of 2017.’ About 30 million small-scale farmers grow East-West Seed varieties and 12,000 contract farmers produce seed. The company also employs about a hundred people who give demonstrations via model farmers.

‘The index can encourage big companies to make advanced technology and skills more available.’

An interesting finding was that East African seed companies in particular are already doing very well at selling vegetable and arable seeds to small farmers. In East Africa companies were selected that work on breeding, production and distribution in several countries. The researchers found the companies by talking to farmers, NGOs and other stakeholders. Eleven African companies, three multinationals (DuPont Pioneer, Monsanto and Syngenta) and three smaller seed companies from outside the region (East-West Seed, the Dutch Pop Vriend and the French Technisem) met the criteria. Many of the African companies breed staple crops and vegetables that are important for the local population, such as millet, beans and sorghum, and they also have an extensive distribution network. Victoria Seeds in Uganda has mobile seed shops – motorbikes with a cabin on the

Seed production, Uganda



back – so they can reach remote villages.

Another interesting company is Seed Co, with headquarters in Zimbabwe. This company supplies seeds for 12 staple crops and 21 different vegetables in 12 countries. Seed Co visits farmers to find out what is important for them so that it can adjust its breeding accordingly. The company is 30% owned by the French Limagrain. Hoogendoorn: ‘What we are seeing is that global companies have a share in regionally operating companies, or have agreements with them.’

The plan is to publish the second Index in 2018. Because the current regional Index provides so much information on East Africa, when the second Index is published it will probably also include a regional Index for South-East Asia.

Choice for farmers

Jitu Shah, director of East African Seed (third place in the regional index), believes that the Index itself encourages companies to do better. But he has his doubts about the reliability of the ranking. ‘Our company has been supplying seeds to small farmers for 40 years with no subsidies at all. How can companies that have only just started score better than us?’

Estimates suggest that still only 2.4 percent of the seeds used in developing countries come from seed companies. Unfortunately the potential yields from locally produced seed are often far lower than those of seed from specialized seed companies. One of the aims of the Index is to improve access to formal-sector seed, so that farmers have a choice. The Index provides facts about what companies really do for small farmers. And the idea is that these facts can inspire other companies, NGOs and governments. For example, a company may not see training farmers as its role. But if the Index shows that this works well for other companies, the company might change its mind and start offering training too. And an NGO working in a particular region might approach a seed company in the same area to suggest collaboration.

Samuel Kugbei is a Seed Policy Advisor for AfricaSeeds, an organization that implements the policies of the African Union Seed Programme. Kugbei thinks that the Index does motivate companies. ‘It can encourage the big companies to make their advanced technology and skills more available,’ he said. ‘And that would benefit the whole seed sector.’ He thinks the Index is a good initiative and, in his view as many companies as possible should participate. He would like to see the Index stimulate more dialogue: not just between companies, but also with politicians, policymakers and farmers. Kugbei: ‘The more different sources of information there are, the higher the quality of the Index will be.’

Room for improvement

Kouame Miezán, director of AfricaSeeds, agrees. He welcomes the Index and would like to see more African companies taking part. He sees room for improvement as well, suggesting that the Index should also examine the public sector, for example the seed policy of governments and their national research institutes in African countries. The Index could also devote more attention to the informal sector. Because it is not so easy to get reliable information, Miezán would like to see partnerships with organizations that could do fieldwork for the Index. Organizations that know a lot about African seeds, such as AfricaSeeds itself. ‘The complexity of the seed sector in Africa demands this.’



Joseph Mukopi uses his cell phone to check the weather in Kikwameti village, Kenya



ACCESS TO SEEDS

© Access to Seeds Index / Humphrey Odera

Seed production, Uganda

Gigi Manicad runs Oxfam Novib's sustainable development programme and she too likes the Index. 'Businesses are needed to supply better seed to small farmers,' she said. But in her opinion the Index first needs a lot of improvement.

Like many NGOs, Oxfam Novib is worried about the increasing amount of power multinationals like Monsanto (fourth in the ranking) and Syngenta (second place) are gaining in developing countries, certainly now that they are patenting more and more varieties, which seems to be the trend. Regionally operating seed companies cannot use patented varieties freely for further breeding purposes, whereas they can use varieties with breeders' rights. Manicad, who is also a member of the technical advisory committee for the Index, would also like to see the Index give penalty points for undesirable activities such as patenting varieties.

Flexibility

Verhagen doesn't exclude the possibility of giving a negative score to undesirable activities in a future Index. But ranking patenting is tricky, he admitted. Many developing countries do not yet have intellectual property legislation. Companies cannot even apply for breeders' rights there, let alone patents. And that's a problem for many companies because they want to protect their intellectual property. Verhagen: 'If a company can't patent its seeds in Africa, you can't ask them not to patent at all. However, we have asked companies if they are prepared to be flexible on their intellectual property rights when it comes to farmer-saved seeds. And we did take their flexibility into account when ranking.'

Multinational seed companies mainly sell hybrid varieties. Hybrids often have higher yields than open-pollinated varieties, but the seed they produce is not good quality. So farmers have to buy new seed each year to grow hybrid varieties, whereas they can keep seed from open-pollinated varieties to use again.

Manicad is not against hybrid varieties, as long as farmers have a choice between high-yielding hybrids and cheaper, open-pollinated varieties. And as long as farmers are also involved in seed production. 'We have a programme running in Vietnam where farmers in the Mekong Delta are producing hybrid rice seeds. They now supply 30 percent of the rice seed in the region. In fact they are so successful that seed companies are now hiring them for seed production.' Manicad would like the indicators in the second Index to focus more explicitly on hiring in farmers as seed producers. She'd also like to see more attention devoted to how well seeds really are

adapted to the diverse agro-ecological systems in which smallholders farm.

These two criteria – autonomy and seed suitability – were also mentioned as important by farmers when they were interviewed by the Index researchers. Other criteria mentioned were availability and affordability of seed, training and education opportunities, and the possibilities for growing profitable crops.

The power that multinationals have can also be expressed through the market share they have in a region. For example if a multinational provided more than 90 percent of the seeds for a crop in an African region, it could keep the price of seed artificially high. Verhagen is not sure whether taking into account market share should be the Index's role. 'This seems to be more something where a government or a competition authority should intervene.'

Second Index

The first Index already had 70 indicators and companies had to fill out extensive questionnaires. Most companies in East Africa did complete the questionnaire, but of the thirteen multinationals, six did not participate. In this case the Index has to rely on a company's annual reports and website. Because completing the questionnaire is such a lot of work, in the next round the entire packet of indicators will be evaluated for relevance and efficiency.

But however many indicators are included, Verhagen expects that the second round will provide more information from companies, whether directly or via websites and reports. 'Companies now understand that they do undertake certain activities, but they hadn't reported these and thus got a lower score. So the second time round they will report these activities.' Verhagen thinks that the scores will change quite a lot in two years. Companies may start a new research project, or start to offer more farmers training, or open up a new market, all of which are activities that can give them extra points.

Finally, it was noticeable that not one single company sold yam or cassava propagating material, even though these are crucial staple foods for many poor families. Coosje Hoogendoorn thinks this is because cuttings are difficult to store and transport. Farmers can also easily propagate their own cuttings, so it's less profitable for companies to produce them. 'It's logical that companies don't invest very readily in these.' However, she does see a lot of potential in legumes such as beans, chickpeas and cowpea, crops that few companies still pay much attention to. 'Legumes are just as important as a food source, and they are potentially profitable.' ●



Burundi: putting business back into seed production

A training of seed potato producers on potato pest and diseases in Kayanza (North province in Burundi)

Access to quality seed is key to increasing agricultural production and food security. But how can entrepreneurship be developed in a post-conflict country where farmers are used to free seed distribution? 'We want to make business in the value chain.'

Author: Manon Stravens

Photography: Cyriaque Simbashizubwoba

Burundian farmer Léonidas Nimpagaritse produces maize and potato seed and is a real entrepreneur. On his 60-hectare farm he employs a seasonal workforce of up to 400 workers and has storage space for 60 metric tons of agricultural produce. Recently he bought a van to sell his surplus and hired a secretary to keep track of all his expenses. On top of that, Nimpagaritse is the president of a seed production cooperative. And more plans keep popping up, such as having his own product label to improve the marketing of his seeds.

Nimpagaritse is one of the roughly 200 registered seed producers who will receive support to professionalize their seed business under the Integrated Seed Sector Development Project (ISSD), a four-year programme that started in 2014 and aims to increase

small farmers' access to quality seeds.

Emerging entrepreneurs like Nimpagaritse are badly needed in Burundi. Family farmers are the backbone of the country's economy, where approximately 90% of the ten million inhabitants depend on agriculture for their daily income. But frequent natural disasters and twelve years of civil war have left deep scars. Agricultural production is low and malnutrition levels are high (12%). Food crises are common, but the densely populated country has many mouths to feed. Burundi is ranked as one of the poorest countries in the world, and the hungriest in East Africa.

'We push local medium-sized commercial farmers to produce high quality seeds at an affordable price for small-scale farmers,' said Alexis Ntamavukiro, IFDC (International Fertilizer Development Center) country representative and coordinator of ISSD, during a Skype call from his house in the capital Bujumbura. 'It will not only result in better yields and stronger and disease-resistant crops. It will also bring back business to the food market.' Conflict and intensive state intervention have distorted Burundi's market for agricultural produce, he explained. In addition, the market is too small and the political climate too insecure for foreign companies or big investors to really invest seriously.

Vicious cycle

Poor access to good seeds is a key cause of poverty and hunger in Burundi, said Ntamavukiro. Only a tiny minority – 'fewer than 5%' – of Burundian farmers use high quality or certified seeds. Most farmers can't afford the high costs 'or are not even aware that these quality seeds are available'. And because the government institutions engaged in seed multiplication and distribution often lack resources and operate inefficiently, farmers don't get the seeds at the right time. In short, there is no adequate response to their needs.

The majority of farmers therefore generate and source their seeds among

themselves. 'They recycle the same materials, reducing seed quality,' explained Ntamavukiro. Crop diseases are common in Burundi and productivity of crops like maize, potatoes and cassava is only half that of neighbouring countries. Farmers therefore have little income to spend on inputs like seeds and fertilizer. Meanwhile, prices of staple foods are rising. Ntamavukiro: 'It's a kind of vicious cycle.'

Six staple crops – rice, beans, potato, maize, cassava and banana – were selected for their impact on food security and farmer income. Strategies and targets were set for each crop, based on its specific characteristics and the availability of quality seed in the country. Many varieties of rice, requiring different cultivation technologies, are available, so ISSD is investigating which varieties are in demand. In collaboration with ISABU, the national Agronomic Research Institute of Burundi, resistant varieties of disease-prone banana and cassava have been selected and multiplied in 'mother' gardens. These gardens are managed by trained individuals and farmers' groups. Maize varieties are improved in the country, but hybrid seeds are also imported from Uganda.

Return on investment

Demonstration plots set up by ministry of agriculture field advisors, NGOs and farmer organizations enable the farmers to compare different varieties and crop husbandry options. 'We show the farmers different options, so they can decide what is best for their own financial situation,' said Peter Gildemacher, senior advisor at the Royal Tropical Institute (KIT), which provides technical assistance to the programme. The farmer sees which varieties perform better, which techniques to apply and how to use fertilizers. Potatoes, for example, are an easy profitmaking crop with a short production cycle, and farmers learn how to select the best seed potatoes from their own field.

Over 300 farmer field schools have been organized so far for almost 11,000 produc-

ers. Jeremie Bancako, who helped set up a hybrid maize field in 2016, said the hybrid maize seed showed a lot of potential. 'If all producers in the region adopt it, famine will be a distant memory.'

Demonstrating to farmers is important, because the demand for quality seed among them is still low. 'Especially if they have to pay for it', said Ntamavukiro. Apart from the costs, lack of information on the added value of quality seeds also keeps demand low, added Gildemacher. 'That's why we calculate with the farmers the return on their investment, when they buy a particular type of seed. And we can't do this enough, since their willingness to pay is still low compared to the realistic economic return.' Once they understand the value of good seeds, that would make it easier to set up a system of pre-order and pre-financing, Ntamavukiro explained. 'Farmers pay for a seed order in advance, without the intervention of a free distributor like an NGO or the government.'

Most farmers generate and source their seeds among themselves.

Financial services therefore are crucial, first of all for seed producers. Some farmers with profitable businesses, for example producing seed potatoes, have succeeded in obtaining commercial credit. But access to long-term agricultural credit generally remains limited. Bank and microfinance institutes demand insurance and charge high interest rates, since they consider agriculture a risk sector. However, rather than developing a financial product specifically for seed ('that's not our expertise'), ISSD has chosen to intermediate with the existing financial sector. Ntamavukiro: 'Build up their trust so that they will eventually provide credit.'





Women selling seed potato

Women in business

Another challenge is the promotion of women entrepreneurs, despite the fact that Burundi has many women farmers. Due to the war, the number of female-headed households is also high, but it is difficult for women to become commercial seed producers, said Gildemacher: 'A commercial seed producer needs capital and, most importantly, ample land, whereas in Burundi few women possess or can inherit land. ISSD provides support, for example to female bean producer groups so they can jointly supply a marketable volume, but more impact is to be expected at seed user level.'

ISSD Burundi has helped train and supervise local, accredited seed inspectors.

Promoting commercial seed entrepreneurship is the backbone of the project. Apart from providing training and coaching in seed production, multiplication and business management, ISSD also co-finances (for 50%) 'innovative' investments like a tractor, an irrigation system or storage facilities. Professionalization of marketing is promoted along with seed labelling and packaging, and a pilot just started with six maize and bean seed farmers. Small quantities of seeds, in packages of 1 kg, 2 kg or 5 kg, are a solution for clients who can't afford large quantities. Mini seed fairs are also organized throughout the country, where seed entrepreneurs meet farmers, potential clients: seed stock can be sold, business contacts established. At

the beginning of the 2016 season, farmer Nimpagaritse held two small exhibitions to promote his brand of seed. They proved worthwhile: he sold all of his stock. Another entrepreneur, François Niyungeko, who grows seed potato, sold his entire yield of 60 tons at another fair. 'Before, I was facing unsold stocks,' he said. The project is also looking at whether tricycles could be used to help supply seed to markets and shops in villages, to assure nearby marketing.

Seed certification

As proof of quality standard compliance, outlined in national seed laws, ISSD also works on seed certification. Certification costs are usually high and the certification process takes time, partly because the national certification body, ONCCS (Office National de Contrôle et de Certification des Semences), is based in the capital. The distance involved makes fraud a risk, said Ntamavukiro: 'Some farmers secretly mix certified seeds with uncertified low quality ones.' So far ISSD Burundi has assisted the ONCCS with the training and supervision of local, accredited seed inspectors who operate under supervision of the national body. This joint work is helping to decentralize certification service provision, and bring it closer to the farmers, Ntamavukiro explained. 'That helps traceability and reduces fraud, as well as costs.'

The ISSD project is ambitious. The aim is a fivefold increase in the volume of quality seed produced and commercialized in Burundi. And for these seeds to be used on at least a quarter of the agricultural area. Distance to purchase of these better seeds should be halved and productivity of the top 25% of farmers should be as high as the best 5% at the start of the project.

Work in progress

The success of the project depends critically on Burundi's political and macroeconomic conditions. One year after the start of the

project, in April 2015, Burundi was plunged into the worst political crisis since the end of the civil war. Democratically elected president Pierre Nkurunziza's bid for a third term sparked protests by opposition supporters, who claimed the move was unconstitutional. An estimated 332,500 people fled the country and another 25,000 were internally displaced. 'The project has been affected above all by the associated economic crisis,' said Gildemacher, 'Which is hampering entrepreneurship in agriculture and in the seed sector.' The conflict seriously slowed down the already fragile economy. Currently the border with Rwanda, an important trade partner of Burundi before the crisis, is closed, national entrepreneurs are postponing investments, and international investors and donors are staying away.

Both Ntamavukiro and Gildemacher agree the biggest challenge is to move from the grant system to a business system: to make all stakeholders think in a more market-oriented way, including donors. Farmers have developed a 'receiving' attitude, because agricultural inputs have long been distributed for free by NGOs, large donor programmes and government, Ntamavukiro said. Subsidies should indeed be 'smart' and not distorting, added Gildemacher, saying the project is exploring a voucher system which would allow farmers to buy subsidized seed from their preferred producer or seller. This would promote seed entrepreneurship rather than competing with existing seed producers through free seed distribution. Moving the whole system is 'work in progress', continued Gildemacher. The project is working with the Ministry of Agriculture on a Code of Conduct for seed sector intervention, so that all intervening organizations will work in the same market-oriented manner. Ntamavukiro: 'A system based on for-profit seed production and marketing is the most sustainable mechanism for improving access to high quality seed.' ●



Why are seed companies hesitant to enter the West African market?

*Jan Arie Nugteren of East-West Seed meets
cabbage farmers in Burkina Faso*

Pest-resistant tomatoes, rainy-season proof onions and yellow peppers that tickle local taste buds: improved seeds are said to be changing small farmers' lives. But while private companies offer selected fruit and vegetable seeds to East Africa, West African markets are being overlooked. 2SCALE, a Dutch programme, wants to change that. Why?

Author: Sarah Haaij

'One day I was walking along a pepper field in Ivory Coast with a professor from a local national university, when he suddenly said: 'I don't think your peppers will be as spicy as our traditional ones'. So I picked one and said 'please try'. He did so, and was unable to talk because the tears kept streaming down his cheeks, that's how spicy our peppers are!' Jan Arie Nugteren, West Africa advisor at the East-West Seed company (EWS), still chuckles when he tells this anecdote. Supported by the Dutch-funded 2SCALE project, EWS is developing improved fruit and vegetable varieties for smallholder farmers in West Africa. One example is seed for hot peppers. But why would a Dutch company

introduce a fruit variety that is already widely available in West Africa?

Before we can answer this question, we first need to understand the difference between local and company-improved seeds. West Africa has a wide range of indigenous fruits, vegetables and crops, including sorghum, millet, leafy greens and all kinds of bean varieties. Peppers, however, are not a local species. They were probably introduced to the continent centuries ago by navigators travelling from Mexico. And the same goes for tomatoes, cucumbers, lettuce, or cabbage. 'Local gene pools of these foreign crops have evolved over time,' Nugteren explained. 'And based on what farmers tell us, we now select and try to improve their genes.'

'With quality seedlings, 50% of the farmer's work to get a good yield is done.'

In Ivory Coast, for example, farmers were worried because their peppers died every year during the same period. EWS responded by developing an adapted pepper in their labs in Southeast Asia. 'Now we have the same pepper but it's resistant to the bacteria that used to destroy the harvest,' Nugteren said proudly. Mind you, the taste and colour will not be tampered with: people are picky about their peppers. Where Burkinaabe consumers want them yellow, Ghanaians or Ivorians will only eat them flaming red.

Installing plastic mulch in Mali



What's innovative?

Smallholder farmers in Africa produce 70% of the continent's food supply. But only 2.5% of the seeds that they use come from seed companies like EWS. If it were up to Denis Gnakpenou, agronomist and innovation specialist in small-scale agriculture, he would change this. In his 13 years with the International Fertilizer Development Center (IFDC) in West Africa he has come to believe that if you want to improve rural livelihoods, you have to make sure that farmers have access to better seed. 'Access to seeds is key!' Gnakpenou said. 'With quality seedlings, 50% of the farmer's work to get a good yield is done. If you start off with bad seeds or bad seedlings, you will have problems all the way. Farmers will face pests and drought, and will spend more money on protective measures.'

IFDC focuses on food security and is one of the three partners in the consortium that implements the Dutch 2SCALE project. 2SCALE, a €41.5 million grant programme funded by the Ministry of Foreign affairs, seeks to improve rural livelihoods and food security in Africa through public-private partnerships in the agro sector. 'Within 2SCALE we want to improve the competitiveness of the value chain for smallholders through innovations,' Gnakpenou continued. And he regards the introduction of good fruit and vegetable seeds in West Africa as 'innovative', especially since there are almost no government programmes working on vegetable seed production. And the handful of initiatives that are in place mainly focus on staple crops rather than vitamin and mineral-rich fruits and vegetables.

'Apart from a few very small initiatives that are developing local vegetable varieties, nothing is happening with hybrids. But high-yield hybrids,' – high-yielding, disease-resistant vegetable varieties adapted to African smallholder farming conditions – 'that is what I think we need!'

The access to the seed products that Gnakpenou and Nugteren envision begins with seeds being available in the countries where smallholders farm. But not only are governments not investing in seeds; until now seed companies seem to have overlooked West Africa as well. Global seed companies are active in Latin America, Eastern Africa, South Asia and Southeast Asia, but West Africa lags behind significantly: six out of fourteen countries are not served at all by businesses.

Enticing partners

Dutch seed companies are no exception. In the highlands of East Africa, Dutch horticulturists appear to dominate the markets. Here, the climate and soils don't differ that much from European conditions, making the relatively cool and dry highlands familiar ground. The lush tropical fields of West Africa, however, are a different story.

And since 2SCALE wants not only farmers but also Dutch businesses to flourish, a challenging part of the programme is to entice partners into these unexplored markets. 'That is a challenge,' Gnakpenou emphasized. 'Only if companies know that they can make profit, will they start to invest in smallholders.' And the same goes for the farmers, buyers, wholesalers, market vendors and consumers; everybody along the value chain needs to know there is something to gain.

To convince their stakeholders, the 2SCALE-partners introduced a grassroots approach to reach out to the farmers. Smallholders were asked to grow hybrid seeds on small demonstration plots, next to the seeds they were already using. It turned out that the hybrids of East-West Seed (which specializes in seed breeding for tropical conditions) adapted well. 'After an evaluation session, the farmers and the vegetable merchants identify which seeds performed best in yield and market. They are the ones who decide what seeds to adopt.' Gnakpenou explicitly mentioned yield and markets, 'Because good seed alone won't do the trick.' The commercial companies that want to benefit from 2SCALE need to have an open



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Demonstration of tomato seedlings in Ghana

mind towards inclusive business. They have to be able to back their seed up with on-the-ground training on agricultural practices that help farmers, like irrigation systems, fertilizer use and improved pest management. This strengthens farmers' capacity to recognize symptoms of disease and pests, and to prevent attacks. And last but not least, Gnakpenou added: 'They need to transfer knowledge on how to sell these products in the best possible way.'

Small scale, small profits?

When all this is taken into account, the engagement required from the commercial companies proves quite intense. And this is all the more so because when talking about 'small scale' in West Africa, we mean really small. The son that boosts his family's income with a potato field is a smallholder farmer; as is the city dweller cultivating salad leaves on bits of wasteland in the centre of Lagos. Most of these small-scale producers are cropping on less than one hectare of land. And sometimes even that hectare is scattered over different plots of land.

So why would a company invest in seeds for a market with challenging climatic conditions and financially strained clients? Simply because the Dutch government is giving support through the 2SCALE project? 'No,' was Nugteren's reply. 'To be completely frank, we were planning to expand to West Africa before this project and we would have done so without 2SCALE as well.' In his view, the good part is that now the endeavour is moving much faster. 'We've ended up working in areas that are further away and poorer, that we would not have reached otherwise.'

And even there, Nugteren confirmed, it is possible to make a profit. Improved onion varieties are one example. In West Africa,

onions can only be cultivated in the cool, dry period. As soon as the rainy season starts, the price of onions rises. Where local customers normally pay 10 cents a kilo, the start of heavy rains can drive the price up to over one euro. 'Our firm in India has developed an onion variety that can grow year-round. And because the climate in India is similar to that of Mali, Burkina Faso and Northern Nigeria, we now sell that seed in these countries as well.'

'If a local approach means you are against improvement, you are in the wrong.'

A small farmer who is able to cultivate off-season can make a lot of extra cash. And the same goes for the company that sells the seed. East-West Seed hybrid and open-pollinated seeds can cost three times – or even as much as ten times – more than local seeds. The research and man-hours that are put into the breeding are reflected in the price as well. On top of this, unlike traditional seeds that are often stored and reused for multiple years, these hybrids are not suitable for a second harvest. 'Reusing the hybrids can create a mess,' Nugteren confirmed. Your plant may turn out to still be pest resistant, but the fruit will not taste good anymore.

Locally grown, locally owned

Companies say that the investment in better seeds (sometimes hybrids) is earned back in significantly higher yields. But now that the first businesses are exploring West African markets, the first protests to this claim can

be heard as well.

Mariann Bassey Orovwuje, from Environmental Rights Action/Friends of the Earth Nigeria, is campaigning against what she calls external interference in local seed markets. Raised in a Nigerian community dependent on cassava, Orovwuje is convinced that small farmers are doing just fine with their own seeds and shoots. 'We know how to control our food locally; we have done so for years. Our farmers have what it takes to feed Nigeria, all we need is government support.' Not seeds, but warehouses and better infrastructure, will help Nigerian farmers she argues.

Food security, in the words of this activist, comes down to locally controlled seeds: the local production, breeding and exchange of seed. The main threat to that ideal now stems from super companies like Monsanto. The multinational recently started to take – highly criticized – steps towards the Nigerian market. 'Foreign controlled seeds is the last thing we need', Orovwuje said. 'Because that way we will lose our sovereignty over our food. And who knows what will happen then?'

Orovwuje's worries lead us back to the question we raised at the start of this article. What is local and what is not? And what is the meaning of 'local' when we discuss seeds and food? Nugteren works on the ground together with farmers and the seeds they are using, so likes to think of East-West Seed as a local company. 'We are not against local seeds,' he said, 'But if a local approach means that you are against improvement, I think you are in the wrong.'

Apparently the question of how to balance small-scale farmers' ownership of food with improved yields and profits makes for interesting, fertile land. Ready to be sown with new and inclusive ideas, West Africa might be just the place to do that. ●



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