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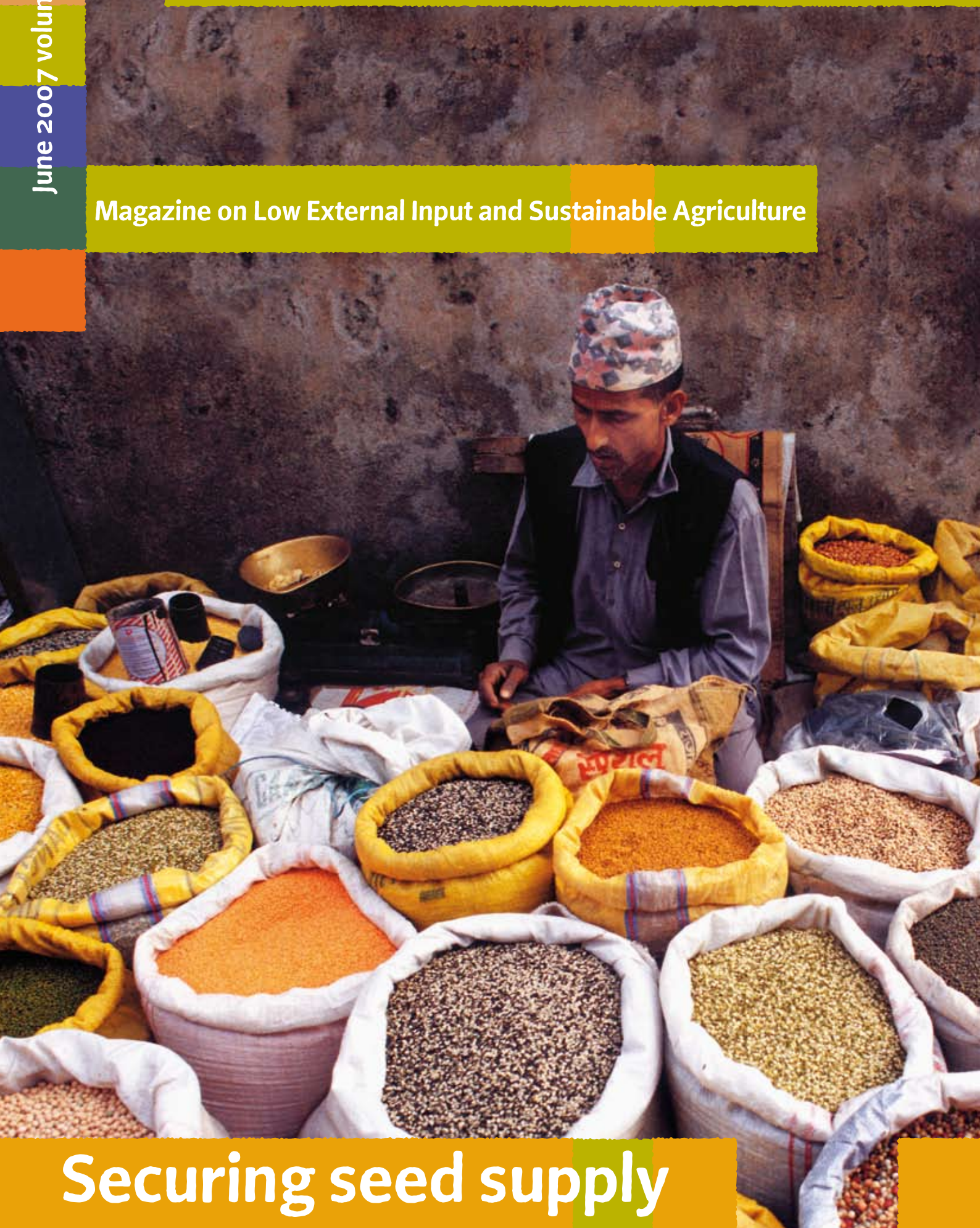
LEISA

Magazine on Low External Input and Sustainable Agriculture



Securing seed supply

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Seed merchant in Kathmandu, Nepal.
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LEISA is about Low External Input and Sustainable Agriculture. It is about the technical and social options open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of external inputs. It is about the empowerment of male and female farmers and the communities who seek to build their future on the basis of their own knowledge, skills, values, culture and institutions. LEISA is also about participatory methodologies to strengthen the capacity of farmers and other actors to improve agriculture and adapt it to changing needs and conditions. LEISA seeks to combine indigenous and scientific knowledge, and to influence policy formulation to create an environment conducive for its further development. LEISA is a concept, an approach and a political message.

ILEIA is the Centre for Information on Low External Input and Sustainable Agriculture. ILEIA seeks to promote the adoption of LEISA through the LEISA magazines and other publications. It also maintains a specialised information database and an informative and interactive website on LEISA (**www.leisa.info**). The website provides access to many other sources of information on the development of sustainable agriculture.

24 Good quality seeds from farmers' seed clubs

SEARICE

The Mekong Delta region is the biggest commercial rice production area in Vietnam. To cope with the growing demands for commercial seeds in the region, farmers organised themselves into Farmer Seed Clubs. To date, there are 57 seed clubs, mostly engaged in varietal selection and breeding, seed production and marketing. More than 1000 varieties have been selected and farmers were able to mass-produce seven new rice varieties from breeding or segregating lines. This article describes how, as a result of these efforts, by 2004, over 80 percent of the total seed requirements for rice cultivation in communities reached by the Community Biodiversity Conservation and Development Network Mekong Delta, are supplied by farmers.

30 Towards self-sufficiency in groundnut seed

K. Suresh Kanna

Farmers in the village of Odugampatti, in the southern Indian state of Tamil Nadu, have been implementing a multiplication and exchange system for groundnut seeds since 2001. This was developed in response to the difficulties they faced in accessing good quality groundnut seed. Nowadays, local farmers who enjoy irrigation facilities grow groundnuts for seeds and make these available to other villagers. This way, groundnut farmers in Odugampatti no longer depend on moneylenders for their seeds. Their seasonal expenditure for planting material has been reduced considerably also because of the higher seed quality for groundnuts that local seed growers attain.

DEAR READERS

It is less than three months since we sent out the 2007 Readers' Survey, and we have already received hundreds of replies. These say a lot about our readers, with many opinions about the quality of the magazine and how it is used. These opinions, together with your ideas and suggestions, help us maintain the quality, content and usefulness of the magazine, so we are very happy to receive them. We thank everyone who has sent us the form, and encourage those who haven't done it yet, to do so. Remember that it is also possible to fill and submit the survey online: http://www.leisa.info/?url=magazine-survey.tpl

Similar surveys will also be carried out by ILEIA's partner organisations in the coming months, looking at the quality and impact of the LEISA regional editions. This was one of the agreements reached at the latest International Editors' Meeting, held recently in the Netherlands (see our back cover). This meeting highlighted the opportunities our expanding network has, in terms of producing regional issues of the magazine, and exchanging more information with a wider audience. We are excited about collaborating with our wider network on the Documentation programme (see http://documentation.leisa.info) and the opportunities and benefits this will bring.

We are also encouraged by the larger number of contributions we have been receiving for the latest issues. However, we are always interested in receiving more articles – we feel that these are the basis for maintaining the quality of the magazine. Please send us your stories. We will be happy to provide editorial support.

The Editors

Securing seed supply

Editorial

Seed is the future of agriculture. For farmers it is the most essential input: without good seed they have no chance of a good harvest. This is a simple truth but the implications are far-reaching. For thousands of years, farmers have been relying on their own harvests, selecting grains, storing them, and then using them as seed for the following season. They have been doing the same with potatoes and other vegetatively reproduced crops. By choosing seeds or planting materials that meet the needs of their particular farming conditions, they have, over time, developed local varieties and breeds which are most suited to their specific context and preferences. As a result, for example, there are thousands of rice varieties in South East Asia. Similarly, it is still common for a farmer in the Andes to know more than a hundred different varieties of potatoes and other tubers by name.

Today, however, many farmers have become highly dependent on seeds supplied by external agents, often large seed companies. As an old woman farmer in India expressed it: "The market has taken agriculture out of our hands. Earlier we produced and managed our own seeds, and in this way we decided what to grow and in what combinations. Now our husbands go to the market, they have to see what they can get there. The shop owner gives them seed on credit, and often leaves them little options as to what seed to buy. We have become totally dependent".

Seed as an external input

The situation started changing about fifty years ago, when improved varieties and hybrid seeds became key ingredients of the so-called Green Revolution. Scientists succeeded in producing varieties that gave higher yields, but only if applied in a package, with chemical fertilizers and pesticides, and with sufficient irrigation. Governments actively promoted these packages as a way of achieving national food security. Farmers too initially saw high yielding varieties as the way out of chronic food shortage and poverty.

There is no doubt that food production has substantially increased as a result of such packages and that this has helped several countries, especially in Asia and Latin America, to become more self-reliant in food. However, it soon became clear that high yields could not be maintained. Repeated high doses of fertilizers and pesticides have resulted in degraded soils, increased resistance to pesticides and declining yields. In addition, the Green Revolution bypassed large areas that are not appropriate for these technologies, especially dry and degraded lands with no or little irrigation facilities.

Using externally produced seeds creates dependency in many ways - commercially produced seeds may not always be available, and farmers may have to choose from what traders, seed companies or research institutions have available, or are promoting. This can lead to a gradual loss of biodiversity in the field, which reduces the potential for agriculture to respond to the changing agro-climatic and social conditions, while increasing the production risks. When farmers in some countries did see greater yields with improved rice varieties, and the uptake of these varieties increased, many rice-producing areas effectively became monocropped. This reliance on one variety is very risky, as seen in the Philippines with the outbreak of the brown planthopper, which famously devastated yields as it passed easily from field to field.

Local seed supply systems

There are areas where farmers have maintained their seed supply systems, even in times of severe stress or drought. Indeed, according to some estimates, up to 95 percent of the small scale farmers in some regions still produce and use their own seed, or rely on seed produced by their neighbours or by others in their own village or region (see Rubyogo p. 27). It is clear that a regular seed supply is based largely on farmers' own efforts and on a series of informal contacts and relationships, all of which ensure the necessary planting material for the coming cropping season. Building on local knowledge and abilities, and on the local resources available, these efforts maintain and increase the rich biodiversity in which small-scale agriculture is based.

However, access to reproductive or propagation material for the coming season is increasingly difficult for small scale farmers worldwide. One reason is the prevalence of pests and diseases which, together with decreasing soil fertility rates, lead to lower yields. The resulting food shortages make it difficult to save enough seeds for the next season. At the same time, through increasing migration, or changing social structures, the social cohesion of rural communities is being weakened. This can have a negative effect on the local mechanisms which replace lost planting material, and can put seed supply at risk.

Many farmers feel that they can only be sure of the seed's quality and production potential if they have produced it themselves or if it has been produced locally. This is related to one basic aspect which differentiates seeds from other agricultural inputs: what Badstue (p. 6) calls seeds' "lack of transparency". While it is possible to easily assess some of the characteristics of seeds and planting material (their weight, purity, their not being diseased), it is not possible to know, by merely looking at them, the vigour of the plants that will grow from them or the potential yield. Commercially produced seeds will be certified, to "prove" that the seeds are in fact what they say they are. But these certificates are of little value when seeds are sold after being stored for too long, when information is not provided, not complete or not available. Not surprisingly, when farmers cannot produce their own seed, they will often turn to friends or neighbours as a first choice.

Seeds of change

There are many advantages for farmers, and for the sustainability of small scale farming systems, to using home produced seed. For example, seed companies and breeders often do not consider that farmers may be interested in more than just high yields. Crop by-products are often an important part of a sustainable farming system, for example in feeding livestock, or using leaves or rice husks to improve soils. Farm families may also prefer traditional or local crops or varieties, in terms of taste, cooking or storage properties. Plants grown from locally-produced seeds are generally better adapted to the local environment, especially considering the local soil types and micro-climates of the marginal rural areas.

Articles in this issue, from countries as diverse as Vietnam and Nicaragua, show that local production is very much related to a greater recognition of farmers' roles and, in particular, of the role played by women farmers. Experiences presented here highlight how farmers ensure the provision of planting material for the coming season, while contributing to wider objectives. Ramprasad (p. 20) describes the seed banks set up by the GREEN Foundation, as a model for storing seed and distributing

Photo: GREEN Foundation

Local seed supply: the best seeds are exchanged through a community seed bank.

it to those interested within a village. The SEARICE staff (p. 24) describe the establishment of seed clubs, with members who produce seed on their fields, following common standards and criteria, and then sell it as a group to other villagers. Efforts such as these not only help in making the seed available: they also ensure that farmers are sure of the seeds they are getting.

Simultaneously, these efforts follow other paths towards a more sustainable agriculture: they encourage the use of local varieties, contributing to maintaining and increasing local biodiversity. They also lead to increasing yields, as seen with the work of the Movement for the Promotion of Indigenous Seeds in Sri Lanka. They validate local knowledge as the basis for sustainable production, giving more importance to farmers' preferences and interests. At the same time, by focusing on the production and distribution of seeds at the local level, these efforts facilitate the exchange of information, and they strengthen community ties.

It is equally important to consider farmers' involvement in broader programmes. Private and public entities are increasingly acknowledging the potential and advantages of *in situ* conservation. *In situ* conservation complements gene banks at regional, national or international levels, facilitating the access of farmers to seeds, and "storing" seeds of traditional or of particular varieties for future use. At another level, more and more crop breeding programmes are actively involving farmers in what are now known as Participatory Breeding Programmes, with positive results. These pay special attention to farmers' criteria for a selecting a variety of a given crop (whether this is resistance to pests, overall yields or culinary properties) and to the environment and socio-economic conditions in which these varieties will later be used. Successful programmes have also led to farmers being in charge of breeding and production activities, even if, as shown by Almekinders *et al*. (p. 14), this is not always an easy or straightforward process: commercial seed production requires farmers to comply with complex national regulations.

One size does not fit all

In order to be successful, the different efforts aimed at locally producing and distributing seeds need to be based on the particular context in which they operate. Starting a seed bank may need the support of an external institution, and then of a strong local organisation, together with motivated members. A system like the one described by Kanna (p. 30), through which some farmers provide others with seed, requires that some of them have access to irrigation, so that they can produce the seed in time for when most farmers need to sow it. In some cases, efforts are made to recover traditional varieties or facilitate access to a "new" or different variety, when traditional varieties are no longer adapted to local conditions, or if consumers prefer new varieties.

The main differences between these efforts, however, relate to the seeds themselves. With vegetative reproduction, tubers, vines or plant cuttings can speed up production, but it is more difficult to transport, exchange or to store them, posing extra challenges when trying to secure the supply of reproduction material for the next cropping season. Similarly, the use of botanical seeds may also require special consideration. Seeds of some species cannot be stored for long periods, so special arrangements may be necessary. There are also large differences between seeds of self-pollinated species and those of cross-pollinated plants. A farmer repaying a loan of rice seeds to a seed bank, for example, will return the same material he borrowed, which in turn can be given to another farmer. Greater generational differences in cross-pollinated species will require additional efforts for ensuring a sustainable supply.

Seeds for the future

As the articles in this issue show, the local production and distribution of good quality seeds is an important aspect of LEISA. Traditional seed systems and innovations facilitate diversity that is both functional to farmers and ecologically sound. More important, they enable farmers to be self reliant. However, local seeds are not always the solution. It may be necessary to introduce seed for example, after natural disaster, social/political instability, when existing seed stock is of poor quality, or growing conditions have changed. This should not minimise the role of farmers, what they are already doing or what they can do. Under all circumstances it is better to rely on local systems, on local capacities, abilities and knowledge, and so ensure the possibilities for sustainable production. Participatory breeding programmes based on the principles of social inclusion and biodiversity can be crucial for the survival of farmers and farming. Farmers have a right to seed sovereignty, while their intellectual property rights with regard to breeding need to be respected and safeguarded. One step in this direction would be to change policies to allow for farmers' certification.

A theme not explored here is the controversy about genetically modified (GM) seed, what it means for small farmers and whether it is desirable or justified. In this issue, we made a conscious choice to highlight the many viable alternatives to GM. Widespread introduction of GM seed would most likely further increase small farmers' dependency on external inputs – if they consider GM seeds as an alternative at all. It has already been shown that the introduction of BT cotton has lead to increased use of pesticides rather than the promised decrease.

Localised seed supply systems are not a romantic idea. They may prove to be critical for the survival of small-scale farmers all over the world. They may well become a core ingredient of a strategy to deal with climatic change. How climate change is going to affect agriculture and what the larger consequences will be, remains to be seen. But it is clear that farming systems based on principles of agro-ecological diversity that rely on diversified seed supply systems, will be far more resilient to climatic shocks than those that depend on the limited choices of externally produced seed.

■

The role of trust in the acquisition of seeds

Lone B. Badstue

Seeds are the most important input in all crop-based agriculture and a prerequisite for the majority of the world's food production. They provide the basis for crop improvement, allowing farmers and plant breeders to develop cultivars with high levels of adaptation. Seed management is therefore a central issue for farmers, and a key element in addressing the challenges of responding to farmers' different requirements and preferences, increasing production, and achieving food security.

Although the adoption of improved varieties through the formal seed systems has been significant in large parts of the world, the formal systems' share of total seed supply remains low. Informal farmer-to-farmer seed distribution continues to be the prevailing system of seed supply for small scale farmers in many developing countries. These mechanisms are mostly based on traditional social alliances and family relations, and are based in the context of mutual interdependence and trust. However, despite the fact that farmer-to-farmer seed exchange is widely recognised as an important source of seed for vast numbers of farmers, little is known about how these systems function. This article draws on a recent study carried out in the Central Valleys of Oaxaca, Mexico, a center of maize genetic diversity and domestication, focusing on the importance of social relations in seed transactions and on the central role which trust plays in the acquisition of seeds.

Photo: Author

Planting maize on Catalina's land in Sta. Ana Zegache, Central Valleys of Oaxaca, Mexico.

A general lack of transparency

Farmers require seeds of good quality and with the characteristics they need for their particular agro-ecological conditions and objectives. However, these aspects can be difficult to assess when acquiring the seeds, for seeds are not "transparent". In other words; it is impossible to know the traits and the performance of the plants that will grow from a particular bagful of seed merely by looking at it. This will only be known when the seed is planted and the crop develops. Seed quality is made up of a range of factors and can be difficult to judge, in particular the seed's ability to germinate. Age, pathogens, or inappropriate storage may affect germination, but these factors are not necessarily visible to the human eye. This principle also applies to other types of planting material, such as tubers and cuttings. It is possible to determine that the material in question is banana, yucca or potato, but the amount of information you can get by visual inspection of the tuber or cutting is limited. Beyond colour, size and possible damage by insects or pathogens, you cannot know the specific characteristics of the plant that will grow from it, or its ability to perform under a particular environment.

Lack of transparency is further influenced by the many environmental factors which determine crop performance. This is especially relevant in open pollinated species which display greater variation from one generation to the next (in contrast to plants growing from tubers or cuttings, or self-pollinating species). Maize, for example, exhibits what plant breeders call a high genotype-by-environment interaction, meaning that its performance across different agro-ecological environments depends on its specific genetic make-up. In other words, a genotype or maize variety, which performs well in one environment, may not do so in another.

As a result, even though they may inspect the seed before obtaining it, farmers therefore depend largely on the quality of the information offered by the seed provider with regards to traits and consumption characteristics, environmental adaptation, and seed quality.

Trust in your own seed

Among the traditional farmers in the Central Valleys of Oaxaca, selecting and saving seed from their own maize harvest is by far the most common way of obtaining seed for the next planting season. There are many reasons for this, but one of the first things farmers mention when talking about maize seed practices is "confidence" or "trust" in their own maize. This refers to the farmers' notion of trust in the seed they have selected themselves. That is, the belief that the plants germinating from this seed will live up to a certain standard under the particular production conditions on the farmers' land.

These concerns are also reflected in a broader sense in local seed management practices. Farmers choose maize varieties according to characteristics they need, knowing the performance of the plants that the seed came from under particular agro-

ecological and management conditions. For social, cultural and agro-ecological reasons, a variety that may be appropriate for one farmer is not necessarily appropriate for another. By using seed that a farmer knows and trusts, the risk of crop failure is minimised. Hence, what better option is there to suit your own needs and preferences and to minimise risk, than to use the seed that you know and select yourself? The farmer knows the characteristics of the maize in question, as well as its management and performance under the particular circumstances where it was cultivated. She also knows exactly when and how the seed was selected, and how it was stored. Even the consumption related characteristics of that particular maize are usually well known by the farmer's household.

Finally, the ability to select and save maize seed from one season to the next is highly valued by small-holders in this region, and is part of what constitutes the local notion of a good farmer (while seed loss appears to be associated with a certain stigma). Nevertheless, there are also other times when farmers look purposefully for external seeds. For example, when the harvest is poor or seed losses have occurred during storage; when the family has used the seed for consumption or sold it all to cover other needs more urgent at the time, or simply, as is often the case, when they wish to try other kinds of maize.

Photo: Author

Cutberto and his family have a break from working in their maize fields.

Acquiring maize seed from other sources

Other farmers, market vendors or the agro-veterinary stockists in the larger regional centres, are alternative sources of seed. However, due to the lack of transparency, seed obtained from these sources will always be accompanied by a lack of adequate information.

Broadly, farmers in the Central Valleys of Oaxaca express general trust in their fellow villagers. Although each individual may have stronger feelings of trust (or distrust) towards certain people in particular, many find it inconceivable that other farmers from the same community would knowingly provide them with low quality seed. For instance, over the years, Cutberto has planted various different types of local maize landraces. Like most farmers in the area, he saves seed every year of the maize varieties he wants to keep. He has never bought seed at the market. Instead, whenever he has tried out a new maize variety, he has acquired seed from other farmers in the community. Explaining his preference for obtaining seed locally, Cutberto says: "How can I sell you something that doesn't work? Next moment, you'll be back to complain or to ask me why I sold you bad seed!" Transactions in the marketplace are different: "There, there is nowhere to complain! Even if you remembered who sold it to you – how are you going to find him? And as you see what you buy, the guy who sold it can say that he is not to blame. Here, if I sell them something that doesn't work, they will complain!" Most other farmers share his view, considering that in the city "it is much more commercial". A large number of vendors on weekly market days are in fact farmers who travel to the market to sell their produce. "They are there to sell. And as soon as they finish, they are off."

Farmers like Cutberto clearly feel it is much more risky to buy seed in a shop or at one of the regional marketplaces, than to get it locally in the community where people by and large know each other, and will have to live with the consequences. In the situation where no previous relations exist between the seed provider and the buyer, the farmer has to rely on the information provided by the seed vendor. Some farmers realise that vendors will not want to be seen as untrustworthy, and assume that he or she will therefore behave in a trustworthy manner. Still, traditional smallholders in the Central Valleys of Oaxaca have very little trust in market vendors and shopkeepers in the nearby market towns and the city of Oaxaca, and they tend to be suspicious about the motives of the vendors. They have little confidence both in the information about the seed provided by the vendors, and in the quality of the seed (see Box). Farmers know that, if there is any problem, they will be told that they did not sow properly, or that their fields were not irrigated on time.

When buying (certified) maize seed from agro-veterinary stockists or (farm-produced) maize seed from market vendors, farmers perceive a greater lack of transparency and information than when acquiring maize seed from other farmers. If seed is bought from an agro-veterinary stockist or from a market vendor, and the crop fails despite "normal" weather conditions, this will very likely be blamed on the seed source. Although a governmental system controlling the quality of formal sector seed exists in Mexico, there are no mechanisms controlling the sale of expired seed at the retail level. Also, small quantities of

A farmers' experience

Catalina's experience buying maize seed at the market illustrates farmers' doubts with regard to acquiring seed from unknown sources. "I felt like trying out the type of [maize] seed from San Martín" she recalls. "It wasn't that I had lost my own seed; it wasn't that I didn't have seed, mind you. I felt like trying this round, fat maize that they have. But I got so mad! I bought the *palomilla* (grain moth)! It was in the market in Ocotlán, where people come to sell their goods. That's where I got it. The seed looked good and I took it home and left it in its bag. When I was ready to plant I opened the bag, and a cloud of *palomilla* came out! And by then it had contaminated the whole house! It was full of *palomilla*! I still planted the seed, but only a few germinated!"

certified maize seed being sold are usually weighed out of a big sack, and are not accompanied by information about the seed, unless the seller volunteers verbal information.

Though it is difficult on this basis to judge whether farmers' doubts and suspicions are justified or not, the point here is that farmers perceive the formal seed sector and other non-local seed sources as less trustworthy and as such also more risky. These farmers therefore prefer seed providers whom they consider to be trustworthy persons; a concept, which may refer to different categories of people, including kin, friends or acquaintances the speaker knows and trusts.

The role of relations of trust and reciprocity

The most important form of trust at work in the farmer-to-farmer seed exchanges in the Central Valleys of Oaxaca is reciprocal trust. This refers to interactions in which trust is mutual or two-way and may be based on interest, feelings of affection, responsibility or shared values. Oaxacan popular culture has a strong tradition of reciprocity and mutual help, principles that remain a significant characteristic of social life despite rapid social change in recent times. This is evident most of all among family members and close relationships (such as between *compadres*), but also in the various village life institutions in which everyone is expected to contribute his or her share. To a certain extent, this is also reflected in local maize seed transactions – more often than not, exchanging seed is just one of several kinds of exchanges taking place between the two parties, thereby forming part of a diverse flow of favours, services and mutual considerations. Social networks and personal relations with different people can help make life easier and provide relief, for example, when emergencies arise, or when new maize seed must be obtained.

For those who cannot pay for the seed with money and therefore depend on negotiating another type of transaction (such as borrowing or exchanging for grains), it is also important that the seed provider is someone they feel confident to approach and who is likely to grant their request. This consideration is linked to a local notion of what it means to be "a good farmer", which besides being skilful and observing local customs also includes issues such as personal integrity, independence and the ability to look after the family's needs. Sometimes it can cause awkwardness or embarrassment when farmers find themselves in a situation where they must ask others for help. This is especially the case when the item needed is as crucial to livelihoods as seed is to a farmer.

Within a trust relationship, it is possible to ask for seed in a relatively relaxed and open manner, and most farmers explain that when they need seed, their first choice is to go to people they feel very confident with. Furthermore, farmers often know the maize types cultivated by close friends and family, and it is generally very easy to obtain reliable information about these maize types as part of ordinary social life.

The significance of trust and reciprocity is also seen when considering which farmers have trouble acquiring maize seed. Most people say that farmers who have no money and who have no relatives or other close relations who are able to help them out, experience the most difficulty. This confirms that reciprocal trust relations are very important when obtaining seeds, particularly if the farmer does not have the means to buy them.

As a closing remark it should be emphasised that a smaller part of maize seed transactions in the Central Valleys of Oaxaca do take place at the market, in other words, not with other farmers from the same community. Like farmers elsewhere, many farmers in the Central Valleys enjoy trying out new and different kinds of maize. At the marketplace, where people come from near and far to sell their produce, different kinds of maize can be found and often attract farmers' attention. In addition, as pointed out by a female farmer, obtaining seed at the market is an easy alternative if you want to avoid the consequences of getting seed from other farmers in the community, such as the norm of reciprocity, the feeling of "indebtedness" or the "stigma" of seed loss. The seed from such sources, with low levels of trust, are almost always planted in small plots to minimise the risk of crop failure.

Photo: Author

Taking a look at the harvest: good results are evident.

The central role of trust in local seed acquisition has important implications for the question of how to convey relevant information about seed and other technologies to farmers in a straight-forward and trustworthy way. The fact that farmers are interested in experimenting and learning about different crop varieties despite the perceived risks involved, presents an opportunity concerning the development of crop genetic diversity and introducing improved varieties or other forms of formal seed sector development in the region. ■

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Local multiplication to ensure timely planting

Hideliza de Chavez, Lorna Sister, Irene Adion, Rizalina Tablarin and Dindo M. Campilan

As sweet potato is a major cash crop in Central Luzon, the Philippines, demand for planting material is always high. In the lowland plains of the Tarlac province, however, most fields become flooded during the rainy season, which, after the harvest of the sweet potato roots, kills all plants. This makes it impossible for farmers to use vines from these plants as planting material for the next season. Differences in the agro-climatic conditions in Central Luzon have resulted in different yet complementary growing seasons. Sweet potato is grown from May to July in the uplands of Bataan province, and from September to December in the vast lowlands of the Tarlac province. This means that the harvest time in Bataan happens at just about the time that farmers from Tarlac are in need of planting material. This has given rise to a flow of sweet potato planting materials across Central Luzon.

Accessing planting material

A hectare of land planted with sweet potato requires about 50 000 vine cuttings. If a farmer from Tarlac has to buy all this planting material it would cost approximately 11 500 Philippine pesos (US$ 230). Over recent decades, farmers from both provinces have developed a practice which substantially reduces the cost of the planting material needed for the entire production area. Individual farmers obtain only a small portion of the entire planting material required, from the Bataan region. They then multiply these cuttings over a period of two to three months, in small field plots known locally as *palakay*, until they have enough planting material for their needs.

The following scenario is typical: sweet potato farmers in Tarlac purchase vine cuttings from Bataan for planting on a *palakay* field (12 500 cuttings for a quarter of a hectare at a cost of about US$ 58). A *palakay* area is selected which is close to a water source but not prone to floods. The vines obtained from Bataan are planted in the *palakay*. Vegetative planting material is collected from this field only after the sweet potato plants have started root formation, or about 30 days later. This also allows the farmers, at a later stage, to harvest sweet potato roots from the *palakay*. Depending on the total size of a farmer's sweet potato production area, cuttings from the *palakay* are collected at intervals of 15 days, until all the fields meant for sweet potato production are planted. Meanwhile, farmers can harvest sweet potato roots from the *palakay* 75 to 90 days after planting. During this time, the price of fresh roots is relatively high.

Photo: UPWARD

Farmers from Tarlac select only the best planting material from sweet potato producers in the Bataan region.

Maintaining seed quality

A very important aspect of this exchange system for sweet potato planting material between two different regions is that there is opportunity to maintain quality through appropriate selection. First, the commercial sweet potato producers in Tarlac travel to the fields in Bataan to select and harvest the cuttings themselves. They select the best plants in the best fields as mother plants. No vine cuttings are collected from farms with plants showing symptoms of virus infection. In collecting the planting materials, these experienced farmers also have specific selection criteria, such as the size or diameter of the stem or vine, greenness of foliage, spread and appearance of leaves, texture of vines and distance of internodes. They also have their own typical collection practices where, for instance, they only take cuttings from the primary vines of a plant and avoid vines with hairy structures.

After multiplying the selected vines from Bataan in the *palakay*, a second stage of selecting cuttings is done prior to planting in the root production fields. Poor quality plants are discarded and most of the selection criteria already mentioned are applied again. For planting in the main fields, farmers also prefer vines of at least 30 centimetres long; they think that shorter vines have softer stems and therefore have low tolerance to drought and heat, conditions commonly experienced in Central Luzon. Moreover, farmers prefer collecting cuttings from the *palakay* not later than 75 days after planting since they believe that older mother plants are more susceptible to diseases and often even carriers of pests and disease. This practice has allowed farmers to eliminate possible sources of disease and abnormality, despite the continuous use of vegetative planting materials from the same source for over 50 years.

Continuing challenges

The International Potato Center (CIP), through its Users' Perspectives with Agricultural Research and Development (UPWARD) programme, has learned from such sustainable practices developed by small farmers in Central Luzon and now works with local partners to enhance farmers' management of varietal diversity and production of planting materials. The Tarlac College of Agriculture, the regional Department of Agriculture and the University of the Philippines Los Baños are leading inter-institutional efforts to address specific needs and opportunities. These include providing a virus-free source of planting materials through tissue-cultured mother plants, and large-scale production of planting materials to meet increased demand for sweet potato roots from commercial companies. Sweet potato has become a major ingredient in commercial animal feed products, leading to rapid expansion in the crop's cultivation. A major commercial company is now engaged in a contract-growing arrangement with sweet potato farmers. To meet increased demand for planting materials, the company has also contracted local farmers' co-operatives and groups to produce adequate volumes of planting materials derived from tissue-cultured mother plants. ■

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Selecting the best plants to improve seed potato

Peter Gildemacher, Paul Demo, Peter Kinyae, Moses Nyongesa and Pauline Mundia

Photo: Peter Gildemacher

Before positive selection techniques were introduced, potato plants in farmers' fields often showed multiple symptoms of infection by viruses and bacteria.

The potato is an important food crop in the highlands of Kenya. It is mostly grown in agro-ecological zones more than 1500 metres above sea level, where population density and pressure on agricultural land is high. Potatoes are used for local consumption and are sold in rural and urban markets. A major problem in smallholder potato production in Kenya is that many seed potatoes, the material for planting a new season's crop, carry viruses and/or bacteria. In the growing plants, these viruses and bacteria can cause wilt, which leads to lower yields. In the past, interventions to tackle this problem have focussed on specialised commercial seed producers who make healthy seed potatoes available. These are purchased mostly by the large-scale potato farmers. This approach, therefore, has had a very limited impact on the quality of seed potato used by smallholder potato farmers. As a result, high quality seed potatoes are not easily available to small scale farmers. Varieties released by research centres are made available only in limited amounts and are expensive. Therefore, the majority of farmers continue using seed potatoes which they save from their last crop. When they do not have enough seed from their own crop, they may buy seed from neighbours. Alternatively, farmers may plant potatoes that they buy on the market, which were sold for consumption rather than seed.

Build-up of diseases

The main problem with re-using vegetative planting material year after year is the build-up of virus diseases: in potatoes, these are transmitted through the tubers. Potato farmers in Kenya only renew their planting material, on average, once every six seasons. It is estimated that only four percent of all seed potato planted during a season comes from specialised seed growers. A recent survey of seed potatoes, sold in rural markets in the main potato areas in Kenya, showed that less than one percent of all seed checked was virus free. Potato Leaf Roll Virus and Potato Virus Y, which are the viruses causing the most serious yield losses, were found in over 70 percent of the seed tubers sampled in this survey. Considering this, it is clear that a completely different approach in potato production systems is required. Instead of focussing on upgrading the quality of planting material through specialised seed growers and on improving the poorly developed seed markets alone, attention should also be paid to enhancing the quality of farmer-saved seed potatoes. As the latter accounts for 96 percent of the potatoes planted in Kenya, any improvement in the quality and vigour of home produced seed would have a tremendous impact on crop production.

Positive selection

A few years ago, a technique known as "positive selection" was suggested by the International Potato Center (CIP) as a possible option for increasing the vigour of smallholders' seed potato. Positive selection means selecting only the healthy-looking mother plants, showing good production characteristics, for seed collection. Positive selection is well known for both increasing and maintaining seed quality in cross pollinating crops that are reproduced through botanical seed. This technique has resulted in landraces of many crops that are well adapted to the circumstances under which they are selected. In potato farming, however, positive selection will not result in new landraces, as it is vegetatively propagated, but it can help in fighting crop degeneration caused by seed borne diseases.

In 2004 and 2005, positive selection was successfully pilot-tested in Kenya by smallholder potato growers in Narok district. Over the next two years, CIP, in collaboration with the Kenya Agricultural Research Institute (KARI) and the Ministry of Agriculture, trained over 100 extension agents and farmer-trainers on all aspects of positive selection, including broadening their background knowledge on potato pest and disease management. "The training was a real eye-opener, we never knew that most of our potato plants were sick" said Michael Macharia, who was trained in May 2005. "This technology responds directly to the needs of our potato farmers because they have no access to clean seed."

Introduction to farmers

After this training, plans were set in motion to introduce the positive selection technique to farmers. The extension agents and farmer-trainers in turn worked with more than 70 farmer groups involving some 1200 farmers. A participatory research approach was used, where a demonstration experiment formed the core of the training curriculum. The potato field was the classroom, learning by doing was the mode of teaching, and group interaction was considered crucial for building knowledge.

With the single focus of improving the quality of seed potatoes, farmer groups would meet regularly during two subsequent cropping seasons, for a total of eight training sessions. Groups of farmers are first shown how to distinguish between sick and healthy plants in a potato field. This field is then divided into two plots. On one of these plots, healthy looking plants are pegged just before flowering, and then checked again for health and vigour two weeks later. Potato plants that are still pegged after this second check are harvested one by one, and only those plants with a satisfactory number, size and quality of tubers are

maintained as mother plants for seed. In the other plot, seed potatoes are selected following the common farmer practice. In the next season, tubers from both selection methods are planted separately in a farmer managed trial and farmers score the disease incidences in both plots. After holding a field day to demonstrate the positive selection technology to other farmers, the potatoes in the experiment are harvested and the results are analysed by the group.

Promising results

Potato yield from these trials increased, on average, by 28 percent. The positive selection method yielded an average of 14.2 t/ha, compared to 11.8 tonnes per hectare using seed potatoes selected the way farmers commonly do. A lower incidence of virus and bacterial wilt symptoms on plants was visible in the plots with positive selection, compared to the plot where the common farmer selection practice was used.

Two years after the first training, a survey showed that over a quarter of the farmers trained have adopted the positive selection method on their farm. These farmers claim to have more than doubled their yields since they were introduced to this technique: "I have done positive selection for three seasons and it has doubled my yields. I expect to harvest 20 bags of potatoes from this 1000 m^2 plot (corresponding to about 22 t/ha). Fellow farmers are now coming to me to buy seed potatoes as they have seen it is better than what they have. My last crop looked so good that thieves came during the night to harvest…." recounts Mr. Wainaina Njoroge, a member of the Pagima Farmers Group in Naivasha district. A researcher from KARI's national potato research centre in Tigoni, Limuru, adds: "We have indeed witnessed several cases of theft from fields where farmers had planted seed following the positive selection process. This is of course not nice, but it is maybe a good indicator that the results of this selection method are appreciated by many".

Some farmers who have now practised positive selection continuously for several seasons have observed that there are progressively less sick plants in their fields. As a result of the positive selection most plants look healthy after some selection cycles and at that stage it becomes easier to peg the unhealthy looking plants instead. The tubers harvested from these plants can then be used for own consumption, or sold on the market. Some farmers went even further than this and decided to remove the few sick plants as a possible source of infection.

Prospects for scaling up

The Kenyan potato farmers participating in this programme have shown that positive selection makes a valuable addition to commercial production of seed potatoes, in fighting declining yields that are attributed to low seed quality. The training programme has improved farmers' awareness about seed potato degeneration as a result of viruses. The participating farmers also know more about bacterial wilt management and other agronomic practices that can lead to improved yields.

Potato farmers can now choose to either buy commercial seed potatoes or practise positive selection. Although the positive selection technique does not require any cash investments, it does require an extra five days of labour per hectare of potatoes. For the more commercially oriented farmers it may, therefore, still be more lucrative to invest in commercial seeds. Many smallholder farmers, however, find it better to put some extra time into selecting their planting material, than buying seed potatoes. Eventually, small farmers should find a balance between renewing their planting material once in a while (by obtaining it from a reliable commercial source) and keeping the quality of their seed potatoes high through positive selection.

The positive selection training programme in Kenya was evaluated and improved based on comments from the participating farmers, farmer-trainers and extension workers. CIP has published a manual on the positive selection technique for trainers, a picture book on potato diseases for use by the trainer in the field and a farmer leaflet in English. The farmer leaflet has limited text and is thus very suitable for translation into local languages. CIP also hopes to translate other publications so that they are available for facilitating the training of smallholder potato farmers on this low input technology in non English speaking countries.

Photo: Peter Gildemacher

For positive selection of mother plants, farmers look for vigorous plants in their fields and pinpoint these using pegs or stakes.

At the same time, CIP is studying the approach of developing the positive selection technique with farmers, assessing its potential for addressing the problem of low quality seed potatoes in other countries. Trials are currently being done with farmers in Ethiopia, Uganda, Peru and India and the technique is also being promoted in Mozambique and Malawi. ■

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Higher yields and income with disease resistant coffee clones

Hudson Gabriel Lebi

The lowlands of the Isangati division, in Mbeya district, southern Tanzania, enjoy ideal climatic conditions for coffee production. Grown here, at about 1600 metres above sea level, coffee is a cash crop which, since it was introduced after independence, has gradually replaced crops such as millet, sorghum or sweet potatoes, benefiting farmers in the whole region. Yields, however, are low. One of the main reasons for this is the high incidence of two diseases, which together contribute to more than 50 percent of yield loss: Coffee Berry Disease (CBD) and Coffee Leaf Rust (CLR). The use of fungicides is expensive and not always successful, while local alternatives such as the use of plant extracts of Tephrosia have worked well, but not over a long period of time.

Trying out resistant varieties

Ten years ago, various organisations decided to try a different approach, looking for and promoting the use of resistant varieties. Under the FARMESA framework (Farm-level Applied Research Methods in Eastern and Southern Africa), an agreement was signed between the Agricultural Research Institute in Uyole and the Isangati project (later formally registered as the Isangati Agricultural Development Organization, IADO, a local NGO). Activities started by identifying villages which were interested in hosting on-farm trials, together with a series of awareness-raising meetings with farmers and the population in general. Special conditions were set for selecting the fields for the trials: they had to be close to fields infested with CBD and CLR, they had to be managed by a farmer and his family, and had to be easy accessible. Each family was to be responsible for the preparation and management of the plantation.

Seedlings of nine different varieties resistant to CBD and CLR were collected from the Tanzania Coffee Research Institute, TACRI, and were only identified as coded clones (SC2, SC3, SC4, SC7, SC11, SC12, SC13, SC14 and SC16). These were distributed among 18 farmers who met the conditions for the field trials, in nine different villages, and were planted in January 1999. Evaluations were carried out every three months, taking into account a set of criteria developed by the farmers themselves: plant height, physical appearance and vigour, and resistance to CBD and CLR. Over a four year period, the performance of the clones was compared with that of the existing local varieties.

The 18 participant farmers harvested the first coffee berries from the trial plots during the second half of 2003, and these were all processed by the farmers themselves to obtain dried parchment coffee. On average, these plants yielded 1 kg of dried parchment coffee per tree, roughly twice as much as the yields of the local varieties. All plants showed vigorous growth, a good branching pattern, and the capacity to bear fruits within three to four years. And although all nine clones were resistant to CBD and CLR, farmers could identify and select the best ones, as they had been observing them closely over four years. Considering the different criteria, all farmers agreed that the best clones were SC3, SC4, SC7 and SC11. Additional evaluations were made later, hoping these clones would meet an additional set of criteria: those set by consumers. Parchment coffee was therefore sent to the Mbozi Coffee Curing Company (the factory owned by the Tanzania Coffee Board) for cup taste. All four clones selected by farmers were approved fit for consumption.

A series of feedback meetings were then organised with the farmer groups involved in the process, discussing the advantages of these new varieties and the need to multiply the material they had at hand. Farmers expressed the importance of preserving the genetic qualities which these plants had shown; recognising that this is more difficult when using harvested botanical seeds, due to cross pollination. Therefore, it was agreed to try clonal replication on a larger scale.

Cloning and multiplication of seedlings

The Isangati Agricultural Development Organization selected three of its extension officers to monitor the process. To prepare them for this task, they were trained for two weeks at TACRI's headquarters in Lymungo. Back in Isangati, their first role was to identify a field fit for the multiplication of the seedlings. Having compared the advantages of the different areas, the organisation chose and acquired a plot in Shizungo, a village in Isuto ward. This was provided with the necessary infrastructure, including a materials preparation unit, a vegetative propagation unit and storage unit. At the same time, these extension officers, in co-ordination with the farmers who had been in charge of the trials, prepared the parental stock for the multiplication process, selecting cuttings from the on-farm trials. These were planted in small propagation boxes, and later transferred to the field.

Photo: Karen Hampson

Selecting the best material is the first step in a successful cloning process.

IADO carried on organising meetings with farmers and other stakeholders, reporting on the progress being made with the propagation of the selected clones, and promoting the use of resistant varieties as an effective way of increasing yields. Contact was also maintained with TACRI, the Tanzania Coffee Research Institute, whose representatives visited the field in Shizungo. Impressed by the results achieved, they offered to continue providing backstopping to the whole project, together with an additional training course for two extension officers, and 700 seedlings of the selected varieties to speed up the multiplication process. Management of the plantation also served as part of IADO's broader programme: aiming at the sustainability of the process, the organisation started training four farmers groups in it, later facilitating the establishment and management of coffee clonal gardens in their localities. This has followed the Farmer Field School approach, and included a visit to TACRI.

Following a decision agreed on by farmers, extension agents and researchers, the cloning process does not now make distinctions between the four selected varieties. On the one hand, this means it will not be possible to continue evaluating the yields or response to disease attacks of individual varieties in the future. In production terms, however, it is preferred to have a mix of plants instead of a completely uniform field. This is particularly important with a reproduction process which produces genetically identical plants.

General results

At the moment, the field in Shizungo has 812 "mother bushes", from which stem cuttings are already being harvested. By the end of 2006, over 7000 cuttings had been planted in the reproduction boxes, of which more than 1000 were ready to be sold. At a price of 100 shillings per seedling (approximately US$ 0.08), this represents a relatively good income. The problem which those in charge are facing now is that the demand from farmers in Isangati and beyond is far larger than the existing supply. This has strongly motivated the four farmer groups to produce their own seedlings, adding to the overall motivation of obtaining higher yields.

This high demand shows how much farmers value resistant varieties as a way of reducing production costs and increasing yields. Seedlings are available in their own villages and at a reasonable price. Although it will be some time before these seedlings produce berries, and replacing the old varieties also costs money and time, planting the new resistant seedlings is, on the whole, a cost-effective practice. Existing demand for the new seedlings also highlights the benefits of involving all farmers throughout the process, and is a direct result of the effort IADO has put into information exchange among all stakeholders.

During various feedback sessions, farmers agreed that using resistant varieties has many advantages, and through cloning these varieties, more farmers can benefit. By reproducing a plant vegetatively, farmers are sure of what they get, and know exactly how each new seedling will respond to CBD, CLR or to other problems. Having had the trials on farms in their own region, farmers know exactly how the future plantations will look like under their own farming conditions.

These sessions, however, also reported some of the difficulties in the whole process. First of all, farmers referred to the expertise needed for cloning plants, and the quality standards which need to be met throughout the process in order to guarantee good results. Without aseptic conditions, for example, cuttings will generate fewer healthy seedlings, so specific training may be needed for setting up or managing nurseries. Furthermore, the whole process takes time, especially if it also includes a thorough evaluation of different varieties. An additional disadvantage in Isangati was that not much parental material was available, and that the backstopping organisation, TACRI, is based on the other side of the country, more than 1000 km away.

Nevertheless, the benefits of working in association with TACRI and with the Agricultural Research Institute have been clear. Seedlings of resistant varieties are being produced and distributed among farmers in the area, following a process in which farmers themselves are active participants. This has resulted in increased knowledge and confidence and, as some farmers are already witnessing, in increased yields. This may become even clearer in the near future, when the seedlings being planted now start producing. With some of the seedlings being sold, an additional income source is now available to some farmers. The challenge for IADO and the coffee farmers in Isangati now, is to continue to improve production and marketing processes. ■

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Photo: Conny Almekinders

Seed producer José Manuel in his bean field.

New bean seeds and the struggle for their dissemination

Conny Almekinders, Eduardo Aguilar and Rolando Herrera

Pueblo Nuevo and Condega are two small villages in the mountainous province of Segovia in northern Nicaragua, not far from the border with Honduras. This region has always been an important bean and maize producing area, although the cultivation of tobacco and tomato picked up after 1990, providing farmers with a cash income. Increased cultivation of these crops resulted in a serious increase of white fly populations (*Bemisia tabaci*), generally controlled with pesticides. These insects, however, soon became resistant to the pesticides commonly used, leading to a higher incidence of viruses in these and other crops. Widespread presence of the Golden Mosaic Virus (GMV) made it impossible to grow beans in the lower parts of the region. The local beans did not show any resistance to the virus, and only a modern variety ('DOR 364') could be planted. Developed by CIAT in Colombia and formally released in Nicaragua and other countries between 1990 and 1993, 'DOR 364' has a dark-black colour and does not have the culinary and commercial qualities of the light-red local bean varieties. As beans are one of the most important food crops in Central America, farmers in these villages were facing the serious problem of having to purchase them to feed the family.

This was the situation in 1999, when a pilot project on Participatory Plant Breeding was proposed by the *Centro para la Promoción, la Investigacion y el Desarollo Rural y Social* (CIPRES), a Managua-based NGO with an office in Pueblo Nuevo. Although the farmers had little clue of what they were embarking on, they were very interested in this initiative because the beans they were planting did not yield well. The support of CIPRES and the involvement of a bean breeder from the National Agricultural Research Institute (INTA) convinced a group of 42 farmers to take part in this initiative that aimed to develop new bean varieties that would fit their ecological conditions and their own specific demands.

Developing a new variety

It was originally planned that farmers would identify a local variety that would be crossed with a variety "improved" by a bean breeder, and that, through selection, they would then develop a bean variety with the characteristics they preferred. But one of the first problems the project faced was that there were no seeds readily available that they could work with. This meant that at least a year would be necessary to produce the desired seeds with which the project could really start. The group of farmers, the NGO technician and the breeder agreed to run a pre-trial with some crosses of which the bean breeder had enough seed. They decided that five of the farmers would host the trials. The farms of those five farmers represented the variation in growing conditions in the area, ranging from the relative warm and dry valley areas at 600 m above sea level to the cooler and wetter mountainous parts at 1000 m above sea level. These five farmers started by planting 15 rows with seeds from 15 different progenies (or plant "families"). Thereafter, together with the breeder and taking into account the preferences of the other 40 farmers involved in the project, the five farmer-breeders selected seeds for their next planting.

This part of the process lasted two years, considering that self-pollinating species segregate (or produce seeds of varying genetic makeup) approximately six generations after crossing. At first, the farmers selected the families with the best looking and most resistant plants, and eliminated the progenies that did not show good overall resistance to GMV. From the progenies that did show good resistance, they selected seeds from the plants with an attractive architecture, and a good number of pods per plants and seeds per pod. Other important criteria for selection were plant growth and seed filling capacity in their drought stressed environment. Yield and grain size and colour were the selection criteria used during harvest. In the later plantings they selected the best families, while removing all the plants susceptible to GMV from these families. One could say that, in this way, each of the five farmer-breeders was running a small breeding program. They planted twice a year on average, applied hardly any fertilizer, but did irrigate (so as not to risk the loss of the experiments to drought). Although the five farmers took the group's criteria into consideration, their final selection very much reflected their personal preferences for plant type, pod load and seed filling performance. For example, one farmer was very keen to select beans that would still give him reasonably well-filled seeds even if the rains stopped early. Another farmer emphasised the ability of plants to remain standing after the torrential rains which typically follow short intense drought periods. After five plantings, each farmer had selected the seeds which performed best in his fields, and ended up with his own "champion" variety.

These "champion" varieties were then planted in a series of trials for comparison. The first round of comparisons consisted of a trial on each farmer's land. This meant that for the first time, they could compare their "champion" variety with the other four "champions" on their own farm. These trials showed how much the selections of the five farmers differed, despite the fact that they had all started with the same seed. Planting was "blind", meaning that there were no labels to indicate which variety was whose, although the farmer-breeders found it easy to recognise their own variety without any doubt. The results of the joint evaluation, involving the 40 other farmers as well, showed that these seeds were better than the varieties commonly used (see Table 1).

What followed was a total of 48 evaluation trials, run in collaboration with the breeder and the CIPRES technicians. Seeds were planted in the second planting season (*postrera*) of 2002 and the first season (*primera*) of 2003. Based on these results, the farmers decided against selecting only one champion variety. They preferred to select two varieties for further seed multiplication: one that did best in the lower, drier areas and one that excelled at higher elevations. The farmers who selected them named them 'Pueblo Nuevo JM 12.7' and 'Santa Elena'. Farmers selected these varieties for their overall performance: they do well at low soil fertility levels, show a good resistance to Golden Mosaic Virus, are drought tolerant and are of a well-liked red colour. 'Pueblo Nuevo JM 12.7' is especially liked because of its culinary qualities. The farmers' aim was to distribute seeds of these varieties to other farmers and also to try to earn some cash income by selling the seed.

Registration and commercialisation of the seed

The commercialisation of their two "champion" varieties in the formal market meant following the official regulations, which start with an obligatory registration of the variety. This requires data on the performance of the genetic materials along with morphological descriptors, all of which was available from the 48 verification trials. But the farmers soon realised that presenting the data was not enough: they also needed to have a legal set-up under which the varieties could be registered. With the support of CIPRES, the farmers organised themselves into a co-operative, COSENUP. This co-operative was founded in 2004 with 42 members, with the specific aim of controlling the quality of the seed and of commercialising it. In anticipation of the registration, the bean varieties were informally "launched" in a big celebration held in October 2004 in Pueblo Nuevo. The news reached the local radio and newspaper.

But this is where the process got stuck. Seed laws and their implications are difficult to understand, especially for a new and small organisation like COSENUP. In addition, there is the difficulty of maintaining the variety. The "owner" of a variety is responsible for maintaining genetically pure, basic seed. Although the farmers are convinced that they can maintain the two new varieties, not everybody else shares this view. Additionally, the registration and the maintenance of pure seed implies yearly costs in visits to the fields by officers of the ministry of agriculture (which can cost up to US$ 300 per year), as well as in inputs and infrastructure (like a storage facility to keep the seed) that are the responsibility of the "owner".

All together, this created a hazy picture that was not easily understood by the farmers and technicians. It was not quite

Table 1. Yield (kg/ha) of the five best families of beans selected by five farmer breeders in evaluation trials on their farm.

			Origin of the material (farmer)					
Farmer	**Location of planting**		**Juan García**	**Jose M. González**	**Pedro Gómez**	**Santos L. Merlo**	**Jairo Videa**	**Test variety**
Juan García	Santa Rosa	850 m	2005	1551	(#) 2717	2069	2127	1875
Jose M. González	Paso Hondo	630 m	969	(#) 2522	2134	2134	2263	1616
Pedro Gómez	La Lima	1000 m	969	839	(#) 1948	1098	1164	1551
Santos L. Merlo	El Rosario	650 m	1035	1016	1180	(#) 1722	1275	1057
Jairo Videa	Rio Abajo	600 m	2328	1616	1357	1482	(#) 2522	2269

(#) The selection with the highest yield in the trial

clear what information was missing and what was the next thing to do, nor who was going to do what. COSENUP farmers multiplied the seed for several seasons and in January 2005 they had a commercial volume of seeds of both varieties. But apart from selling seed to an NGO that planned to distribute it for evaluation trials in the south of Nicaragua, nobody has shown major interest in buying their seed. Of course, there has been interest from neighbouring farmers and family members, but the COSENUP farmers feel they cannot charge neighbours and friends commercial prices for the seed. So, in these cases they give or exchange seed. Apparently, one of the factors that discouraged farmers in other villages from buying seed was a government seed distribution programme which provided seed for free. As a result, the investments made by COSENUP and the farmer-breeders for the construction of silos to store the seed have so far not paid off. Farmers also invested time, energy and land in developing the varieties, and the lack of interest for their varieties is discouraging. This represents a dilemma: formal commercialisation of a new variety is not legal without an expensive registration process, while it is difficult from the beginning to know the potential demand for their seed. More than two years after the informal launching of the two new bean varieties, the National Seed Council (CONASEM) has now acknowledged that the provided information is sufficient, and has officially approved the registration of 'Pueblo Nuevo JM 12.7' as a bean variety in April 2007.

Photo: Conny Almekinders

José Manuel Gonzalez and his father from Pueblo Nuevo, Nicaragua examine different varieties of their sixth generation bean seeds.

Lessons

The overall process took three years (six plantings) of selection and one additional year for evaluation trials. It was extremely time consuming and difficult at times, and the farmers acknowledge that they could not have managed without the breeder and the CIPRES technician. With the breeder they discussed the options and made the plans for the trials. Initially, he was seen as their instructor and teacher. But over the seasons, as the farmers increased their understanding of the selection process, the relationship between the breeder and the farmer-breeders developed into a partnership, in which they discussed the planning on an equal footing. The NGO technician was also crucial in the whole process. He co-ordinated the contact between the breeder and the farmers, and made sure the plantings were correctly followed through. He mobilised resources for irrigating the plots, made sure there were good bags to store the seeds between the seasons and, something the farmers saw as very important, he inspired the farmers when they got discouraged. He also helped out if there was a difficulty with the trials or when a family crisis had to be overcome.

Despite the time consuming efforts, the COSENUP farmers feel proud. The project has boosted their confidence because they now have more knowledge, understand where varieties come from, and what is involved. Bean yields have definitely increased, and farmers can again produce enough for their own consumption. Selling the surplus allows them to buy more meat for the family, extend their house, put on a new roof or buy a bicycle. An interesting observation is that not only the two "champion" varieties are grown by other farmers; they also like a third selection because of its drought resistance.

Future actions

Although the registration and marketing of the bean varieties took a long time and occasionally lessened the enthusiasm of the farmers, the fire did not extinguish. Several farmers have continued to work with the breeders of INTA. Some of them like to work with early generation bean families that are still segregating into different genotypes, others feel this is too time-consuming and prefer to select the best seeds from advanced, genetically stable families. Recently, breeders and farmers have started talking about evaluating bean varieties preferred by the Hispanic population in the United States, discussing what they would do differently in a new process (try out each others' materials at earlier stages; not wait three years before doing culinary tests). Other farmers have engaged in the development of better maize and sorghum varieties, and some have also asked INTA and CIPRES to bring them tomato varieties to work with.

In the meantime, the breeders at INTA have developed new varieties that have good grain colour and show resistance to the Golden Mosaic Virus. And although it does not look as if structural changes in the breeding and production of seeds will result, the interaction between the farmers and the breeders has changed, as they undeniably work more closely together. Maybe the changes in the interactions at the personal level are even more relevant than those in the procedures of the research institutions. In any case, despite the fact that sometimes steps are taken forwards, and at other times backwards, the overall feeling of all involved is that they are moving in a positive direction.

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Photo: Author

Rufunsa village field day, Zambia. These farmers' field days are a great opportunity to exchange of ideas, expertise and materials.

Conserving the plant genetic resources of southern Africa

Barnabas W. Kapange

Back in 1988, the 13 countries of the Southern African Development Community (SADC) pooled resources and established the SADC Plant Genetic Resources Centre (SPGRC). Based in Lusaka, Zambia, and working with other national centres, this centre co-ordinates the conservation activities for the whole region, and stores a collection of local plant genetic resources. To date, 37 000 accessions of different crops have been collected and registered, and over a third of these have been deposited in the base collection at SPGRC. However, germplasm collection is not the only way in which SPGRC aims to conserve and guarantee the safe preservation of crop and wild plant genetic resources. The centre is also documenting the efficient and sustainable use of the plant genetic resources of the region, and is providing a forum for the exchange of scientific, cultural, traditional and indigenous knowledge.

Alternatives to *ex situ* conservation

Since its foundation, the centre has been actively working with complimentary approaches to *ex situ* conservation, such as *in situ* and on-farm conservation. In both cases, SPGRC has been following different strategies after selecting relevant species and identifying interested farmers or communities. These include the collection, multiplication and redistribution of seeds within a community; the identification of volunteer farmers willing to grow or multiply seed; the promotion and identification of marketing possibilities (seed fairs, restaurants, etc.); and the documentation of indigenous knowledge related to the species collected.

In situ conservation targets wild relatives of food and cash crops, under-utilised plants, or endangered indigenous species. This choice includes species found in protected areas, as well as nut and fruit trees endemic to the region, for which the centre has carried out eco-geographic studies in protected areas, and has developed a series of databases with all the information resulting from these studies. More specifically, on-farm conservation focuses on crops. In doing so, it highlights the role of farmers in the conservation of biodiversity, while at the same time considering the processes of evolution and adaptation of the crops to the environment. This process integrates farmers into the national (and international) conservation system for plant genetic resources, considering their expertise, knowledge and interests. It is also an important way of maintaining the provision of ecosystem services, such as soil formation, which are linked to specific plant species.

Carried out in partnership with the National Plant Genetic Resources Centres (NPGRCs) in the different countries, these activities take different shapes. In Malawi, for example, a study was carried out in five separate areas, with farmers growing sorghum, pearl millet, cowpea and maize. It was observed that traditional varieties of these crops are threatened by the early-maturing "improved" varieties, leading in some cases to their complete disappearance. In the Shire valley, for example, late maturing sorghum varieties which used to be common in these areas (such as 'Gonkho', 'Dikwa' and 'Kapsyabanda') were no longer found. As a result of these studies, several groups of women were identified who would grow and multiply seeds, considering that women in this valley are the main custodians of traditional crops. They started with seeds of these sorghum varieties.

Pilot studies were also carried out in Zambia, but went on to consider the participatory characterisation of crop genetic resources. The approach aimed at a thorough understanding of the processes and practices that farmers follow for maintaining their own crop diversity. With the support of SPGRC, Zambia's National Plant Genetic Resources Centre, its Extension Department and a local NGO have joined efforts to document the many farming practices and knowledge systems that contribute to the maintenance of crop genetic diversity. In an initial phase, work was mainly carried out in Rufunsa and Lukwipa, two communities on the road which links Zambia's capital, Lusaka, to Malawi. Information was gathered through farmer group discussions and field walks, focusing on those factors related to crop diversity: farmers' sources of seed, planting methods, general crop husbandry, seed selection during harvest, seed storage methods, and the challenges faced in the maintenance of quality seed. Farmers have been encouraged to participate in these processes, for example during seed fairs organised in the two communities.

As a result, before the 2005/06 season started, farmers from Rufunsa and Lukwipa approached the NPGRC to request seeds: they were particularly interested in those crops which were becoming rare in the areas, such as certain landraces of groundnuts and bambara groundnut (*Vigna subterranea*). Volunteer farmers were identified to multiply the seeds available and were all given 10 kg of seed. All of them had to bring 20 kg back, which were then distributed to other farmers.

Documentation and dissemination of information

Another important result has been the standardisation of all genebank information, which was made possible through the development of the SPGRC Documentation and Information System, now installed at all the NPGRCs. The network has adopted international standards of plant genetic resources conservation and documents its information in a standard computerised format. This helps in adding data from the field, as well as producing inventories of all genebank collections. It also helps take decisions in relation to collecting priorities, the production of catalogues, or the distribution and exchange of germplasm. This is particularly important when crop "restorations" are necessary, such as after floods, changes in farming systems, or homestead relocations. In such cases, the benefits of seed collections, and of having all the necessary information related to them, are considerable. ■

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Community based seed supply in Sudan

Abdelrahman Khidir Osman

More than 75 percent of the population in North Kordofan state, in western Sudan, depend on agriculture as their main source of food and income. The farming systems in the area are predominantly rainfed, traditional, and operate with limited resources. They are characterised by the small size of holdings, being dependent on manual family labour, and using few or no external inputs such as fertilizers, chemicals or seeds. Farmers have poor access to information and relevant research results, and yields obtained are very low.

Over the last three decades the area has been severely affected by repeated droughts, which has resulted in partial or complete reduction of farmers' seed stock. In addition, the rainy season is becoming shorter (about 90 days), while some of the traditional varieties of millet, sorghum and cowpea are late maturing, requiring about 120 days to mature. This means that planting traditional varieties can be very risky. Farmers are well aware of this problem, and they no longer prefer these traditional varieties. Moreover some of these varieties are no longer available. Many farmers in the area became heavily dependent on relief programmes for the provision of food and seed. In several surveys conducted in the area, communities identified availability of seed as the most important constraint, and seed as the input most needed to raise productivity.

Between 2002 and 2005, CARE International in Sudan implemented a project to enhance the food security status of approximately 65 000 rural families in Sheikan and Enhoud, two localities in North Kordofan. Some of the main components of the project were to improve seed availability through distribution of high quality seeds of improved varieties released by research, capacity building and training of local communities, and the promotion of seed multiplication at community level.

ElObeid Research Station is a local agricultural research organisation established in 1983 to serve the small scale farmers in the traditional rainfed sector. They gave technical backstopping to the CARE project through providing appropriate seed varieties; training farmers and project staff on production technologies;

Photo: Author

Khirat bringing groundnut to the local seed company.

developing an appropriate extension program; assisting implementation of the improved technologies and developing a training manual.

The research station adopted the Farming System Research approach, conducting both on-station and on-farm trials. Their research programme started with participatory diagnostic surveys, working with farmers to identify production constraints and their order of importance. From this, the station went on to develop a number of improved, early maturing, stable, and drought tolerant varieties of millet, sorghum, groundnut, sesame and cowpea, which were later used for distribution and multiplication in the three year project. The majority of the farmers in the area had acknowledged the benefits of using these varieties, but the main reason for not using them before 2002 was the non-availability, poor accessibility and lack of extension advice.

Seed distribution

During its three years of operation, the project distributed 136 tonnes of sorghum, 138 tonnes of millet, 447 tonnes of groundnut, 27 tonnes of sesame, and 9 tonnes of cowpea. Each household was provided with 2.5 kg of sorghum, 1.5 kg of millet, 15 kg of groundnut, 1 kg of sesame, and 2 kg of cowpea. The amount of seed provided was enough to plant about 1.5 hectares. Seed distribution was co-ordinated through linkages with relevant government institutions such as the Ministry of Agriculture, agricultural research stations, and community organisations. As these quality seeds of improved varieties became available, yields increased at both project localities (Enhoud and Sheikan); increases ranging from 10 to 67 percent (Table 1). The seed distribution activity was the initial step needed in improving food security in this region, and has improved farmers' accessibility to quality seeds and enhanced the spread of the improved varieties.

Seed multiplication

The next step was to promote the role of local farmers in the continued provision of quality seeds at household and community levels. To achieve this, the project conducted several trainings to strengthen farmers' capacity and knowledge regarding technical aspects of seeds and seed production. Topics covered included quality (e.g. genetic and physical purity, germination rates, absence of weed seeds and diseases),

Table 1. Average yield increase as a result of using quality seeds of improved varieties

Crop	Yield (kg/feddan)		Percentage increase	
	Enhoud	Sheikan	Enhoud	Sheikan
Groundnut	247	327	30	24
Millet	165	111	66	67
Sorghum	135	190	27	10
Sesame	116	109	19	57
Cowpea	193	96	67	52

One feddan = 0.42 hectare

testing, storage, multiplication, and certification. Researchers and specialists from local seed inspection services participated in these trainings. As a result, farmers have become more aware of the importance of high quality seeds, new varieties, and seed multiplication techniques.

Some farmers showed willingness to produce seeds and follow the necessary multiplication regulations and standards. Multiplication standards such as isolation distance, rogueing (removal of weaker plants and weeds), standard cultural and harvesting practices, as well as packing, are not difficult for farmers to follow and attain. Farmers used part of their land for seed production, as land availability is not a problem in the area. Their farms were inspected by the Seed Management Administration of the Ministry of Agriculture, to guarantee production of quality seeds. Inspection fees were paid by the farmers. Other field inspection duties were shared between project staff and research staff. These farmers have since become a source of quality seeds of the improved varieties, and were also able to sell their inspected seeds to the project, to individual farmers, and to formal seed sector companies. This brought many benefits for the communities involved: for example, it was then possible to purchase seeds locally instead of buying externally produced seeds, and transport and seed distribution costs were reduced. Another benefit was that the prices the farmers were able to charge for the seeds became an incentive for promoting and establishing the informal seed production sector. This in turn improved local community income.

Seed repayment

To ensure the continued dissemination and supply of the improved varieties the project adopted a seed repayment system. The purpose of local seed multiplication and seed repayment was to promote the tradition of seed exchange among farmers and reduce dependence on external sources for provision of inputs and to develop local self-reliance. Once the improved varieties entered the system, seeds returned through repayment were further redistributed. However, total seed repayment rates were low, ranging from 29 percent for millet, to 78 percent for groundnut. The main reasons for low repayment were the poor availability of storage facilities, little monitoring and follow up, and lack of awareness in general. In addition, because several relief programmes in the area had distributed food for free, the concept of repayment needed some time to be deepened, understood and accepted. Farmer-to-farmer seed exchange is now common, especially for the new desired varieties. Through training, the project increased awareness about the benefits of repayment and helped the communities to build stores to keep the returned seeds until redistributed. Community-based organisations, known as Village Agricultural Committees, were established and were responsible for record keeping, storage and redistribution of repaid seeds.

Sustainability

The seed repayment concept was initiated, implemented and accepted at several sites, and the project has contributed to establishing improved seed supply and variety dissemination systems at the community level. In addition, this has provided income-generating opportunities for farmer seed producers. However, sustainability is a major problem with many projects implemented by NGOs, and this project is no exception. To help sustain this system after the project's lifetime the most important factors to be considered are:

- Supporting the formation and capacity building of the community-based organisations;
- Continue decreasing dependency on external resources;
- Increasing the involvement and interaction of government counterparts and strengthening their linkages with the communities; and
- Improving seed repayment rates and building seed storage facilities.

One of the main difficulties encountered during this project was the low seed repayment rates. However, this has been addressed, and a sustainable supply of seed has been enhanced through establishing community-based organisations such as Village Agricultural Committees, and strengthening the links between these committees and other stakeholders, including the Ministry of Agriculture, the Farmers' Union, local seed companies and ElObeid Research Station. The station now advises farmers associations or development projects that are planning to multiply or distribute seeds.

For small scale farmers, the development and maintenance of a sustainable community-based seed supply system is essential to improve their food security, especially in conditions where their seed stocks have been severely affected, or farmers have become dependant on relief aid. The project has been very effective in spreading new early maturing varieties, but has also built on this through farmer multiplication activities. With its local distribution channels, this community-based system is very effective in improving the dissemination, accessibility and availability of quality seeds of the adopted improved varieties. The newly introduced varieties become part of the farmer stock, and the importance of the multiplication, repayment and exchange system is well recognised by the farmers after their experience with this project. ■

One farmer seed producer's experience

Khirat Salim Khirat is a 27 year old farmer from Um Diressa village, 35 km west of ElObeid town. He is the head of the Village Agricultural Committee. Khirat has been involved in seed production for the last three years. He attended four trainings organised by the project in different aspects of seed production. In the 2005/06 season Khirat planted and produced:

Crop	Area (Mkh)	Yield (kg) per Mkh
Sorghum ('Yarwasha')	3	360
Sorghum ('Arf Gadmak')	16	405
Groundnut ('Sodiri')	3	540
Groundnut ('Guebish')	2	675
Cowpea ('Ainalgazl')	1	300

Local variety names are in brackets.
One Mkh = 0.725 ha.

Khirat mentioned that he continued to follow seed multiplication regulations and standards such as proper isolation and cultural practices, as it has been taught in the trainings. His fields were inspected twice and an endorsement certificate was issued to him. He managed to sell seeds to neighbouring farmers, a local seed company, projects and the Farmer's Bank. Prices offered were 15 percent more than the regular grain prices. The manager of the seed company in ElObeid said that the company had purchased about 17 million Sudanese dinar (US$ 85 000) worth of seed from the seed producer farmers during 2006. Khirat indicated that about 15 farmers in the area are involved in the seed multiplication business and this has opened an avenue for agricultural development in the area.

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Community seed banks for maintaining genetic diversity

Vanaja Ramprasad

By the beginning of the 1990s, the Genetic Resource Ecology Energy Nutrition (GREEN) Foundation had realised the importance of working with the farmer community to conserve agro-biodiversity, and its importance in ensuring food security and developing a sustainable agriculture. So, in 1992, we initiated a programme with small farmers in the drier areas of the Indian states of Tamil Nadu and Karnataka. The first activities were aimed at creating awareness about the rapid loss of useful plant species and the concept of conservation of agro-biodiversity. To begin with, farmers had to go through an "unlearning" process, as years of modernised agriculture had taken them very far away from a sustainable production. Many farmers did not seem aware that traditional crops and varieties had been lost, which made it difficult to talk with them about conservation of plant diversity. It was even more difficult to convince them that some of the traditional varieties could yield as well as the introduced, commercial varieties that they had become used to.

Our approach was to promote a sense of pride and ownership within the community towards their common traditional knowledge. The important message was that they were the custodians of their genetic heritage. Seed *yatras* were organised, where farmers, NGO staff and other supporters marched through several villages to promote awareness about the effects of globalisation, and the way this has impacted on the agricultural sector. Such a mass awareness raising activity also helped to build links between farmers from different villages, and stirred general public interest in the concept of sustainable agriculture. During a *yatra*, a combination of art, culture and music is used to engage peoples' interest: an oxen-cart decorated with produce of different crops and vegetables is taken around the village, which brings people out to see. Subsequently, folk songs and street plays with a message are enacted.

A participatory inventory

During meetings with the community (particularly with the elders) and by using PRA techniques, information was gathered about the plant species and varieties that had previously been in use by the local people and which, in the course of time, had either become extinct or were not used any more. This ethnobotanical survey of a village area was referred to as "seed mapping". This activity yielded valuable information on genetic diversity, on how local plants were used by people from the community, and where these species could be found. This inventory also revealed whether seeds of the most interesting plant species were still available. Where possible, small quantities of seeds were collected, sometimes from other areas where they were still grown. One such participatory seed mapping exercise, conducted in the northern dry regions of Karnataka, helped to identify 61 different varieties of sorghum and eight varieties of pearl millet.

A seed mapping exercise also provokes dialogue and debate in the village community. Through their discussions, farmers would come to realise what the effects of their conversion to modern, high-yielding crop varieties had been: a mono-crop farming system and loss of plant diversity on their land. However, the GREEN Foundation was always very careful with the message that they tried to convey to farmers so that they would not feel pushed into any decision to change their agricultural practices. This is very important, because when a farmer does decide to convert to a more diverse and integrated cropping system, it is his or her own decision. The GREEN Foundation deliberately uses the meetings with the communities to motivate the women to participate in this effort because, traditionally, women decide which food crops to grow, and the men work in the fields.

Multiplying seeds

After the awareness creation activities and the seed mapping, all interested farmers were provided with seeds of some of the plant species collected during the seed mapping exercises. Some women were also interested in assisting the programme voluntarily by multiplying seeds of several crop varieties on their land. That way, more farmers could be provided with seeds at a later stage.

Photo: GREEN Foundation

Women have been important partners in this programme since its inception and they have assumed a very significant role in the GREEN Foundation's efforts to assist local communities in the conservation of agro-biodiversity. The men, however, showed less interest at first because they were mostly focused on growing commercial crop varieties, for the market. But when Karnataka was hit by drought in 1995, the men noticed that some local varieties of finger millet, for instance, still managed to be productive while the so called high-yielding varieties failed.

In time, the assortment of seeds that the programme managed to gather began to increase, and provided an interesting base for further work. Gradually, more women farmers started joining in the programme activities and became involved in multiplying seeds of different varieties of rice, finger millet and other food crops that could be planted in mixed-crop systems. This gave way to the idea of establishing a saving system for seeds, from which villagers could borrow seeds for planting. The first such "seed bank" was established by an existing self help group in a village called Thally. This group's original objective was to organise micro-credit and savings activities for its members.

Seed banks

A community seed bank functions very much like a commercial bank. The transfers are, however, not in money but in seeds. Any inhabitant of the villages that a seed bank serves can become a member of the seed bank by paying a nominal annual fee. Seeds of food crops that are stored in the bank are provided free of charge to members of a seed bank. The member then sows the seed and after harvesting the crop, returns double the amount of seeds to the seed bank.

Seed banks do not require special building structures and seeds are stored at ambient temperature. The staff of a community seed bank have various tasks: making sure the seed is treated properly against pests; monitoring seed distribution by maintaining monitoring cards to see who is growing what; working out a record of members' needs for seeds, and planning for seed distribution in the following season. Seed banks also develop some activities to promote the use of local varieties of food crops. To ensure the continuous quality of seeds managed by the seed bank, the members set down some rules such as banning the use of chemical fertilizers and pesticides. "We go to farms now and then to see whether the farmers are following these rules", says Kalamma, who works for the seed bank in Thally. "When it is harvest time, we often go to the fields of members who have borrowed seeds, and we select the best seeds and ask that these be returned to the seed bank". The women who work for the community seed bank are paid for their service from the membership fees and from commission that the seed banks make on the marketing of rice, sorghum and millets on behalf of farmers. Furthermore, some seed banks earn some income from processing activities, adding value to crop produce.

Initial challenges

The farming community responded slowly to the first community seed bank in Thally village. As the concept was new to them, and they had lost the sense of ownership over their seeds, it took some time for farmers to see the importance of having the option to plant traditional varieties again. The GREEN Foundation took farmers for exposure visits to well-established seed banks, as a way to enable learning between farmers from different regions. When farmers interact with one another, it creates an enhanced understanding, awareness and knowledge about the process at work. With some persistent efforts, the belief in the seed bank concept grew and local farmers also began to see the differences between the traditional varieties and the commercial varieties, both in terms of production cost and yield reliability.

At a completely different level was the somewhat demoralising attitude of the scientists and business community. The GREEN Foundation team often felt dwarfed by the opposition of the big multinationals, universities and the scientists who regarded them as reactionary, trying to take science backwards by promoting the use of traditionally used crops or varieties. We went through cycles of despair and frustration as our work was often looked at with disbelief. But our strong belief in our work made us continue. More farmers became involved in seed banks, and media attention regarding the conservation of agro-biodiversity increased, spreading the message to other stakeholders. Eventually, the message was convincing enough that resource persons from agricultural universities, industry and other NGOs have now also become involved in training farmers at the village level and district levels.

Upscaling

Once the programme had taken root in Thally, the GREEN Foundation looked to expand activities. In 1999, awareness-raising programmes were conducted in the surrounding villages on the need to conserve agro-biodiversity, and the methods of conserving seeds efficiently. Seed mapping was carried out and indigenous seeds were tracked and collected from the farmers who had conserved them. Subsequently, more seed banks were set up in different villages, catering for larger clusters of farmers. A network was created with other NGOs to expand plant diversity conservation activities with selected organisations in their own regions. Of the 45 seed banks currently operating in Tamil Nadu and Karnataka, the GREEN Foundation has facilitated 14 seed banks covering about 100 villages.

Immediately after harvesting the crops, seed fairs are held. This is traditionally the time that several festivals are celebrated while there is also a quiet period in agricultural activities, so farmers have time to participate. A seed fair is much like a traditional market setting where besides buying their weekly needs, farmers also interact socially and exchange knowledge and information about certain practices. By reviving this "market" concept, the GREEN Foundation brings diverse farming communities together, and during seed fairs more farmers become convinced of the need to conserve agro-biodiversity. The seed fairs also provide opportunities for demonstrating seed storage techniques to farmers, and other sustainable agriculture practices such as soil nutrient management, control of pests and diseases, and managing crop diversity.

Over the years, the GREEN Foundation has become an umbrella organisation that trains and serves more than thirty local sustainable agriculture organisations in Karnataka and northern Tamil Nadu. Training and other capacity building activities are based on farmer-to-farmer extension with some farmer-teachers receiving a small compensation for their involvement. Training is also done through village governance programmes where a village can now apply for help from the state government in the process of changing to organic growing. Community seed banks are an important aspect of the programme for safe-guarding traditional varieties of food crops. The GREEN Foundation believes that the seed bank is not just a store where seeds of traditional varieties of food crops are kept for distribution to farmers. More than this, it is an important self-help strategy for maintaining genetic diversity in crop and plant species on farms. ■

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Increasing the availability of traditional seeds in Sri Lanka

Alex Thanthriarachchi, Samantha Green and Julia Wright

Photo: Julia Wright / Samantha Green

Experimenting with composts to promote ecological practices in rice production.

The highly varied climate, topography and soils of Sri Lanka make it one of the most biodiverse regions of the world. In terms of cultivated resources, the country holds a rich treasure of agrobiodiversity, with 2800 different types of rice and more than 1000 distinct cultivars. In the early 1970s, the excitement surrounding High Yielding Varieties (HYVs) so captivated the island's farmers and others concerned with agriculture, that few foresaw the resulting displacement of indigenous genetic resources, nor their extinction. Traditional rice varieties under cultivation dwindled to about 5 percent of total paddy acreage.

After the collapse of a political uprising in 1979, a few of those involved in the protest decided to try their hand at farming in the arid zone of the north west of the country. One of their objectives was to grow indigenous varieties according to indigenous practices, as opposed to buying into the hybrids and technologies of the Green Revolution that were growing around them. To their dismay, however, they found that indigenous varieties had all but vanished. They realised that these varieties, together with the accompanying knowledge about farming, food preservation or preparation, had been lost to HYVs and synthetic inputs. These young farmers combed far and wide in their search for indigenous seeds. Sometimes the amount uncovered did not even fill a match box, in which event the seeds were tested out in flower pots.

Steadily, seed stocks increased, as did the gathering of ancestral farming knowledge and art of food preparation, and more people joined the group. Initially only a few farmers agreed to experiment with indigenous varieties. Some did so in a small portion of their fields. Gradually, more and more people became interested, and the results achieved by one farmer were an impetus to his or her neighbour to become involved. The increased workload necessitated some form of organised body. So in 1986 the Movement for the Protection of Indigenous Seeds (MPIS) was born.

Soon after, the first "seed camp" was held – a meeting of MPIS and veteran farmers, where each farmer brought with him or her a sample of seeds. Held from time to time and at different locations, these "camps" were explosions of indigenous knowledge, as lively discussions were held where each farmer recounted the memories of how their ancestors worked, ate and lived. This served as a great inspiration for the farmers present, while MPIS documented this knowledge. At the first "camp", for example, the traditional paddy varieties like 'Rath Swandel', 'Heeneti', or 'Ma Vee' were collected.

Eventually, the growing paddy stock and organisational expansion required a permanent research settlement, and in 1995 a rice research farm was established in the village of Eppawala, in the north-central province of Anuradhapura. The inauguration of this site marked a turning point, as MPIS started running comparative tests of indigenous rice varieties and HYVs. These tests showed that the biological yield vigour of the former surpassed that of the latter, demonstrating that the high yields of HYVs were mainly due to chemical input "boosters", without which they did not perform at all well. These trials also showed that the low yields generally reported for indigenous rice varieties are basically a result of inappropriate cultivation methods, not the seed or the genetic material. By applying proper cultivation methods, such as improving soil fertility with fresh humus and avoiding flooding the field, MPIS succeeded in demonstrating higher yield averages. Trials, research and monitoring also demonstrated the diverse characteristics of rice varieties which in the Green Revolution were grouped simply according to yield. Indigenous varieties differed in taste, nutrition, hue, preservability, medicinal quality, pest, drought and flood resistance, and more.

With time, the ecological transformation of the Eppawala premises became increasingly visible and tangible. Within a decade, it has developed into a healthy oasis with a pool full of

Farmer perspectives

"I cultivated 6 acres of paddy and I used indigenous varieties of paddy, 3 acres of 'Kaluheenati', 1 acre of 'Rathsuwandel' and 2 acres of 'Hondarawalu'. I have been doing this for six consecutive seasons. At the beginning, we were given seeds by the Movement for the Protection of Indigenous Seeds (MPIS). These are not hybrid varieties, but the seeds that were given to us by our forefathers. Our yields are very good. We get a yield of between 80 to 90 bushels. We have been able to sell our paddy at a price as high as Rs. 20 per kilo and all this paddy is being purchased by MPIS. In order to get this kind of yield, it is not necessary for us to buy chemical fertilisers and pesticides, which only makes the companies richer. Earlier, when we were applying expensive chemical inputs, we got yields of up to 100 to 120 bushels on one acre."
H Chandratilake, President of Ranamaura Farmers' Organisation

"Earlier my paddy cultivation died due to insufficient water, but since I started cultivating indigenous seeds, my paddy did not die. The reason is the variety of paddy that I use requires less water. Members of my family work the two acres. I did not need any chemical fertilisers or pesticides. I applied glyricidia, paddy straw and semi-burnt paddy husks, poultry droppings, and similar types of fertiliser. From the moment we picked up the scythe, people started asking for our paddy. People don't know it, but the purchasing of paddy was done by MPIS, who provided us with the seeds. There were less pest problems with 'Kaluheenati' and 'Rathsuwandel'. On my field, there was no problem at all, and I got more than 150 bushels out of my 2 acres. There were fewer losses. Even in our own area, there are many farmers who are finding it very difficult to sell their paddy cultivated with hybrid varieties and these people have begun to ask us how they could get these indigenous seeds."
Lalitha Dissanayake

fish, and wildlife such as birds and other creatures attracted to each other and to the vegetation. Insect pests are minimised by the presence of other creatures such as the dragon fly, and many bee hives help with pollination. MPIS now estimates that more than 4000 paddy farmers have shifted to ecological farming as a result of its efforts. MPIS itself holds 170 rice varieties, of which about 50 are from the Department of Agriculture.

How it works

The aim of MPIS is to breed and propagate local rice varieties and provide seeds and ecological awareness to farmers. It strives to do this by training farmers in ecological farming, building awareness among farmers to shift to ecological farming, assisting ecological paddy farmers to market their produce at fair prices, and developing a more direct rice chain from farmer to consumer and ensure a price fair to both. Among its different actions, possibly the most important is the collection and recording of varieties and associated knowledge (such as their medicinal and other useful properties, growing techniques and provenance), gathered from farmers throughout the country who meet every season to share seeds. Knowledge is stored in hand-written form at MPIS, and made available to farmers through a monthly news sheet. Seeds are stored in 20 kg bags and clay pots. Although the storeroom is cool and well protected, a modest level of pest attack is tolerated. According to the MPIS philosophy, insects select out the weakest seed which is not worth storing. Nevertheless, samples of the more important varieties are also kept in a back-up store in the cooler hill country of Nuriya Elia. MPIS staff grow the newly collected varieties, and the characteristics and performance of the plants are noted. This data assists with varietal classification as well as providing useful practical growing advice.

Each year, between 7 and 10 varieties from the collection are multiplied and made available to farmers. MPIS staff and selected farmer leaders discuss and choose those varieties they feel are most appropriate for that season, in relation to demand, climatic conditions and other factors. A farmer approaching MPIS will receive 2 kg of paddy seed and its accompanying knowledge, free of charge, on the condition that he or she returns the same quantity at the next harvest. A contract is signed, committing the farmer to following specific ecological husbandry practices for that season. MPIS provide training on ecological rice production, based on its paddy plots which demonstrate the evolutionary development of a humus-rich soil.

This agreement provides market opportunities for ecologically-grown rice. On top of the 2 kg rice returned to MPIS by the farmer, he or she may also choose to sell more of the harvest back to the organisation, which purchases this surplus at a favourable price. Because of the agreement made to follow ecological practices, this enables MPIS to mill and sell this "high quality, traditional rice", along with information on its provenance, at a premium price (40 rupees/kg in the Colombo market, compared with 37 rupees/kg for standard rice). There is currently an increasing domestic demand for ecological rice, partly owing to raised consumer awareness on health issues. The post-harvest value-adding and premium price enable MPIS to make a profit which is reinvested in the enterprise (such as a pick-up truck, or facilities for accommodating visitors). To ensure that this traditional rice also reaches non-elite markets, MPIS also makes it available at affordable prices through trade unions, welfare societies and co-operatives, and disseminates free seed to social programmes, schools and religious groups.

Challenges and innovative achievements

After 32 years, the multiplication of seeds, the milling operations and the income generation activities have reached a momentum, and are now self-sustaining. Still, this was not always easy. One challenge encountered was that although both rich and poor farmers apply for and use the seed, the poor farmers have tended to lack confidence, knowledge and resources to fully experiment and take the risk in the first instance. Another challenge has been to encourage farmers to overcome their belief of the marketing claims of large seed companies over supposedly higher yielding, more profitable varieties. The increasing national recognition of MPIS has also proved a challenge, as the organisation is encouraged to further grow and expand larger than what they consider to be its optimum size for self-regulation. Other groups, and possibly the government, may therefore need to step in and develop similar operations to meet the increasing demand for traditional seed as well as for training visits to the centre by farmers groups from around the country.

Four aspects of MPIS highlight its pioneering status as a successful model for increasing the availability of quality seed. First, MPIS has drawn on the interest and demand by farmers for locally adapted seed as a means to introduce and encourage sustainable farming techniques. By encouraging participating farmers to sign an agreement, MPIS can be sure of receiving and benefiting from the market premium of ecologically-produced rice, without having to impose certified organic standards. In this respect, the MPIS model is simialar to a Participatory Guarantee System, whereby stakeholders agree to an informal set of ecological husbandry techniques and follow them on a trust basis. Second, MPIS has successfully carried out its own experiments. Growing specific varieties on humus rich paddy over several years, and saving seeds, it has found that varieties can dramatically increase their genetic yield potential over generations, currently reaching up to 85 bushels/acre. This figure compares favourably with rice varieties promoted by the formal sector which are dependent on costly chemical fertilisers. Third, MPIS is not now the only producer and supplier of indigenous seeds. Through its influence, the traditional farmer practice of sharing seeds within communities has been revived, with farmers now borrowing seed from their neighbour to return after the harvest with a nominal interest, rather than purchasing from dealers. Fourth, MPIS has stubbornly determined to be financially self-reliant, its slow growth being supported through bank loans and repayments rather than donations, the only external donor over the years being HIVOS. In this sense it provides a replicable model for other groups without access to major donor funding, showing that this approach can, with careful planning, pay its own way. ■

"I didn't spend anything other than my own labour. I only made use of dry leaves on the land and some cow dung. Also these seeds require less water compared to the hybrid seeds. We were given indigenous seed paddy by MPIS and we signed an agreement with MPIS that they would buy our paddy at Rs. 20 per kilo. This agreement was signed even before we planted our seeds. Therefore we don't have any difficulty about selling our paddy. We don't need to go behind people and plead with them to buy our paddy. Further, we eat rice that is more nutritious and free of poison, so it is of better quality."
Mallika Seneviratne

Drawn from an article published in the Sri Lankan *Lakbima* newspaper, 8th April 2006.

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Photo: CBDC-BUCAP

Farmers use all available space to dry seed in the Mekong Delta.

Good quality seeds from farmers' seed clubs

SEARICE

For centuries, rice farmers across Asia have relied on the practice of saving, exchanging and re-using harvested seeds as their main source of planting materials. They have been, and are still able to do so because rice is a self-pollinating crop and farmers are assured that there will be no significant change in performance after seasons of repeatedly using pure seeds. This, together with inherent knowledge systems, practices and innovated technologies, enables them to sustain their rice-farming culture. Farmers' access to the quality and quantity of seed they need depends on the types of seed available and the mode of seed supply. Certified seed from the formal sector becomes integrated and diffused into the farmers' seed system through their practices of saving, re-using and exchanging seeds. But farmers' efforts to mass-produce and market certified seeds and varieties at higher prices outside of their communities are usually restricted by seed regulations. Most often, there is no public sector support for producing farmers' varieties, which have to undergo the certification process. Farmers must be government-accredited seed growers and adhere to the technical guidelines set by government agriculture agencies in order to produce certified seeds.

Public institutions often have limited resources and cannot meet the communities' seed requirements. Even with the presence of commercial seed growers, the challenge of meeting farmers' seed requirements persists. Farmers often complain of the quality of the seeds being delivered, the efficiency of the seed delivery system and the availability of the volume of seeds required. So how do rice farmers address this chicken-and-egg situation?

Farmer seed clubs of the Mekong Delta, south Vietnam

The Mekong Delta region is the biggest commercial rice production area in Vietnam, annually producing about 18 million tons of rice. The bulk of the seed supply comes from the informal sector (farmers) through different modes of seed exchange. Farmers, however, tend to replace seed every two or three cropping seasons, mainly depending on purchased seeds to improve their rice production. The formal system cannot adequately supply this demand, which makes up between 5 to 15 percent of the total seed requirement.

Through the Community Biodiversity Development and Conservation (CBDC) Network, SEARICE initiated the Community Plant Genetic Resources Conservation and Development project. This ran from 1996 to 2000, and was managed by the Mekong Delta Research and Development Institute (MDI). Starting with 229 farmers in four provinces, the project has since expanded to reach eight other provinces. A network of 40 communities was established, with more than 1200 farmers actively participating. More than 1000 varieties have been selected from stable lines provided by formal institutions, and farmers were able to select and mass-produce seven new rice varieties from breeding or segregating lines. Two of these varieties are currently undergoing the process of formal seed certification at the provincial and national levels. By 2004, over 80 percent of the total seed requirement for rice cultivation in communities reached by CBDC Mekong Delta was supplied by farmers.

To cope with the growing demands for commercial seeds in Mekong Delta, farmers organised themselves into farmer seed clubs after participating in Farmer Field Schools. To date, there are 57 seed clubs facilitated by CBDC Mekong Delta, mostly engaged in varietal selection and breeding, seed production and marketing. The seed clubs also serve as marketing hubs for good quality seeds in local communities.

How a typical seed club operates

The farmer-members of the seed clubs produce seed on their individual farms. They are provided with seeds (by the Mekong Delta Research and Development Institute) from varietal selection and seed purification studies, for mass production. The farmers' seed club produces about 200 tons of seeds per cropping season from around 100 hectares. Seeds produced include the traditional variety 'Jasmine', and modern varieties such as 'OM 4498', '2517' and 'HD1'. Notably, 'HD1' is a farmer-developed variety that was successfully stabilised and selected after the FFS sessions.

As a form of quality assurance, the seed club maintains a core population of good seeds. Farmers clean the seeds after harvest and ensure that moisture content is below 14 percent before seeds are sold. Random samples for germination tests are also conducted before the seeds are sold. Germination rates should not

go below 90 percent. Samples of the seeds sold are also kept as a form of guarantee protection. In cases of poor quality, members repay the customers or replace the poor quality seeds. Under this "farmers' guarantee system", so far, no farmer has reportedly complained of poor quality.

The Provincial Department of Agriculture and Rural Development regularly inspects the seed production areas of the seed club, but they only provide verbal approval of the quality of the seeds, as the seed club is producing purified lines, not certified seeds. This "informal" approval of the farmers' seeds is seen as support for the farmers' seed system.

The seed club also undertakes a different kind of marketing. After harvest, farmers mill and cook the rice for taste evaluations. Samples of the milled grains and seeds are sent to other seed clubs and farmer groups for evaluation. The results of the evaluation are then uploaded onto the Mekong Delta Research and Development Institute website (in Vietnamese), and are also shared with other farmers. The most important method of sharing information is through Farmers' Field Days (FFDs), where other farmers are invited to observe the standing crops. Farmers in the seed club network make leaflets with information about the varieties available – including the name and location of the farmer, and contact numbers. CBDC Vietnam also produces seed bulletins detailing basic variety characteristics. These leaflets and seed bulletins are distributed during Farmers' Field Days. Farmers who are interested in a particular variety can place advance orders with the seed clubs.

In the context of Mekong Delta, it is the market that provides the impetus for the seed clubs. This is supplemented with access to better varieties from the Mekong Delta Research and Development Institute, and from the government Seed Centres (the seed procurement and certification units of the Department of Agriculture and Rural Development). The seed clubs have also benefited from the partnership between scientists from the research centre, local government extension agents and other authorities who have collaborated in providing technical, financial, marketing and facilitative support in setting up mechanisms to enable the seed clubs to take on the daily management of farmer's seed production.

Aside from the knowledge and skills gained and practised, farmers attested that they have been able to increase their income by 10 percent through the sale of seed. Farmers also remarked that seed clubs have facilitated the accessibility of quality seeds. Seed club members are committed to comply with the "farmers' guarantee system" observed by the organisation as this is their edge over commercial certified seeds.

Challenges confronting farmers' seed supply system

These experiences are some among many community initiatives addressing the issue of access and control of genetic resources – particularly quality seed. What the formal system cannot adequately supply, farmers' seed production initiatives, though limited, supplement. It should be emphasised that the informal seed exchange systems have not been replaced by the farmers' seed production activities. Farmers are paid in cash for the relatively large volume of seed produced as this is the standard

Rehabilitating preferred rice varieties

Nico Vromant

The Mekong Delta region is largely regarded as the Vietnamese rice basket. Since 2002, the Mekong Delta Agricultural Extension Project has been working on the introduction of participatory extension methodologies. With the Mekong Delta being famous for its rice production, it is not surprising that many of the farmers' extension demands are rice-related.

Old varieties

The ethnic Khmer rice farmers of the Giong Dau Extension Club (in Cau Ke district, Tra Vinh province) complained about the quality of their 'Hầm Trâu' variety – the seeds had different shapes, sizes or colour. Similarly, farmers in the Binh Nhi Extension Club, (in Binh Nhi district, Tien Giang province) complained about their 'VD20' variety – it suffered from similar loss of quality but also loss of fragrance. These varieties were introduced years ago ('Hầm Trâu' in 1990-1992, and 'VD20' in 1996-1997) and it has become impossible to get these seeds in local seed centres. Still, as farmers particularly like these varieties they continued cropping them by storing part of their rice yield as seeding material for the next crop. However, after some reproduction cycles, these seeds showed strong varietal degeneration: their stand and performance were no longer uniform, resulting in poor rice harvests and poor grain quality. Farmers had to sell their rice at lower prices. They clearly had their reasons to complain.

One response would be to introduce a new rice variety with high quality grains that can easily be exported and fetches high prices on the international market. However, this is not what the farmers were asking for. While they agreed that "older" rice varieties are not fit for export, they also knew that these varieties gave high and stable yields, and fetch relatively high prices at local markets (as this is the rice most local people use for daily consumption). New varieties fetch much lower prices, although they might have a better grain quality. According to the farmers, local middlemen refuse to give higher prices for high quality varieties, because they cannot sell them. Local customers continue to demand the local varieties such as 'Hầm Trâu' and 'VD20'.

The farmers in both clubs decided to rehabilitate these varieties, not for commercial production, but for their own use. While not all local authorities and organisations were entirely happy about this move (they felt it was a step back, not in line with current development goals in the rice sector), the farmers argued that if they could rehabilitate the 'Hầm Trâu' or 'VD20' variety, they would also be able to produce "improved" seeds in the future.

In 2005 and 2006 both clubs participated in a Farmer Field School (FFS) programme in their trial fields, organised by the Mekong Delta Development Research Institute and Can Tho University, on rice rehabilitation (covering issues such as removing off-type plants and seeds, transplanting, crop care, harvesting, and cleaning). They first tried out this –for them– new technology on small plots. Later on, when they were convinced of the efficiency of the methodology, they increased the plot sizes. The transplanting (instead of rice seeding) and continuous rogueing (the removal of undesirable rice plants from seed production plots) were seen as very cumbersome and labour intensive. However, after 2 or 3 consecutive seasons farmers got their much anticipated result: a brand-clean 'Hầm Trâu' or 'VD20' variety. The news spread very fast. At first

mode of exchange existing in the communities. However, they still give or exchange small amounts of seeds as they traditionally have. The farmers are just making the most of an opportunity, without displacing their normal systems of exchange.

However, due to the application of intellectual property rights (IPR) on registered varieties, farmers are restricted from exchanging and/or commercialising seeds without approval from a recognised plant breeder – they cannot use a protected variety as parent material. This dissuades small farmers from venturing into seed production as a value-added livelihood activity because whatever income generated will be subjected to royalty payments to plant breeders. However, it is quite ironic that there is no recognition accorded to farmers whose indigenous varieties are used by plant breeders as parent materials without any restriction.

Moreover, the introduction of technological forms of IPR such as hybrid rice has other adverse implications for community seed supply systems. For one, seed saving is not a viable option. Even under market-oriented situations where farmers rely heavily on purchased seeds, the "farmer-guarantee system" cannot work, as hybrid rice is only economically viable for one cropping season. Hence, customers are not assured of good performance just by observing the crop stand of a hybrid rice seed production area.

Photo: Nguyen Thi Hoai Chau

The practice of rogueing helped to rehabilitate rice varieties.

neighbours found out, then farmers in nearby villages, then those further away… they all came to inspect this "new" rice, their rice. They all wanted to buy this rice to plant in their fields. Even the governmental Seed Centres in the provinces bought some of these high quality 'Hầm Trâu' or 'VD20' rice seeds; needless to say that the work of the farmers in both clubs was a huge success. They were proud and understood that they could provide a service to their farming community. They soon planned to make leaflets, and share their newly acquired technology with other farmers.

Lessons learnt

When farmers are looking for a new rice variety they usually use different criteria than rice breeders, scientists and extension workers. Newer rice varieties might have improved characteristics, but these "better" varieties do not always suit the specific conditions and preferences of the farmers. Marketability is certainly an important criterion for farmers

when selecting a rice variety. However, many people talk about "markets" meaning export markets. Farmers sell on the local market. Therefore, introducing new rice varieties without thinking about the local market (and about the preferences and conditions of farmers) is doomed to fail.

Farmers not only know what criteria they are looking for, they are also able to select (and rehabilitate) their rice varieties if given the chance to do so. The farmers only got assistance for their first rehabilitation experiments and then continued on their own. Through the participatory extension approaches used in the project the farmers in these (and other) clubs became more independent and confident. They had learned how to go about rehabilitating, selecting and testing rice varieties (including designing small-scale experiments) and to draw conclusions from these experiments. When working with farmers on seeds the issue is not: "this is the best rice variety, try it", but rather "this is how you can do it, go ahead".

Epilogue

In the winter-spring rice season (2006-2007), rice farmers all over the Mekong Delta faced serious brown planthopper (and associated rice diseases) infestations. However, the Giong Dau and Binh Nhi farmers had a good night's sleep. Their rehabilitated "old-fashioned" rice varieties were not seriously affected, while many new varieties were heavily infested. ■

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The issue of whether farmers should subject their varieties to a certification process similar to that of certified seeds is a complicated one. Some argue that there are provisions in seed certification laws of some Asian countries that regulate the flow of varieties from one region to another as a form of protection for seed buyers. In order for farmers to sell seeds in another province, they have to comply with these regulations and have their varieties certified. On the other hand, the "farmer guarantee system" observed by the seed clubs demonstrates that farmer-seed producers, being first and foremost farmers, are very concerned with seed quality. Being recognised producers of quality seeds, their names and reputation in the communities are at stake.

What is seemingly inadequate in public agricultural policies is the formal recognition of farmers' contribution in sustaining genetic diversity and their capacity as plant breeders and quality seed producers. Without having to adhere to strict certification guidelines, it is vital for public policies to acknowledge the vibrancy and the informal nature of farmers' seed systems, and to translate these into technical, market, and infrastructural support that would enable farmers to continue with crop improvement and seed production initiatives. ■

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Photo: Authors

Women have been able to increase their incomes by selling beans on the market, as preferred bean varieties have become much more plentiful.

A new approach for facilitating farmers' access to bean seed

Jean Claude Rubyogo, Louise Sperling and Teshale Assefa

Common beans (*Phaseolus vulgaris* L.) are an important crop for food, cash and agro-ecosystem improvement in many countries in eastern, central and southern Africa. The crop is mainly grown by small scale farmers with limited access to agricultural inputs. Since the introduction of beans in the sixteenth century, farmers have been able to maintain, adapt, increase and share a large genetic diversity to suit their needs. But because of different problems, such as root rots and drought, some of the farmers' bean genotypes are no longer adapted to their growing conditions. At the same time, a rising demand for beans in the cities and abroad means that some of the local varieties are no longer among the most preferred by the consumers in general. For both reasons, many farmers are eager to get access to and experiment with new bean varieties, complementing (and not necessarily replacing) their own local types.

With the support of the International Centre for Tropical Agriculture (CIAT), various National Bean Research Programmes and their partners are running a region-wide programme, supporting the existing seed systems through the provision of bean varieties coming from these research centres. The approach aims to increase and speed up farmer access to novel types, while at the same time strengthening the existing institutional and social networks which supply seed to farmers on a continuous basis.

Assessment of existing seed systems

These efforts started with an assessment of the existing seed systems. This meant looking at the factors which guide farmers' preferences, at the institutions which provide access to these varieties, and at how the flow of existing and new genotypes can be continued. The advantages and disadvantages of the different seed systems were looked at by farmers and extension agents, together with a "self assessment" which focused on the roles of the various actors involved, and on the possibilities for new roles. Apart from showing the differences between the "local" and the "commercial" systems (Table 1), these assessments facilitated the interaction among the various social actors, and paved the way for stronger relationships among them.

Even though both systems have advantages, the decentralised, local one, has unique aspects which make it particularly suited to small scale farmers' needs: it has a greater geographic reach, greater social reach, costs less, offers farmers a greater variety of options, and is accountable for its product – to the community. Hence, strategies which try to reach lots of farmers, at an affordable price, need to build on the strengths of the local system, rather than ignoring it. Needless to say, these assessments also showed that the introduction of new varieties through the local system also presents some challenges. Among these, an inadequate supply of initial ("basic" or "foundation") seed; an often restricted geographic coverage of local seed providers; and diffusion rates which are relatively slow when small quantities of new varieties enter the local seed channels.

A new approach

Starting in 2002, CIAT-PABRA (Pan African Bean Research Alliance) decided to try a new approach to address these challenges and help small scale farmers access new bean varieties more effectively. Carried out with partners in eastern, central and southern Africa, this multi-partner bean seed system approach followed these steps:

1. An assessment of farmers' needs through participatory interactions.
2. A search for suitable varieties to address these needs.
3. On-farm participatory variety assessments, involving farmer groups and the local extension service providers.
4. The selection of the appropriate varieties by farmers and other users.
5. An examination of the existing seed systems; exploring the possibilities for strengthening them and for fostering new linkages.
6. The dissemination of research-derived (or "improved") varieties through these newly integrated seed channels.
7. Strengthening of farmers' skills in pre-and post harvest bean management.
8. Strengthening of local actors' capacities to sustain the intervention and improve dissemination.
9. The promotion of a research for development alliance by focusing on the comparative advantages of each partner and supporting a co-learning process.

This new seed chain approach moved away from the standard practice which puts the full responsibility of new variety production and delivery on centralised national research programs, public extension systems and formal seed suppliers. In contrast, it moved towards a more decentralised approach, aiming to produce the preferred varieties in the areas where they were selected. This approach builds on the strong points of different stakeholders, considering that there are many who can contribute to an effective seed chain. For instance, farmers organisations and NGOs are often locally based and have good links with the community, while traders may have special skills for moving products widely throughout a region.

Results

Having assessed the different seed systems and the role of the different actors within them, scientists from the national research programmes had the opportunity to present new bean varieties in response to the existing farming constraints. Common actions were planned jointly for effective dissemination, depending on the expertise and strengths of every organisation. The majority decided to strengthen their interactions and initiate national or regional platforms where they meet regularly to assess the progress and look at any emerging issues.

The results of such partnerships can be clearly illustrated using a case study from Ethiopia. By building links among the different actors, the Ethiopian Bean Research Programme and its partners have expanded their outreach in many different ways. Before producing and distributing the seeds, potential varieties were evaluated by farmers in their own contexts, using their own selection criteria (for example, the total yield, drought tolerance, marketability, cooking time and taste). Suitable varieties, such as 'Awash Melka', 'Awash -1' (canning beans for export) 'DOR 544', 'AFR 222' and 'AFR 702' (regional and food types) were taken up as the basis of the whole initiative. Working together since 2004 mainly in the Central Rift Valley, in the east and southern highlands of Ethiopia, this collaborative group can already show a number of key results:

Scaled up production of basic seed

To respond to the growing demand for bean seeds, the production of basic seed became the focus of the Ethiopian Seed Enterprise and the Ethiopian Bean Research Programme. The annual production of basic seeds of the key improved varieties increased 50 times (from 3.3 tonnes to 149 tonnes) in three years. This occurred as both the Ethiopian Seed Enterprise and the bean programmes explicitly intensified efforts to meet increased requests: the Ethiopian Seed Enterprise expanded its output from 50 to 550 hectares (including contracting small scale farmers) and more bean research centres became engaged in basic seed production.

Dissemination of a greater number of varieties

Instead of focusing on only one or two varieties, the initiative facilitated the distribution of several varieties, which enabled farmers to choose the ones they prefer. Overall, within Ethiopia, the organisations involved went from working with six varieties in 2004 to working with 14 in 2006. In other words, they recognised the farmers' need for a range of varieties.

A faster diffusion of varieties

The initiative also facilitated faster access to new varieties.

Table 1: Advantages and disadvantages of the decentralised (local) and commercial seed systems

Important comparison criteria in seed systems	Local system	Commercial systems
Bean genetic diversity	Supplies multiple varieties	Focuses on a few varieties
Agro-ecological suitability	Seeks varieties adapted to micro-ecology e.g. intercropping	Seeks widely adapted varieties
Means of accessing seeds	Varieties move through seed gifts, seed exchanges such as grains/labour, cash	Varieties move only via cash and often at higher prices (for example, three times the local seed price)
Access to information about new varieties and techniques	Information exchanges between neighbours and farmers, at demonstrations, field days and in social networks	Very minimum promotion by seed stockists or agents
Types of clients	Potentially all farmers, based on their interests and needs (for variety, seed quality and quantity)	Commercial farmers and those geared to export, NGOs and government agencies involved in development work and relief
Seed quality assurance	Promoted through "social certification" (i.e. "if you cheat me, neighbours will know")	Promoted through "formal certification" (Governmental stamp of guarantee)
Building partners' (farmers, extension agents) capacity	Strengthening farmers' skills and organisations development e.g. encouraging experimentation/ promoting innovation in local seed systems	Benefiting only seed stockists and other formal suppliers
Amount of seed supplied	Over 95%	Less than 5% (and often 1-2%)

For instance, following regular approaches, 'Awash Melka', a variety which was officially released in 1999, had not really reached farmers even five years later. However, by 2006, using the new multi-partner seed system approach from 2004 onwards, this same variety represented about 15 percent of bean grains exported from Ethiopia. More recently released varieties, such as 'AR04GY' and 'Dimtu', have also reached large numbers of farmers in less than three years. The faster and wider spreading of varieties was a result of the several assessment meetings organised locally. These were followed by seed production efforts at the local level which built on the existing social and institutional assets, such as farmers' cooperative unions.

Scaled up production

By engaging other (non-formal) interested partners, the amount of bean seeds regularly supplied to farmers increased six times in about three years. The efforts of individual farmers and local organisations represented almost half of the seed supplied in 2006. As examples of scale, the Loma Adama Farmers Union, extension-service supported farmer seed producers and various NGOs (e.g. Catholic Relief Services, Self-Help Development International) multiplied 250, 200 and 300 tonnes respectively of acceptable quality bean seeds. This clearly shows the important role which local seed producers can play.

Increased number of diffusion partners

Before this initiative started, the most important seed partners of the Ethiopian Bean Research Programme were a few collaborating farmer research groups and the Ethiopian Seed Enterprise. However, with the new approach, many other partners became engaged, including the district Bureaus of Agriculture and Rural Development across the country, large farmers' co-operative unions, NGOs, bean exporters and traders, and large and middle scale seed producers. Building on these different partnerships lead to wider geographic coverage, facilitating the promotion of bean varieties with different objectives (for local consumption or for export).

Increased number of farmers being reached

The Ethiopian Bean Research Programme estimates that more than one million Ethiopian households countrywide gained access to new bean varieties between 2004 and 2007. This does not include the farmers who received seeds directly from other farmers (non-seed producers) through normal exchange networks. Engaging with multiple, diverse partners helped to reach remote and poor farmers, many of whom had not had access to new bean varieties before.

Some of the partners involved, such as the Melkassa Agricultural Research Center, Catholic Relief Services, Self-Help Development International, and the Amhara Agricultural Research Institute, have mentioned that the impacts achieved have mainly been due to two factors: targeting the resource poor, and not the model farmers in traditional bean growing areas like the Central Rift Valley; and the introduction of bean varieties to areas where bean production had stopped or where it had never fully developed, such as the Amhara region. In general terms, we can say that success has depended on various factors:

- An impact-oriented national bean research programme;
- The identification of farmers' preferred varieties through several decentralised assessments across the country, using farmers' groups as community entry points;
- The provision of seeds of preferred varieties through various channels, including farmer-to-farmer exchanges and local seed markets;
- The focus on local seed systems which are already providing seeds, information and capacity building through social networks;
- The enhancement of farmers' skills and capacities in pre- and post-harvest management, including wide awareness-raising through social networks and promotional campaigns;
- The creation of a multi-stakeholder platform to review and assess progress; or
- The active participation of traders in supporting the various seed supply procedures, and linking production to external markets.

Challenges and next steps

After four years of working together, many of the partners in this initiative are already thinking of working in similar ways with other crops such as teff (*Eragorstis tef*, fam. Gramineae) and sorghum. At the same time, development organisations like Catholic Relief Services have also taken the approach as model for increasing farmers' access to improved varieties in other countries. However, among the problems which concern critics, two are consistently raised. First, some worry about the quality of seed resulting from local production. Our work shows that worries are often based more in myth than reality: tests carried out in several countries (Ethiopia, Rwanda, Kenya and Uganda) have shown that farmers are able to produce acceptable quality bean seed. Second, as the approach is gaining popularity among diverse partners, the demand for the first seed (the "basic" or "foundation" seed) increases dramatically. This puts pressure on the formal seed sector to scale up the initial multiplication, a challenge which is already being taken up in Ethiopia.

The multi-partner seed chain approach is very versatile and gives farmers access to new varieties quickly and widely. One of its key attributes is that it builds on existing local skills and knowledge, support farmers' own organisations, and ensures that even the poorest can access new variety materials, if they desire. More specifically, this approach works to create partnerships and networks with actors at different levels of the seed production and supply chain. This strategic, inclusive linking, benefits those in the formal sector desiring broad impact as well as the many local organisations which work to increase and stabilise agricultural production, even in remote and stressed zones. ■

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Towards self-sufficiency in groundnut seed

K. Suresh Kanna

Some forty years ago, seeds were not considered an external input in Indian smallholder agriculture. While seeds were then in the hands of farmers, today the situation is totally different. About 80 percent of the food crop varieties traditionally grown have become rare or even extinct in some places. New varieties are produced and sold by seed companies, and the cost of seeds is constantly increasing. This is a common situation in places such as Pudukkottai, a district in a drought-prone area in Tamil Nadu, a state in the south of India.

Farmers in Odugampatti, a small village in Pudukkottai, are mainly dependent on rain-fed agriculture, cultivating drought evading or drought resistant crops such as cotton, pulses and millets. The most important marketable crop for many farmer families in this area is groundnut. They cultivate groundnuts on approximately 100 hectares, often intercropped with cowpeas, red gram (pigeon peas), field beans or lablab beans. Farmers who have no access to irrigation grow groundnuts only once a year, in the season that starts in July. The average field size is about one hectare, and women play the most important role in the production work.

Photo: Mrs. Pangayavalli

Farmers estimating the plant population and calculating yield during a Farmer Field School session.

Groundnut oil from this region is known for its high quality. For many years, seeds of the best varieties for oil production have only been available in towns like Alankudi, some 60 km from Odugampatti. Every year, the farmers from Ogudampatti had to go there to purchase the commercial varieties of groundnut seeds. With its many groundnut oil mills, Alankudi is the groundnut marketing centre for farmers from the surrounding areas. It is the best place to find the seeds of the commercially interesting varieties, and also the best place for farmers to sell their produce after the harvest. However, these transactions are rarely advantageous for farmers. At about 40 rupees per kilogram (or US$ 0.8), the price of hybrid seeds is relatively high, especially considering that at least 100 kg of groundnut seeds are needed for a one-hectare field. The financial situation of most small farmers forced them to either take a loan from an oil-mill owner at a high interest rate, or to sell some property to be able to purchase the seeds. An oil-mill owner would provide a farmer with seeds and other inputs in the form of a loan under the condition that, after the harvest, the farmer had to deliver the harvest to the oil-mill owner. A large share of the harvest would pay the loan and the interest, and the remainder would then be bought from the farmer at a price determined by the oil-mill owner.

Kudumbam's development activities

Kudumbam is a non-governmental organisation actively involved with the communities in Pudukkottai. In 1991 it introduced the idea of a seed bank to the farmer groups it works with. Being specifically interested in improving the food security of smallholder families, Kudumbam started working with seeds of local varieties of important food crops such as different millet and pulses. These were made available to farmers in Odugampatti and also in other villages of the district, agreeing that they would return twice the amount of seeds received to the NGO, so that these seeds could be made available to a wider circle of farmers.

The seed bank model developed in parallel to the various other activities carried out by Kudumbam, among which was the organisation of Farmer Field Schools. Since 1995, as part of the Tamil Nadu LEISA Network, Kudumbam also organised planning meetings at the village level, and courses on cotton and groundnut production. Interaction between the NGO staff and the villagers facilitated a better understanding of the local situation and of the main difficulties which farmers were experiencing. Discussions within the community made it clear that one of the main bottlenecks for the intensification of agricultural production was that farmers depended heavily on hybrid seeds for several crops, as external inputs which had to be purchased. There was therefore an urgent need for them to reduce their dependency on such expensive external inputs and to rely more on seeds of their traditional varieties.

During this period, the seed bank facilitated access to millet and pulse seeds. This effective and inexpensive process of borrowing seeds and paying back the loan with seeds made some farmers in Odugampatti think about organising a similar type of seed exchange for other crops. The crops that they had been discussing in the FFS meetings were mostly rice, cotton and groundnuts. Although the land area under rice cultivation in this village is considerable, all farmers felt that they should all be able to secure rice seeds for a next season without relying on a seed bank. The amount of seed needed for planting a hectare of rice can easily be stored in a gunny bag inside the farmer's house, and rice seeds can even be stored for two years without much reduction in the germination rate. They also decided against working with cotton, basically because they were not familiar with seed collection technology. For groundnuts, however, the farmers noticed several reasons why production of their own planting material could be very advantageous: commercial groundnut seeds are expensive, they had to be collected from far away, and groundnut seeds cannot be stored for longer than about three months after harvest. Preparing and discussing at length for more than two years, farmers in Odugampatti decided then to venture into the process of making seeds of different groundnut varieties available locally, progressing to organise themselves in a setup different to that of a seed bank.

Local seed production

After deciding jointly how to proceed, a few farmers with irrigation facilities started producing groundnut seed in Odugampatti in 2001. By 2007 the total area has increased to about 25 hectares, involving more than 45 farmer families. All of them have irrigation facilities, something that has a clear advantage: groundnut production is more reliable when it is irrigated. At the same time, groundnut seeds can be produced in the dry season in an irrigated field, ensuring a year-round supply of seeds that cannot be stored for long periods.

Among the seed producers, 16 farmers are members of the Odugampatti "LEISA Thrift Cooperative" (LTC). Promoted originally by Kudumbam, LTCs are mutual help groups, working as a financial institution in many ways (e.g. facilitating savings and providing credit for "sustainable agriculture investments" like bunding or green manuring). This group is now also co-ordinating seed production. The process starts by deciding which varieties will be produced, a discussion in which all member farmers are involved, both producers as well as buyers of the groundnut seeds. Production is also planned in advance, taking into account the demand at any given time and the subsequent distribution of the seeds (see Table 1).

Over recent years, more and more farmers in Odugampatti have decided to use the locally produced groundnut seeds. Between 2004 and 2006, the whole district experienced much lower rainfall than before, and the groundnut varieties purchased from Alankudi did not yield much compared to some local varieties. This made even more farmers aware of the disadvantages of the seeds bought from afar. Nowadays, no-one depends on seeds from Alankudi. One advantage of purchasing seeds from fellow farmers, as mentioned by many in the village, is that seeds cost much less. Groundnut seeds produced in the village are about 2 rupees cheaper compared to the general market price of groundnut seeds. Farmers who are not able to pay for the seeds can often borrow from a seed grower and pay back 150 percent of the amount of seeds borrowed after the harvest. Fewer farmers now have to sell their cows in order to purchase groundnut seeds. For local seed growers, both selling their seeds as well as providing them on a credit basis is better when compared with the market price for groundnuts for consumption, which is 30 rupees at the most.

Table 1. The seed exchange process

(a) seed produced by Mr. Rengasamy

Season	Seeds received from	Seeds given to	Quantity
June 2001	Mr. Rengasamy	3 Farmers	4 Bags
November 2001	3 Farmers	7 Farmers	11 Bags
June 2002	7 Farmers	12 Farmers	23 Bags
June 2003	12 Farmers	15 Farmers	25 Bags

(b) seed produced by Mrs. Chinnapponnu

Season	Seeds received from	Seeds given to	Quantity
June 2001	Mrs. Chinnaponnu	7 Farmers	9 Bags
November 2001	5 Farmers	5 Farmers	6 Bags
June 2002	5 Farmers	12 Farmers	17 Bags
June 2003	12 Farmers	13 Farmers	25 Bags

Besides the clear financial incentive for all groundnut farmers in this local seed production system, many farmers also recognised that the quality of the seed produced in the village is much higher. This is shown in higher germination percentages. According to farmers, only about 50 percent of the seeds purchased from Alankudi would normally germinate compared to a 90 percent germination rate for the locally produced groundnut seeds. Other positive observations include that this collective community effort has helped to break social barriers in the village, based on the caste makeup. The exchange of groundnut seeds is now taking place beyond such social barriers: members of all castes and communities now sit together in a common place and discuss things equally with each other.

Comparing different systems

Groundnut seed production and supply to other farmers in Odugampatti is all organised by the farmers themselves. Kudumbam has very little involvement in this activity, although they are still supporting the general organisational development of the local LTC. It is expected that, in the long run, the farmers will manage all LTC activities themselves without any further external support.

Table 2. Seed banks and a farmer led seed exchange

Seed banks	Farmer to farmer seed exchange
Often related to the programme focus of the NGO.	It emerged from the farmers' needs and is related to their livelihoods.
A well-structured storage facility is required for keeping the seeds.	Seeds will not be stored in one place or structure. They will be almost constantly in the field under multiplication.
Some investment is required.	No investment is required.
Control and monitoring is usually done by NGOs and NGO staff.	Control and monitoring is kept within the farmers group.

As shown in Table 2, the groundnut seed exchange system differs from the seed bank concept that is promoted in many villages in India and which is mostly relevant to, and used for, crops which can be stored for longer periods.

We have seen an increase in self-reliance and self-sufficiency in groundnut seed among farmers in Odugampatti. The groundnut seed exchange system developed in this village is very effective for this particular crop. It ensures that groundnut seed, which cannot be stored for more than three months, is available locally, is of good quality and is affordable. Another important development during this process has been the change in mindset of the farmer who has irrigation facilities, becoming actively involved in seed production and multiplication for their fellow villagers. The farmer-led seed exchange system is addressing the immediate needs of farmers in a very cost-effective manner. ■

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The development of Farmer Managed Natural Regeneration

Tony Rinaudo

Conventional methods of reforestation in Africa have often failed. Even community-based projects with individual or community nurseries struggle to keep up the momentum once project funding ends. The obstacles working against reforestation are enormous. But a new method of reforestation called Farmer Managed Natural Regeneration (FMNR) could change this situation. It has already done so in the Republic of Niger, one of the world's poorest nations, where more than 3 million hectares have been re-vegetated using this method. Farmer Managed Natural Regeneration involves selecting and pruning stems regenerating from stumps of previously felled, but still living trees. Sustainability is a key feature of the programme which requires very little investment by either government or NGOs to keep it going. The story in Niger can offer valuable insights and lessons for other nations.

Photo: Author

Children helping to source firewood.

The situation in Niger

The almost total destruction of trees and shrubs in the agricultural zone of Niger between the 1950s and 1980s had devastating consequences. Deforestation worsened the adverse effects of recurring drought, strong winds, high temperatures, infertile soils and pests and diseases on crops and livestock. Combined with rapid population growth and poverty, these problems contributed to chronic hunger and periodic acute famine.

Back in 1981, the whole country was in a state of severe environmental degradation, an already harsh land turning to desert, and a people under stress. More and more time was spent gathering poorer and poorer quality firewood and building materials. Women had to walk for miles for fuel such as small sticks and millet stalks. Cooking fuel was so scarce that cattle and even goat manure was used. This further reduced the amount of fodder available for livestock and manure being returned to the land. Under cover of dark, people would even dig up the roots of the few remaining protected trees. Without protection from trees, crops were hit by 60 - 70 km/hour winds, and were stressed by higher temperatures and lower humidity. Sand blasting and burial during wind storms damaged crops. Farmers often had to replant crops up to eight times in a single season. Insect attack on crops was extreme. Natural pest predators such as insect eating birds, reptiles, amphibians and beneficial insects had disappeared along with the trees.

Conventional approaches

The severe famine of the mid 1970s led to a global response. Stopping desertification became a top priority. Conventional methods of raising exotic tree species in nurseries were used: planting out, watering, protecting and weeding. However, despite investing millions of dollars and thousands of hours labour, there was little overall impact. Conventional approaches to reforestation faced insurmountable problems, being costly and labour intensive. Even in the nursery, frogs, locusts, termites and birds destroyed seedlings. Once planted out, drought, sand blasting, pests, competition from weeds and destruction by people and animals negated efforts. Low levels of community ownership and the lack of individual or village level replicability meant that no spontaneous, indigenous re-vegetation movement arose out of these intense efforts. Meanwhile, established indigenous trees continued to disappear at an alarming rate. National forestry laws took tree ownership and responsibility for care of trees out of the hands of the people. Even though ineffective and uneconomic, reforestation through conventional tree planting seemed to be the only way to address desertification at the time.

Discovering Farmer Managed Natural Regeneration

In 1983, the typical rural landscapes in the Maradi Department in the south of Niger, were still windswept and with few trees. It was apparent that even if the Maradi Integrated Development Project, which I managed, had a large budget, plenty of staff and time, the methods being employed would not make a significant impact on this problem. Then one day I understood that what appeared to be desert shrubs were actually trees which were re-sprouting from tree stumps, felled during land clearing. In that moment of inspiration I realised that there was a vast, underground forest present all along and that it was unnecessary to plant trees at all. All that was needed was to convince farmers to change the way they prepared their fields.

The method of reforestation that developed is called Farmer Managed Natural Regeneration (FMNR). Each year, live tree stumps sprout multiple shoots. In practising FMNR the farmer selects the stumps she wants to leave and decides how many shoots are wanted per stump. Excess shoots are then cut and side branches trimmed to half way up the stems. A good farmer will return regularly for touch up prunings and thereby stimulate faster growth rates. The method is not new, it is simply a form of coppicing and pollarding, which has a history of over 1000 years in Europe. It was new, however, to many farmers in Niger who traditionally viewed trees on farmland as "weeds" which needed to be eliminated because they compete with food crops. There is no set system or hard and fast rules. Farmers are given guidelines but are free to choose the number of shoots per stump and the number of stumps per hectare that they leave, the time span between subsequent pruning and harvest of stems, and the method of pruning.

Acceptance of this method was slow at first. A few people tried it but were ridiculed. Wood was a scarce and valuable commodity so their trees were stolen. A breakthrough came in

FMNR in practice

1. FMNR depends on the existence of living tree stumps in the fields to be re-vegetated. New stems which can be selected and pruned for improved growth sprout from these stumps. Standard practice has been for farmers to slash this valuable re-growth each year in preparation for planting crops.

2. With a little attention, this growth can be turned into a valuable resource, without jeopardizing, but in fact, enhancing crop yields. Here, all stalks except one have been cut from the stump. Side branches have been pruned half way up the stem. This single stem will be left to grow into a valuable pole. The problem with this system is that when the stem is harvested, the land will have no tree cover and there will be no wood to harvest for some time.

3. Much more can be gained by selecting and pruning the best five or so stems and removing the remaining unwanted ones. In this way, when a farmer wants wood she can cut the stem(s) she wants and leave the rest to continue growing. These remaining stems will increase in size and value each year, and will continue to protect the environment and provide other useful materials and services such as fodder, humus, habitat for useful pest predators, and protection from the wind and shade. Each time one stem is harvested, a younger stem is selected to replace it.

Species used in this practice in Niger include: *Strychnos spinosa*, *Balanites aegyptiaca*, *Boscia senegalensis*, *Ziziphus spp.*, *Annona senegalensis*, *Poupartia birrea* and *Faidherbia albida*. However, the important determinants of which species to use will be: whatever species are locally available with the ability to re-sprout after cutting, and the value local people place on those species.

1984, when radio coverage of an international conference on deforestation in Maradi helped to increase awareness of the link between deforestation and the climate. This was followed by a Niger-wide severe drought and famine which reinforced this link in peoples' minds. Through a "Food for Work" programme in Maradi Department, people in 95 villages were encouraged to give the method a try. For the first time ever, people in a whole district were leaving trees on their farms. Many were surprised that their crops grew better amongst the trees. All benefited from having extra wood for home use and for sale. Sadly, once the programme ended, over two thirds of the 500 000 trees protected in 1984 - 1985 were chopped down! However, district-wide exposure to the benefits of FMNR over a 12-month period was sufficient to introduce the concept and put to rest some fears about growing trees with crops. Gradually more and more farmers started protecting trees, and word spread from farmer to farmer until it became a standard practice. Over a twenty-year period, this new approach spread largely by word of mouth, until today three million hectares across Niger's agricultural zone have been re-vegetated. This is a significant achievement by the people of Niger. The fact that this happened in one of the world's poorest countries, with little investment in the forestry sector by either the government or NGOs, makes it doubly significant for countries facing similar problems.

Reasons for the rapid spread

Aside from simplicity, early returns and low cost, other factors contributed to the rapid spread of FMNR. Introducing the method on a district-wide basis with a "Food for Work" programme eliminated much of the peer pressure that early innovators would normally have to endure. As villagers experimented, project staff who lived in the villages were supportive, teaching, encouraging and standing alongside farmers when disputes or theft of trees occurred. This support was crucial, particularly in the early days when there was much opposition to FMNR. As trees began to colonise the land again, excited government forestry agents nominated lead farmers and even project staff for regional and national awards. Often these nominees won prizes, lifting the profile of FMNR. As news began to spread, national and international NGOs, church and mission groups received training and began promoting the method across Niger.

During the development of farmer-managed natural regeneration, farmers did not own the trees on their own land. There was no incentive to protect trees and much of the destruction of that era was linked to this policy. After discussions with the head of the Maradi Forestry Department, project staff were able to give assurances that if farmers cared for the trees on their land they would be allowed to benefit without fear of being fined. These laws were only changed in 2004 after much negotiation by entities such as USAID. Farmers began to access markets without undue hassle. And as trees on farms switched from being nuisance weeds to becoming a cash crop in their own right, this was good motivation for farmers to cultivate them. Over time, locally agreed upon codes and rules with support from village and district chiefs were established. Without this consensus and support for the protection of private property, it is unlikely that FMNR could have spread as fast as it did.

The benefits of FMNR quickly became apparent and farmers themselves became the chief proponents as they talked amongst themselves. FMNR can directly alleviate poverty, rural migration, chronic hunger and even famine in a wide range of rural settings. FMNR contributes to stress reduction and nutrition of livestock, and contributes directly and indirectly to both the availability and quality of fodder. Crops benefit directly through modification of microclimate (greater organic matter build up, reduced wind speed, lower temperatures, higher humidity, and greater water infiltration into the soil), and indirectly through manuring by livestock which spend greater time in treed fields during the dry season. The environment in general benefits as bio-diversity increases and natural processes begin to function again. With appropriate promotion, FMNR can reduce tensions between competing interests for land-based resources. For example, as natural regeneration increases fodder availability (tree pods and leaves), farmers are in a better position to leave crop residues on their fields and are less likely to take offence when nomadic herders want to graze their livestock in the dry season.

Since 2000, World Vision has been promoting this method in a number of other African countries. Malatin André, a Chadian farmer practising it for just two years reported: "Thanks to the new technique our life has changed. Food production has doubled and many people who were laughing at us, have also adopted the techniques for soil regeneration. As a result, there is always good production, the soil is protected from erosion and heat, and women can still get firewood. We have been using the same plot for more than 30 years and without such natural fertilizing possibility, we would soon stop getting food from it". Khadidja Gangan, a 35 year old Chadian mother of six said: "This year is very exceptional for me because I have been able to get enough sorghum. I cultivated one hectare and harvested 15 bags of sorghum. Generally, I could get three to five bags when working this land in the past. This would have been impossible if I was not taught the new technique of land management".

Conditions for success and future challenges

There are, however, still many gaps in our knowledge of natural regeneration. Farmers adapt it to their own personal needs and have different reasons for practising it. Further investigation is needed into various technical aspects, such as the most beneficial spacing, species mix, age to harvest, or type of harvesting, for specific purposes. In addition, legal and cultural considerations and historical relations between stakeholders need to be taken into account. For example, the major difficulties faced in Niger included:

Photo: Author

Harvesting millet amongst the naturally regenerated trees in Niger.

- The tradition of free access to trees on anybody's property and a code of silence protecting those who cut down trees. It was considered anti-social to expose anybody who had felled trees. This tradition was hard to break and those who left trees were often discouraged when their trees were taken by others. This situation was successfully addresses through advocacy, creation of local by-laws and support from village and district chiefs in administering justice. Gradually, people accepted that there was no difference between stealing from someone's farm and stealing from within someone's house.
- Fear that trees in fields would reduce yields of food crops. Field results put these fears to rest over time.
- Inappropriate government laws – if the farmer does not have the right to harvest the trees she has protected, there will be little incentive for her to do so. Farmers feared that they would be fined for harvesting their own trees. By collaborating with the forestry service, we were able to stop this from happening.

Other factors also affected the spread of the technique, for example, where language may reflect deeply held attitudes. In Hausa the word for tree (*itce*) is the same as the word for firewood, and therefore trees were seen to have little value of their own, apart from for firewood. Cultural factors may also work against adoption. Traditionally, Fulani cattle herders saw their lifestyle as the best in the world. Initially they found it humiliating to consider harvesting and selling wood, the way sedentary farmers did.

In addition, the practice of FMNR depends on having living tree stumps in the fields to start with. However, in many cases, farmers can successfully broadcast seeds of desirable species which, once established, become the basis of a FMNR system. The number of trees to be left in a field will depend on the number of stumps present and the farmer's preferences. Some left over 200 trees per hectare, others not even the recommended 40. The "correct" number of trees to be left will be a balance between farmers' needs for wood and other products, optimal environmental protection and minimal negative effect on crop yields. In areas of low rainfall, growth rates will be slower, and harvest or cutting regime should be reduced accordingly. Also, in low rainfall areas, establishment of direct sown seeds will take longer and be more difficult than in higher rainfall areas.

In areas where existing species are predominately thorny, or they compete heavily with crop plants, farmers may have second thoughts about FMNR. Where existing tree species are palatable to livestock, the increased effort required to herd animals or protect trees is beyond the reach of many farmers. In many cases however, the species are not palatable and there is no need to exclude animals from the field during the dry season.

Conclusion

What most entities working in reforestation have failed to recognise is that vast areas of cleared agricultural land in Africa retain an "underground forest" of living stumps and roots. By simply changing agricultural practices, this underground forest can re-sprout, at little cost, very rapidly and with great beneficial impact. In other words, in many instances the costly, time consuming and inefficient methods of raising seedlings, planting them out and protecting them is not even necessary for successful reforestation. Presumably, the same principle would apply anywhere in the world where tree and shrub species have the ability to re-sprout after being harvested.

Farmer managed natural regeneration is a cheap and rapid method of re-vegetation, which can be applied over large areas of land and can be adapted to a range of land use systems. It is simple and can be adapted to each individual farmer's unique requirements, providing multiple benefits to people, livestock, crops and the environment, including physical, economic and social benefits to humans. Through managing natural regeneration, farmers can control their own resources without depending on externally funded projects or needing to buy expensive inputs (seed, fertilizers, nursery supplies) from suppliers. Its beauty lies in its simplicity and accessibility to even the poorest farmers, and once it has been accepted, it takes on a life of its own, spreading from farmer to farmer, by word of mouth.

■

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Experimenting with the System of Rice Intensification in Iraq

Khidhir A. Hameed

Iraqi farmers usually cultivate rice according to cultural practices learnt from their parents. They use a large amount of seed (about 160 kg/ha) and dry cultivation methods. Transplanting is not common, but where it is used, seedlings are transplanted at distances of 15 cm from each other. Organic matter is not used, and farmers commonly depend on chemical fertilizer. Weeding is done by hand. Farmers generally grow an aromatic local variety, 'Amber 33', because it is preferred by Iraqi consumers. Since the early 1990s, farmers found they could ensure sufficient food production for the people if they also cultivated wheat after rice; however, this system has exhausted the rice land. It is in this context that we at the Al-Mishkhab Rice Research Station in Najaf, Iraq, began to try out the system of rice intensification – SRI. The aim was to enhance rice yields but also help to improve the soil, promote awareness of the environment and new agronomic practices among farmers, while reducing production costs.

In 2005 we began experimenting with SRI methods such as using wider spacings (25 cm x 25 cm), less seed, and early transplanting using the "parachute method", where young seedlings are thrown onto a shallow puddled field. These methods were tried out by one farmer on a quarter of a hectare in Al-Mahanawiya subdistrict, in the province of Diwaniya. The results were encouraging, with the "parachute method" using only 30 kg of seed per hectare, and yielding 4.5 t/ha, compared to the conventional dry method which used 160 kg of seed per hectare and yielded 3.8 t/ha. Farmers liked the "parachute method" because it was a fast way of transplanting seedlings into puddled fields. This method contributes to increased photosynthesis and encourages vigorous rooting.

After these results, in 2006 we decided to extend this method into three provinces that have large marshy areas. The farmers there grow flooded rice, and transplanting is not common due to shortages of labour and the limited time for transplanting. Farmers do not have access to transplanting machines, but do use a system of flow irrigation, so the "parachute method" of scattered transplanting is feasible in such situations. A chief of the Agricultural Department, several agriculture engineers, and farmers at all locations were trained in how to apply this method. The trials, comparing the "parachute method" to the traditional method, at eight sites in the three provinces, indicated yield increases in most sites. Yields were affected at some sites by improper nursery management, poor control over water, and high water salinity. However, the Iraqi Minister of Agriculture was impressed enough to promise to support extension of these methods next season, because of the low labour requirement and low cost. A field day was conducted at each site, attended by many farmers, professionals, managers, and political party representatives.

In 2006, for the first time in Iraq, we conducted rice experiments using cattle manure. Applications of composted cattle manure, assuming different levels of available nitrogen, were used, also with wider spacings (30 cm x 25 cm) between seedlings. The results indicated that rice yield increased with the amount of composted manure applied, and further increased when a combination of composted manure and nitrogen fertilizer were used. These results can promote the use of organic matter where there is still heavy reliance on chemical fertilizer, and show us that it is cost effective to use 10 t/ha cattle manure rather than the 15 t/ha cattle manure we expected to need. Yield increases of 20 to 26 percent were also recorded at the same sites in comparison to traditional fields. These results are encouraging us to continue.

To reduce farmers' costs, increase yield, and promote soil improvement, we will now extend these trials to farmers' fields. We will provide training in how to produce organic matter for their fields from animal manure, plant waste and crop residues, food scraps, and food stock. Equally, reducing the need for water when using SRI concepts will contribute to reduced hours of water pumping work, which then also means less use of oil or electric power. Next planting season, we plan to establish demonstration plots in farmers' fields at three sites. We will also look at introducing mechanical transplanting, and rotary hoes to contribute to the range of SRI methods which can be useful for reducing costs, saving time and contributing to reducing environment pollution.

Photo: Author

The parachute method of rice transplanting improved rice yields when tested in Iraq.

A meeting was held recently at the Al-Mishkhab Rice Research Station to discuss the best ways to continue and expand SRI research and demonstration in farmers' fields in our difficult situation. We would also like to involve staff from the Department of Agriculture in rice-growing provinces to assist in our continuing efforts. At this meeting, we decided to form an SRI committee which will oversee SRI methods as a formal committee, leading to the establishment of an SRI project. We will notify the Ministry of Agriculture about our committee, and we intend to be active in many spheres, hoping that SRI will become a "national project". ■

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Appreciation is expressed to Shaher F. Nwahi, Abdul Kaddum J. Mossa, and Raheem A. Hallool for their cooperation and assistance in this work.

Setting breeding objectives and developing seed systems with farmers: A handbook for practical use in participatory plant breeding projects by Anja Christinck, Eva Weltzien and Volker Hoffmann, 2005. ISBN 3-8236-1449-5. Margraf Publishers, Germany. Available from CTA, P.O. Box 380, 6700 AJ Wageningen, the Netherlands. E-mail: cta@cta.int ; http://www.cta.int

This book presents a range of methods, approaches and useful communication tools for working together with farmers in setting objectives for a participatory plant breeding programme. The different chapters focus on how to identify target environments and user groups, analyse production and seed systems, identify key traits, and set priorities. Furthermore, it offers practical advice on planning and implementing both participatory breeding and seed system development activities, summarising practical experiences gained in participatory breeding projects from different parts of the world.

Seed provision and agricultural development: The institutions of rural change by Robert Tripp, 2001. ISBN 0-85255-420-6. Overseas Development Institute (ODI), 111 Westminster Bridge Road, London SE1 7JD, U.K. E- mail: publications@odi.org.uk

This book is based on more than six years of field research, including examples from Asia, Africa and Latin America. Taking the view that "any discussion about agriculture or agricultural change leads inevitably to the subject of seed", this book provides a detailed look at the strengths and weaknesses of seed management in traditional farming systems, reviewing the history of formal plant breeding and the origins of seed trade, and examining the roles of the public and private sectors in the contemporary seed systems of industrialised and developing countries. Focusing on practical issues of seed provision and their relation to agricultural development, it also describes the major types of aid interventions in developing country seed systems, and explains why many of these have not been successful.

Farmers' seed production: New approaches and practices by Conny Almekinders and Niels Louwaars, 1999. ISBN 1-85339-466-1. Practical Action Publishing (former IT Publishing), Bourton Hall, Bourton-on-Dunsmore, Rugby CV23 9QZ, Warwickshire, U.K. E-mail: publishinginfo@practicalaction.org.uk ; http://practicalactionpublishing.org

Arguing that most seed in the world is produced by small scale farmers, this book focuses on how this process takes place at the local level. Its aim is to contribute to a better understanding of what farmers' seed production systems are about, with their strengths and weaknesses, covering a whole range of theoretical and practical issues relating to the improvement of local seed systems of the main tropical food crops. After a description of the local seed systems, the second part of the book deals with the technical issues of seed production, handling, storage and selection to improve seed quality. It also contains practical guidelines on how local seed systems can be studied, analysed and improved, considering the necessary links to formal seed systems. The final section contains crop-specific information, with special attention to those aspects which are relevant for seed production.

A nursery man and his trees: The work of John Maurice by Ed Verheij and Harrie Lövenstein, 2004. ISBN 90-77073-82-5. AgroSpecial 1. Agromisa, P.O. Box 41, 6700 AA Wageningen, the Netherlands. E-mail: agromisa@agromisa.org ; http://www.agromisa.org

With the same format as the well-known Agrodoks, this special publication presents the work of John Maurice, written as a tribute to him. John Maurice pioneered the use of "mini-trees", as a propagating method for a wide range of trees. "Mini-trees" are small and light (less than 100 g); their small size achieved by early budding or grafting. Instead of stimulating the growth of the shoot, this technique focuses on the branching of the roots, leading to an extensive and fibrous root system. As a result, these tiny trees have a surprising ability to survive during transportation and after being planted in the field. The method is discussed in detail and placed in the context of developments in plant propagation in general.

Small-scale seed production by Harry van den Burg, 2004. ISBN 90-77073-43-4. Agrodok no. 37. Agromisa, P.O. Box 41, 6700 AA Wageningen, the Netherlands. E-mail: agromisa@agromisa.org ; http://www.agromisa.org

This manual presents the general principles behind seed production and the maintenance of cultivars, making special reference to cereal and legume seeds. Written for extension staff and small scale farmers, it highlights the basic ideas behind inheritance and genetic variation, describing the differences between self- and cross-pollinated species. The later sections describe the different aspects which determine the quality of seeds, the importance of post-harvest care, and some issues to consider when setting up a seed production small business.

Business skills for small-scale seed producers by Soniia David and Beth Oliver, 2002. Book 2 of the "Handbooks for small-scale seed producers" series. Network on Bean Research in Africa, occasional publication series no. 36. International Centre for Tropical Agriculture (CIAT), P.O. Box 6247, Kampala, Uganda. E-mail: ciat-uganda@cgiar.org ; http://www.ciat.cgiar.org/africa/pdf/handbook_2_english.pdf

Without focusing on any particular crop, this handbook presents some basic information for establishing a small scale seed production business, as one which provides important services to a community: permanent availability of good quality seed, or the possibility of introducing new varieties. Issues covered include an analysis of the need for a seed business in a given area, the preparation of a business plan, record keeping and inventories, the importance of knowing the market and the customers, and the opportunities for broadening services. Also available online are Handbook 1 ("Producing bean seed") and Handbook 3, a guide for trainers supporting small scale seed enterprise development. This series was written for people who have no formal training or experience in seed production. It is particularly oriented towards small scale farmers, entrepreneurs, and community-based institutions.

Banking on seeds: Community Seed Bank Network, 2005. GREEN Foundation, 570/1 Padmashri Nilaya, 3rd Main 4th Cross N.S. Palya, BTM Layout 2nd Stage, Bangalore 570076, India. E-mail: greenfound@vsnl.net

Based on the work of the GREEN Foundation in Karnataka, India, this book presents the community seed bank as a system within community agriculture. This system encompasses the village level facilities where traditional varieties are safeguarded, and the key role farmers have played in the creation, maintenance and promotion of crop genetic diversity. The book describes the process which led to the establishment

of the Community Seed Bank Network, describing how it started, how it grew, and looking at the wide impact achieved: a large number of traditional seeds revived, more food being produced in kitchen gardens, and a reduction in the use of external inputs. More importantly, these efforts have led to a self-learning process and to an increased awareness of the advantages of traditional seeds and sustainable agriculture.

A training guide for in situ conservation on-farm. Version 1 by D.I. Jarvis et al., 2000. ISBN 92-9043-452-X. IPGRI International Plant Genetic Resources Institute, now Bioversity International, Via dei Tre Denari 472/a Maccarese (Fiumicino), 00057 Rome, Italy. E-mail: Bioversity-publications@cgiar.org ; http://www.bioversityinternational.org

The role farmers play in maintaining agricultural biodiversity on-farm is increasingly being recognised as an important way of conserving plant genetic resources in a local environment. This manual is intended for national programmes interested in supporting the *in situ* conservation of agricultural biodiversity. It presents the differences between *in situ* and *ex situ* conservation strategies, together with the information necessary for designing an on-farm conservation programme. Later sections focus on the design and implementation aspects, considering the institutional frameworks or the documentation of results. Through its different sections, the manual covers a range of disciplines, from genetics to ecology to anthropology, including sampling, data analysis and participatory methods. Many examples illustrate the different key concepts.

Seed potato technology by Paul C. Struik and Siert G. Wiersema, 1999. ISBN 90-74134-65-3. Wageningen Academic Publishers, P.O. Box 220, 6700 AE Wageningen, the Netherlands.

Considering the potato as the most important non-cereal crop in the world, this book reviews the current state of the art in potato seed production technologies. It starts by looking at the importance of seed quality, and at the agronomy and physiology involved in its manipulation. Further, this book provides a detailed analysis of the technical aspects of seed tuber production, and also a description of the production and use of the botanical seed, contrasting sexual and asexual multiplication. It includes a section on quality control, inspection and seed certification, as well as on the practical aspects of seed supply systems. It also describes diverse examples of these systems in countries as diverse as Bolivia, Yemen, Vietnam and Poland.

Seed multiplication by resource-limited farmers: Proceedings of the Latin American workshop, Brazil 2003, 2004. ISBN 92-5-105217-4. FAO Plant Production and Protection Paper 180. FAO, Viale delle Terme di Caracalla, 00100 Rome, Italy. E-mail: Publications-Sales@fao.org

The aims of the workshop were to identify the major constraints facing on-farm seed production, to identify the groups of limited resource farmers to be targeted and to propose solutions for increasing the availability of good quality seed to smallholder farmers. The workshop was one of the many efforts carried out by FAO's Seed and Plant Genetics Resources Service to generate ideas and facilitate initiatives aimed at strengthening on-farm seed multiplication. The papers presented include a comparison between the formal and informal seed systems, as well as case studies from Cuba, Nicaragua, Brazil and Bolivia.

Seed aid for seed security: Advice for practitioners by Louise Sperling, Tom Remington and Jon M. Haugen, 2006. International Centre for Tropical Agriculture (CIAT) Africa Program, P.O. Box 6247, Kampala, Uganda. CIAT, A.A. 6713, Recta Cali-Palmira, Cali, Colombia. E-mail: ciat-library@cgiar.org ; http://www.ciat.cgiar.org/africa/seeds.htm ; http://www.ciat.cgiar.org/africa/practice_briefs.htm,

These practice briefs are one of the results of the Seed Systems Under Stress project, implemented by CIAT, Catholic Relief Services and CARE Norway. This project aims to increase the effectiveness of seed-based interventions in acute and chronically stressed African farming systems, for which it seeks to influence and enhance the knowledge, attitudes and practices of donors and practitioners as they support and undertake seed assistance. These Briefs, also available in French and Portuguese, provide practical advice on how to improve aid oriented at sustaining and strengthening seed systems during disaster response and recovery periods. They include technical information addressing issues such as introducing new varieties, protecting agrobiodiversity, and exploiting market opportunities. Specific aid-response tools include methods for assessing seed system security, guidelines for learning-focused evaluations and checklists to ensure quality in seed aid proposal development.

Agricultural input trade fairs and vouchers in Mozambique: Experiences and lessons learned by Catherine Longley, Carlos Dominguez and Milly Devji, 2005. ICRISAT / ODI Working Paper. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), c/o INIA, Av. das FPLM No 2698, Caixa Postal 1906, Maputo, Mozambique. E-mail: icrisatmon@panintra.com ; http://www.icrisat.org

Many relief organisations in Africa have been trying to improve the efficiency of seed distribution in emergency situations by organising seed fairs. In the approach presented in this paper, farmers are not given free seeds, but vouchers with a specific cash value, which can be exchanged for seeds at a specially organised seed fair (or "input trade fair"). Vouchers are distributed to those most in need in the community, identified by community members themselves. At the fair, farmers "purchase" seed from a range of vendors, including farmers, small scale traders, and large seed companies, having the freedom to choose what varieties and quantities of agricultural inputs they want. This approach helps to build the local seed system by providing a market for local seed producers to sell their products. This report describes the experiences in Mozambique since 2001, together with a series of issues and lessons arising from them.

Seeds that give: Participatory plant breeding by Ronnie Vernooy, 2003. ISBN 1-55250-014-4. IDRC, P.O. Box 8500, Ottawa, ON K1G 3H9, Canada. E-mail: info@idrc.ca ; www.idrc.ca/seeds

Genetic erosion makes the world's food supply more vulnerable to disease and sudden climatic change - this may be the price to pay for having successfully developed and widely used new high-yielding crop varieties over the last decades. This paradox, and how it is being addressed by a novel plant breeding approach that takes into account the invaluable contribution of small farmers, is the topic of this book. It explores some of the issues surrounding the loss of agricultural biodiversity and reviews 10 years of IDRC support for participatory plant breeding research around the world. Complementing the book are six case studies in the developing world and a thematic website (www.idrc.ca/seeds). The book is available in English, French, Spanish and Chinese.

GRAIN

http://www.grain.org

Girona 25, pral., 08010, Barcelona, Spain

GRAIN is an international non-governmental organisation which promotes the sustainable management and use of agricultural biodiversity based on people's control over genetic resources and local knowledge. Established at the beginning of the 1990s, it focuses on what it sees as one of the most pervasive threats to world food security: genetic erosion. Its website contains news, information and publications, in English, French and Spanish. It also provides access to *Seedling*, GRAIN's quarterly magazine and flagship publication, with articles, news and interviews related to seed and food security.

Association Kokopelli

http://www.kokopelli-seeds.com

Oasis, 131 impasse des Palmiers, 30100 Alès, France

This is a non-profit making organisation set up in 1999, aiming to promote the preservation of biodiversity through the distribution of organic and open-pollinated seeds of heirloom varieties of vegetables and grains. Thanks to the support of its more than 6000 members, Association Kokopelli focuses on seed donations, organising workshops and establishing seed banks. In 2002 it started the "*Semences sans Frontières*" campaign (Seeds without Frontiers), inviting members to grow seeds in their own garden to be sent to countries in need of good organic seeds. In recent years, they have run workshops with farmers from India, Sri Lanka, Niger, Senegal, Burkina Faso, Mexico and Guatemala. In most of these countries, they have also helped set up community seed banks and seed networks. Their main achievement is the Annadana seed centre in south India: a seed bank surrounded by seed gardens.

Save Our Seeds

http://www.saveourseeds.org

Save our Seeds is a campaign committed to the establishment of strict purity standards for seeds and the accurate labelling of contamination with genetically modified organisms (GMOs) in Europe. This campaign is co-ordinated by the Foundation on Future Farming in Berlin, Germany, and is supported by over 100 000 individuals and 300 organisations. Its website includes very comprehensive dossiers for specific GM crops or cases (e.g. bt10 maize or LL601 rice), links to organisations in the different countries of the European Union, and a possibility to subscribe to their newsletter. Its "how to" section facilitates quick access to relevant information through links to websites and online documents.

ECHO, Educational Concerns for Hunger Organization

http://www.echonet.org

17391 Durrance Road, North Fort Myers, Florida 33917, U.S.A.

ECHO is a non-profit, inter-denominational organisation located on a demonstration farm in Florida, U.S.A. It has been assisting a global network of missionaries and development workers since 1981, and is currently serving agricultural workers in 180 countries. ECHO strives to provide ideas, training, information, and seeds critical to those working in agricultural development in developing countries. One of ECHO's best-known programmes is to send free, trial packets of seed overseas. ECHO's seedbank contains over 335 varieties of hard-to-find food plants, multi-purpose trees, fruit trees, and other tropical crops. Information sheets for some of these plants are available in PDF format on the website. Those who receive seeds report back on the performance of the plants in their conditions. This information is kept in ECHO's seed database then shared through *EDN - ECHO Development Notes*, ECHO's technical bulletin for overseas missionaries and development workers, to which it is possible to subscribe.

New Forest Project's World Seed Program

http://www.newforestsproject.com

731 Eighth St., S.E., Washington, DC 20003 U.S.A.

The New Forest Project strives to protect, conserve and enhance the health of the Earth's ecosystems along with the people depending on them, by supporting integrated grassroots efforts in agroforestry, reforestation, protection of watersheds, water and sanitation and renewable energy initiatives. It is part of the International Center, a non-profit organisation founded in 1977 to focus on issues linking the United States and the developing world. Its World Seed Program was established in 1982 in order to bring training materials, educational assistance and high quality tree seeds to farmers, environmental groups, women's cooperatives, municipal governments and anyone interested in initiating a reforestation project. Through this programme, the New Forests Project has supported over 4400 projects in more than 120 countries. NFP distributes a wide range of fast growing, mostly nitrogen-fixing tree seeds, which are primarily used in the tropics.

HDRA - Garden Organic

http://www.gardenorganic.org.uk/international_programme/index.php

Ryton Organic Gardens, Coventry CV8 3LG, Warwickshire, U.K.

Garden Organic is the working name of the Henry Doubleday Research Association (HDRA). This is Europe's largest organic membership organisation, dedicated to researching and promoting organic gardening, farming and food. The International programme has been running since 1986. Garden Organic facilitates organic, sustainable agriculture appropriate for small and medium-scale farmers in developing countries. It undertakes this through research, capacity building, training and the provision of information and advice. It has over 100 booklets, information sheets and research papers available to download free of charge on a range of issues from composting and weed control to multipurpose trees. They also operate a tailor made enquiry service, answering specific questions on organic farming, which is available free to farmers and community organisations in Africa, Asia and Latin America. Documents are available to download at http:/www.gardenorganic.org.uk/international_programme/ip_publications.php

European Consortium for Organic Plant Breeding, ECO-PB

http://www.eco-pb.org

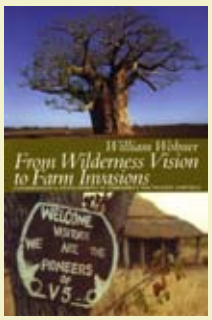
The European Consortium for Organic Plant Breeding, founded in April 2001, aims to provide a platform for discussion and exchange of knowledge and experiences. It runs and supports organic plant breeding programmes, and also provides independent and competent expertise to develop standard setting with respect to organic plant breeding. To further its purpose the Consortium may also provide, for example, for the exchange of knowledge and thoughts among its members, for the information of the public, and for representation in parliamentary and administrative rule-making. Its website includes reports and proceedings, discussion papers, concept papers and internal reports, all of which are free to download. It is also possible to subscribe to their electronic newsletter, which is also available as a PDF file.

NEW BOOKS

The gene revolution: GM crops and unequal development

by Sakido Fukuda-Parr (ed.), 2006. ISBN 978-1-84407-409-9 Earthscan, 8-12 Camden High Street, London NW1 0JH, U.K. E-mail: earthinfo@earthscan.co.uk ; http://www.earthscan.co.uk

Genetically modified crops are currently being grown on more than 90 million hectares, with research programmes running in at least 60 countries. This is presented as a new "revolution", comparable to the earlier Green Revolution in many ways. In the same way as with the Green Revolution, there is no consensus as to its benefits or dangers. Some see it as having many, possibly negative, unforeseeable consequences, or as a "corporate sell-out", while to others it is the necessary technological solution to lower yields, increasing populations, climate change and drought. This book is presented as a first attempt to bridge the gap between those in favour and those against GM crops. It looks at the relation between GM crops and national development policies, and compares the situation in different countries. The contributing authors detail five case studies, showing the experiences of Argentina, Brazil, China, India and South Africa.



From wilderness vision to farm invasions: Conservation and development in Zimbabwe's southeast lowveld

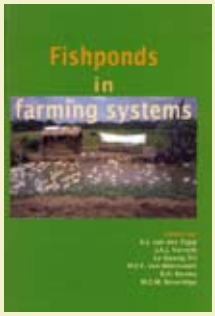
by William Wolmer, 2007. ISBN 978-0-85255-436-4. James Currey, Weaver Press, African Academic Press, 73 Botley Road, Oxford OX2 0BS, U.K. E-mail: james.currey@james.currey.co.uk

Throughout the years, the different conservation and development programmes in Zimbabwe's south-east "lowveld" have been shaped by the way in which this landscape has been seen: either as a wilderness to be tamed into productive landscape by white "pioneers", or as a pristine natural landscape to be preserved. Dryland agriculture in the lowveld has been regularly dismissed as inappropriate; irrigation projects have been biased towards large-scale commercial initiatives (sugar production, livestock management); and wildlife conservation initiatives have imposed coercive regulations on resource use, deepening antagonism over land. In general terms, the uses and perceptions of the local population have been largely ignored in national policies. As of 2000, land reform programmes and farm invasions have re-populated this area, highlighting the contrasting ways of understanding this landscape. A positive result of the "turbulent dynamics" through which the country is going may be the possibility of an open space for "the previously silenced notions of landscape to influence policy".

Seed diversity in the drylands: Women and farming in South India

by Carine Pionetti, 2006; and **State-farmer partnerships for seed diversity in Mali** by Didier Bazile, 2006. IIED Gatekeeper Series no. 126 and 127. ISSN 1357-9258. International Institute for Environment and Development, 3 Endsleigh Street, London WC1H 0DD, U.K. E-mail: sustag@iied.org ; http://www.iied.org

Drawing on examples from India and Mali, these two papers argue for changes in the existing seed systems. On the one hand, seeds are increasingly becoming the "property" of the private sector and big business, making it more difficult for farmers, and women in particular, to reach their objectives in terms of biodiversity or food production. On the other hand, governments face many constraints when trying to promote genetic diversity. Carine Pionetti argues that a radical re-orientation of public policies is needed to support autonomous seed production; Didier Bazile calls for stronger partnerships between research bodies, farmers and the various state services.



Fishponds in farming systems

by Akke J. van der Zijpp et al. (eds.), 2007. ISBN 978-90-8686-013-5. Wageningen Academic Publishers, P.O. Box 220, 6700 AE Wageningen, the Netherlands. E-mail: sales@WageningenAcademic.com

The integration of aquaculture into cropping systems provides wide options for creating a number of technical complementarities in terms of nutrient recycling, re-use of water and waste management. This book is a collection of refereed papers that investigate the feasibility of integrated aquaculture-agriculture systems for small scale farming in Asia and Africa (covering issues such as the management of nutrients or the relationship between sustainability, livelihood and markets). Case studies from Bangladesh, Thailand and Vietnam show that integration and diversification increase both farm productivity and farmers' income. The final paper deals with the strategies necessary to enhance the role of fishponds in farming systems. As the different chapters show, fishponds can contribute to sustainable food production without compromising environmental integrity.

Manifesto on the future of seeds

by The International Commission on the Future of Food and Agriculture, 2006. ARSIA Secretariat, Regional Government of Tuscany. Via Pietrapina 30, 50121 Florence, Italy. http://www.future-food.org

Created in 2003 with the conviction that "a better world is possible" the Commission seeks to shape a new future of food in which small farmers' livelihoods are secure, rural areas are economically and culturally vibrant, ecologically resilient, and citizens have nutritional security. Its work is guided and inspired by the principles elaborated and developed in its "Manifesto on the Future of Food" (first presented in July 2003) and its Manifesto on the Future of Seeds. This was prepared through a global stakeholder consultation at Terra Madre, the world meeting of food communities held in Turin, Italy, in 2006. Describing the threats under which the diversity of life and cultures is found, it calls for a new paradigm for seed and presents the "Law of Seed", under which farmers are free to save seeds, breed new varieties or exchange and trade seeds.

Fertile ground?: Soil fertility management and the African smallholder

by Michael Misiko, 2007. ISBN 878-90-8504-654-7. Wageningen University, P.O. Box 8130, 6700 EW Wageningen, the Netherlands. E-mail: office.tad@wur.nl ; http://library.wur.nl/wda/dissertations/dis4185.pdf

This book is the final product of the author's Ph.D. research, interested in the performance of soil fertility research within the ever shifting contexts of small scale farming. Focusing in western Kenya, this study examined the application of agro-ecological knowledge for soil fertility management with the objective of enhancing the utility of research among resource-deprived farmers. Results showed that the use of research technologies and concepts do improve soil fertility, but their application is generally bolstered when they fulfill indirect benefits. This leads the author to recommend a shift from component research to one at subsystems or whole farm system levels, thus addressing broader household objectives.

The global LEISA network

The global LEISA network is growing in size and ambition, and in April this year, ILEIA hosted our annual international editor's meeting in Wageningen, the Netherlands. As well as welcoming all the editors, we were also joined by the directors from our partner organisations as we discussed strategic issues related to the expansion and future of the magazines and the network. For a week, more than sixteen people representing all seven editions of the LEISA magazine, covering four continents and reaching approximately 250 000 readers, engaged in often heated discussions about how to improve the magazines and increase the exchange of quality information on Low External Input and Sustainable Agriculture.

A key element in the LEISA magazines is that each issue has a theme. At the recent meeting, we chose the themes for 2008, aiming for a mix of topics reflecting current global debates as well as returning to some of the basic ingredients in low external input and sustainable agriculture. Provisional titles are:

Issue 24.1, March 2008
Green and fair trade
Green and fair trade initiatives are mushrooming in many places, and then take many shapes. Some are very local in nature, some are global. With this issue we will look at various experiences and explore the opportunities they offer.
Deadline for submission of draft articles: 1 December 2007.

Issue 24.2, June 2008
Living soils
In this issue we intend to return to this fundamental topic and look at soils, not only as part of the ecosystem, but also at how soil management is linked to the social and economic aspects of sustainable agricultural systems.

Issue 24.3, September 2008
Social inclusion
With this theme we would like to look at the opportunities which LEISA brings to the most disadvantaged in society –for example the landless, differently abled, geographically dispersed or internally displaced people– in the process of agricultural development.

Issue 24.4, December 2008
Building resilience
Various techniques in sustainable and ecological agriculture (such as use of trees, intercropping or use of local varieties) help to build resilience in a small scale farming system. We are looking for experiences which demonstrate how LEISA farmers are better suited to withstand uncertain and changing conditions, particularly in relation to climate change.

With the upcoming Chinese edition, LEISA articles are now published in seven different editions and six different languages. We are proud of this achievement as it lets us reach an ever increasing number of subscribers and readers. The regional editions (as pictured) translate the highlights of the *LEISA Magazine*, and add more articles from their regions. This mix clearly shows that many principles and experiences in LEISA are relevant all over the world, but recognises that one aim of the regional editions is to present information particularly relevant to their context and interests. The *LEISA Magazine* that you are holding presents experiences from all over the world and as such we use our various networks to find the NGOs, projects, local organisations or research institutes who contribute the articles you read. At our meeting, we jointly decided that we can improve this sourcing process if it is synchronised – if all partners are working on the same theme at the same time. From now on, the LEISA partners will work more closely together to publish the most up to date and interesting articles we can collectively find. We hope this will improve the quality of all magazines and reflect current developments in sustainable agriculture. We do, of course, still rely on you the readers, as part of our extended LEISA network, to send us your contributions!

Call for articles

December 2007, Issue 23.4
Ecological Pest Management
With an increase in public concern over possible adverse health effects of agricultural pesticides, more consumers are taking a stand against the use of such chemicals. Integrated Pest Management, in practice since the 1970s, was in its early stages a technical approach designed to reduce the number of pesticide applications in crops. It subsequently developed into a methodology in which farmers were encouraged to develop healthier pest management interventions themselves, in the process of coming to a better understanding of their agro-ecosystems. With this coming issue of *LEISA Magazine* we want to examine how farmers have integrated ecological solutions and strategies for crop pest problems (insect pests, nematodes, diseases and weeds) with farm and natural resources management. We welcome examples of how farmers, by completely rethinking their farming practices, made their farming system much more resilient and resistant to pests.

Pest management projects all over the world often developed around a more dynamic extension model: the Farmer Field Schools. This approach combined training with field-based, location-specific research to build in farmers the skills, knowledge and confidence to make ecologically sound and cost-effective decisions on crop health. This new model of extension on crop pest management also generated many research questions. We are therefore also very interested in hearing about practical and successful experiences with such an integration of the natural and social sciences, and we welcome examples of how institutions have changed in order to be able to support these processes better.
Deadline for submission of draft articles: 1 September 2007