21. The Seed Constraint: New approaches for smallholder agriculture in eastern and southern Africa

ES Monyo[1*], **NVPR Ganga Rao**[1], **C Ojiewo**[2], **F Simtowe**[3], **JC Rubyogo**[4], **RK Varshney**[5] **and CLL Gowda**[5]

[1]ICRISAT, United Nations Avenue, Gigiri, Box 39063 Nairobi 00623, Kenya; [2]ICRISAT, Addis Ababa, Ethiopia; [3]ILRI, Nairobi, Kenya; [4]CIAT, Arusha, Tanzania; [5]ICRISAT, Patancheru, India.

[*]Corresponding author: E.MONYO@CGIAR.ORG

Pilot interventions through the Tropical Legumes II (TL-II) Project have shown promise in making new varieties available to farmers who depend on the farmer seed system. These initiatives which includes community seed schemes, seed recovery and seed bank schemes, seed fairs, contracting schemes, small seed packs, etc being promoted under TL-II, are further developed, and linked to participatory research, where farmers are directly involved in variety selection and testing. R&D agencies linked through TL-II implementation are designing and testing demand-driven seed supply strategies, which provide the necessary incentives for farmers to buy seed from the marketplace. The alternative approaches described above are based on two propositions; that different approaches are required for different crops and that we must lay greater emphasis on stimulating seed demand rather than focusing exclusively on seed supply. This report describes the legume seed dissemination strategies used for chickpea in Ethiopia, and groundnut and pigeonpea in Malawi and Tanzania and other TL-II focus countries. Preliminary research results from TL-II baseline studies in all three countries found that there was very limited awareness about improved legume varieties, and that neither public- nor private-sector interventions to produce and market legume seeds had a successful track record in these countries. To overcome these constraints investments have been made in breeder and foundation seed production, and proceeds from seed sales used to re-capitalize seed revolving funds that are then used to support subsequent seed production cycles.

Key words: Smallholder agriculture, community seed schemes and seed bank

Introduction

As a result of the inadequacy of the currently existing seed supply system for legumes in Eastern and Southern Africa, the rate of adoption of improved chickpea, groundnut, and pigeonpea varieties is very low - generally less that 10% of the planted area. Most farmers rely on own-saved seed and access seed of improved varieties either through informal networks or relief seed. These crops, particularly chickpea and groundnut, have high seeding rates and low seed multiplication ratio making the regular use of fresh seed expensive to farmers, and as a result yield levels of these crops remain low.

The lack of access to seed of improved varieties was particularly identified as a key hurdle to the adoption of legumes as farmers were observed recycling seed for many seasons without experiencing significant yield reductions. A baseline survey was conducted in Tanzania, Malawi and Ethiopia to confirm these hypotheses and to establish a baseline scenario for the project sites. Farmers were asked to provide information on sources of seed for the crops they grew including chickpea, groundnut and pigeonpea.

The survey results from all study countries reveal two main seed supply systems for the three target legumes. They are the informal, which are usually non-market based seed supply systems and the quasi-formal, mainly market-based seed supply systems. The informal seed supply sources included own saved seed; gifts from family and friends; farmer-to-farmer seed exchanges and others (e.g. donations by NGOs, government agencies, farmer groups/cooperatives, research demo plots etc.). Across both the target crops and countries, most smallholder producers got seed from informal sources with the use of own-saved seed being the most important source. The inter-country comparisons reveal differences on the magnitude of importance of the different sources. The relative importance of own saved

seed in the supply of seed was highest in Tanzania: chickpea (100%), groundnut (93%) and pigeonpea (86%). In Malawi own-saved seed accounted for 63% of groundnut and 71% of pigeonpea seed supply. The share of own-saved seed in the total supply was about 60% for pigeonpea, indicating the increasing importance of market-based channels with the emergence and diffusion of new varieties. The situation in Ethiopia for chickpea in the surveyed districts was different with 54% of the total seed supply coming from own-saved seed, and many farmers accessing new *kabuli* varieties from market-based channels. In general these findings are consistent with earlier expectation that informal seed sources are the most important sources of legume seeds in the surveyed communities. The importance of quasi-formal or market based channels seems to increase with the availability of new farmer-preferred varieties, which creates incentives for the emergence of markets and trade in the supply of seed of improved varieties. The observed low private sector participation in legume seed systems provides a justification for encouraging public support for legume seed production. The high cost of exclusion (low excludability), renders investments in legume seed systems unprofitable discouraging the private sector from investing in legume seed production.

Bottlenecks which the project component set out to solve

The inability of the system to meet the legume seed needs of smallholder farmers was a result of a number of constraints on which the project was developed.

- The public sector has consistently failed to ensure a consistent supply of good quality source seed (breeder and foundation) to guarantee further multiplication of the improved varieties by others.
- The private sector has shown little interest in venturing into chickpea, groundnut, and pigeonpea seed production

and marketing due to limited profitability especially relative to hybrid maize.

- The majority of farmers simply do not know of the existence of improved varieties with the result that there is no effective demand.
- Most often, seed is produced in high potential areas or areas with infrastructure for storage and processing far away from its area of utilization – leading to high costs of seed.

The lack of awareness of improved legume varieties by farmers is one of the key bottlenecks being addressed by the project. Results from the baseline confirm this hypothesis in that most farmers are unaware of improved legume varieties being promoted. In Ethiopia the improved *kabuli* varieties ‗Areti' and ‗Shasho' are known to 43.9% and 48% of the sample respondents respectively, but only 6.4% knew of the more recently introduced variety ‗Chefe' and 25% were aware of ‗Ejere'. In comparison 98% of the sample knew the local *desi* variety.

In Malawi about 74% of the sampled farmers were aware of at least one pigeonpea variety, but awareness of the improved pigeonpea varieties ICP 9145 and ICEAP 00040 was only 20% and 8% respectively. These findings indicate that after almost a decade since the two improved varieties were released, efforts to create awareness among farmers have been disappointing. The situation for groundnut was not that different with Chalimbana, that was developed and released in the 1960's, being the most widely known variety (84%) followed by CG7 that was developed and released in the early-1990's (53%). More recently developed and released varieties including Nsinjiro Baka, Kakoma and Chitala were even less well-known. The main source of information about varieties of both groundnut and pigeonpea was found to be other farmers.

A related bottleneck being addressed is the low adoption of legume technologies by small holder farmers in the three countries of study. In Ethiopia the proportion of farmers who planted improved chickpea was even lower than those who knew about improved *desi* and *kabuli* types. The demand for new varieties is high but limited by lack of seed, information and land constraints. In Malawi the situation was not that different with only 57% of farmers who knew about local pigeonpea varieties actually growing them. For both local and improved varieties there appears to be some dis-adoption as fewer farmers planted the crop in the 2007/08 season than had planted them before.

The levels of adoption from the baseline are about 10% for improved pigeonpea varieties (ICEAP040 and ICPL9145) and about 30% for improved groundnut varieties. While 84% of the sample farmers are aware of _Chalimbana‘, only 69% have ever grown the variety but in the 2007/08 season only 49% actually grew the variety. These results tend to suggest that there are a range of factors influencing the decision of farmers on which crops and varieties to plant, and that this is more than about the availability of information and seed, as these patterns are also observed with local as well as improved varieties.

Econometric results on the adoption potential for improved pigeonpea in Malawi indicate that once all farmers are aware of a variety, 45% can be expected to actually adopt it as compared to the 10% who were found to have adopted improved varieties. The findings suggest that there is potential for increasing the adoption of improved pigeonpea once awareness is increased and seed made available.

Reasons for not planting varieties that were known included lack of seed. In Ethiopia the share of farmers who mentioned seed constraints as a reason for not growing the varieties ranged from about 20% for all of the *kabuli* varieties to about 37% for improved *desi* types. In Malawi about 60% of the farmers

reported that they lacked seed for some of the groundnut and pigeonpea varieties they knew but never planted. The second major reason – around 20% of farmers - for non-adoption of groundnut and pigeonpea varieties were low yielding, and related to the seed problem is the lack of cash to buy seed reported by about 10% of the respondents.

Approaches tested to overcome bottlenecks

Two broad models of seed system operate in the formal sector. These include:

1. State/parastatal Seed Grower Model where researchers provide breeder seed to a parastatal or state agency to multiply on state farms or with contract seed growers,
2. Private Sector Model where researchers provide breeder seed and/or foundation seed to cooperatives and private companies who then undertake certified seed production and marketing.

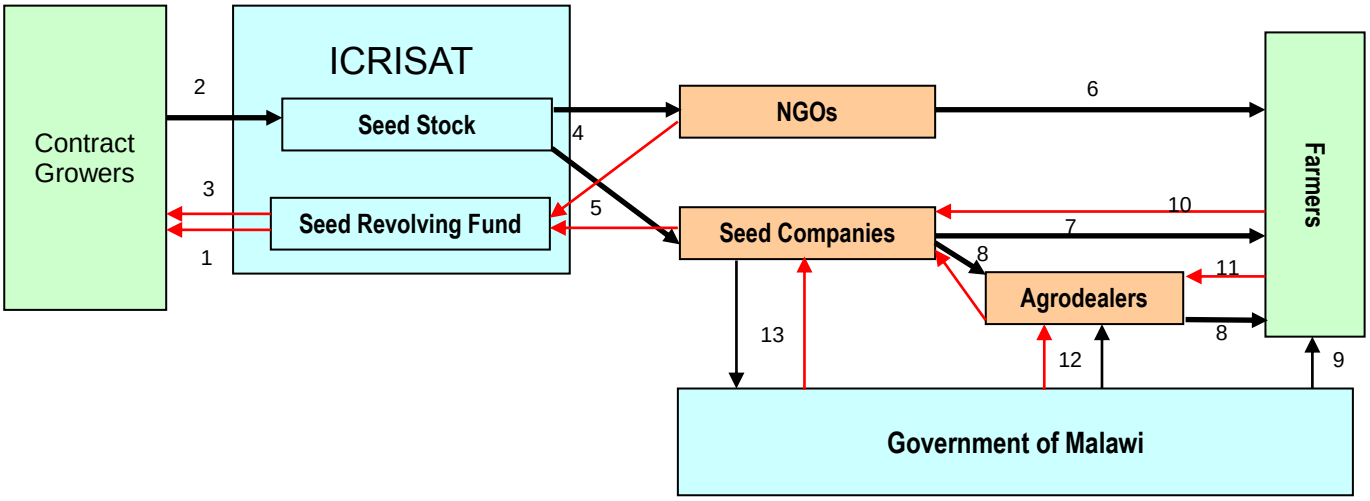
In eastern and southern Africa neither model has been very effective for the three crops under discussion and the project has utilized a combination of approaches that are described below.

ICRISAT and the national agricultural research systems (NARS) in Ethiopia, Malawi, and Tanzania have been producing high-quality breeder seed of the improved varieties being promoted at their respective research stations using optimum agronomic practices. This seed is then fed into the foundation seed production chain. Project funds are used to purchase breeder seed from the respective research stations, which is then either sold or provided on credit to contract farmers for production of foundation seed. ICRISAT and NARS scientists provide all necessary technical guidance to the contract growers including training courses and regular visits to ensure seed quality. In Malawi a seed revolving fund is then

used to purchase seed that has been independently inspected by the national seed service from contract growers and seed loans recovered where this was provided on credit. The seed is then processed, packed and sold to NGO partners running community seed production schemes and in some cases to local seed companies. Proceeds from seed sales are used to replenish the seed revolving fund and a new cycle of seed production undertaken. ICRISAT is working with NARS to establish similar mechanisms with NARS so that funds realized from seed sales can be used for the production of breeder and foundation seed beyond the life of the donor project. The Malawi model is depicted in fig. 1.

The program involves wide-scale promotion of three improved groundnut varieties (CG7 and Nsinjiro in Malawi, and Pendo in Tanzania), two pigeonpea varieties (Kachangu and Mwaiwathu alimi in Malawi Mali and Tumia in Tanzania), and several chickpea varieties in Ethiopia (including Areti, Shasho, Habru, Chefe, Ejere, Teji, Acos dubie, Kutaye and Natoli). Seed marketing is handled by the National Smallholder Farmers' Association of Malawi (NASFAM) in Malawi, by the Agricultural Seed Agency (ASA) and Zenobia Seed Company in Tanzania, and by the Ethiopian Seed Enterprise (ESE) at national and regional level in Ethiopia. These agencies offer smallholder farmers seed production contracts to produce certified seed under joint ICRISAT/NARS supervision, which is then bought back by these agencies. The national seed services of each participating country do independent inspections to assure quality.

Figure 4. Schematic diagram of the Malawi seed revolving fund model



Source: Van den Berg, 2009

To facilitate production, ICRISAT promotes the use of a block system led by agricultural field officers and enumerators to carry out the program of seed production. The agricultural field officers have some formal training in agriculture, but enumerators are elected by their peers because of their status as lead farmers in their respective communities. ICRISAT and NARS train the enumerators (training of trainers) and contract farmers in quality seed production, and additionally train the enumerators to carry out data collection and dissemination of information and program inputs. The farmer field schools extension approach is used for imparting knowledge of the principles and options for improved crop management systems to the farmers.

Community-based seed supply is the major seed source for smallholder farmers in eastern and southern Africa. This sector serves over 90% of the legume seed needs of smallholder farmers. There is, therefore, a lot to gain if strategies to improve the quality of seed coming from this sector were designed and properly implemented. ICRISAT and NARS recognize that assistance is needed to improve the efficiency of the range of investments already being made in NGO seed multiplication schemes. Our intervention is targeted to help NGOs improve seed quality control and develop more efficient seed distribution and marketing practices. Particularly, we undertake to develop a systematic seed production program with NGOs through provision of technical support to undertake:

- Variety evaluation and selection of suitable genotypes (e.g. conduct of participatory varietal selection).
- Maintenance of improved and selected genotypes through appropriate production technologies (e.g. on farm seed production).

- Development of training materials for use in assisting farmers to produce genetically pure seed of cultivars of their choice.

The project focus is resource-poor farmers most of whom cannot afford to buy improved seeds. Farmers are trained how to increase production by using farm-saved seed produced using recommended seed production practices (many farmers access improved seed through NGOs and relief programs but they cannot maintain quality). In addition, our project is also encouraging farmers who like experimentation by training them to first select, and then stabilize varieties they themselves have selected. These farmers - who tend to be the lead farmers in the community - are then encouraged to share seed with other members of the community. This is facilitated through seed fairs organized by the project.

NGOs make huge investments through relief and other seed supply schemes to poor rural communities. Our project is intervening to make these investments more sustainable particularly for self-pollinated crops like chickpea and groundnut. The project has partnered with CARE, the Millennium Village Project, Plan (Malawi), CRS, KIMAS, LVIA, Dutch Connection, DTM (Tanzania), Self-Help Development International (Ethiopia) and follow-up on their huge seed investments, with a simple message – ~~f~~or every one kilogram of improved seed received by the farmer, two kilograms should be paid back to the community seed bank for use by other members of the community who did not directly benefit". This simple request is followed up and managed by the community themselves and is resulting in a massive injection of improved seed to the community. The project is addressing five key activities, and the monitoring and evaluation plan for each activity is highlighted below.

a) ***Improving availability of foundation seed***

Area planted for production of foundation seed (FS) of different chickpea, groundnut and pigeonpea varieties per year.

- Quantity of FS produced of each crop and variety per year.
- Irrigation system for breeder seed installed and functioning in each country.

b) ***Designing, testing and implementing seed production programs***

- Area of land planted for production of commercial seed of different varieties for each crop per year.
- Quantity of commercial seed produced of different varieties for each crop per year.
- Number of seed farmers trained in quality seed production methods.
- Extent of participation of the private sector seed producers in seed production.
- Cost-benefit analysis of alternative seed production systems

c) ***Designing, testing and implementing seed marketing and diffusion systems***

- Survey report on constraints to existing seed delivery systems.
- Potential pro-poor seed marketing and diffusion channels identified.
- Cost-benefit analysis of alternative seed packaging and marketing arrangements.
- Number of small seed packs sold through agro dealers and farmer groups.
- Number of farmers (male & female) accessing improved seed.

d) ***Enhanced local capacity to produce deliver, store and market seed***

- Number of short courses on seed production.
- Number of short courses on seed delivery.
- Number of participants in seed training courses.
- Manuals prepared on seed related issues.
- Trial seed packs available at local agro-dealer and retail outlets.
- Evidence of involvement of graduate students to build capacity.

e) ***Enhanced local level awareness of available varieties***

- Number of farmers participating in PVS and demo trials.
- Number of farmer field days organized per year.
- Number of farmers participating in farmer field days for each crop per year.
- Number of small packs of seed distributed during farmer field days.
- Number of seed awareness material (leaflets) printed and distributed to farmers.
- Media (radio, newspaper) coverage to enhance awareness.

Results and lessons from TL–II and previous other ICRISAT initiatives

The project in ESA is addressing issues surrounding production, distribution, marketing and awareness of improved seeds of groundnut, pigeonpea and chickpea in three countries – Ethiopia, Malawi and Tanzania.

Seed Supply and Delivery Strategies: A Three-pronged Approach

We are using three alternative approaches, depending on the area and "target" community:

Contract seed production

In this approach, smallholder farmers take up seed production as a farm business. Researchers working with NGOs and other development partners help organize smallholder farmers into viable seed production groups. These can be farmer clubs in specific villages, farmer field schools or registered farmer associations. The farmers are then trained on procedures for production of good quality seed, and successful famers are linked to organizations interested in seed (seed companies, cooperatives, and commodity companies interested in seed of particular varieties or government initiatives). They then produce a specified class of seed of new improved varieties for the organization/company, which provides logistical support – including further training and credit for inputs. ICRISAT and partners are promoting and have executed this type of arrangement with good success in several countries including Zimbabwe, Zambia, Tanzania, Malawi, Mozambique etc (Monyo *et al.* 2004). Farmers are normally paid 30-50% more for seed production as compared to grain prices.

Strategy

- The program involves promotion of wide scale adoption of new varieties with a regional market. This was initiated in earlier efforts through the Sorghum and Millet Improvement Network for Southern Africa executed from Zimbabwe. The strategy involved Zimbabwe, Mozambique, and Zambia - one variety each of groundnut, sorghum, pearl millet and cowpea.
- ICRISAT used a block system led by local supervisors and enumerators to carry out the program of seed production. The local supervisors have some formal training in

agriculture, whereas the enumerators are elected by farmers on the condition that they are lead farmers. ICRISAT trains the enumerators and the farmers on procedures for quality seed production, and additionally trains the enumerators to carry out data collection and how to disseminate information and program inputs.

- ICRISAT also uses the farmer field schools extension approach for imparting knowledge of the principles and options for improved crop management systems to the farmers.

Achievements

- This project proved that smallholder farmers are committed and can grow seed as a commercial crop. The farmers wanted to maintain the links with the commercial seed company so much they were willing to sell some of their harvest as seed even during the worst seasons of drought (eg 2001/2002 season in Zimbabwe). This shows that smallholder farmer/ private sector partnerships are feasible if based on mutual trust.
- Smallholder farmers were capacitated to produce good quality seed and within four years of the program no single in the program was disqualified for reasons of not following the recommended seed production techniques.
- The methodology and strategy have been tested and refined in Zimbabwe but have since spread to other SADC countries with minimal adjustments.

Reasons for success and lessons

- The scheme is profit motivated. Farmers look at seed production as an enterprise.

- Capacity in seed production in the rural smallholder sector has been developed and opportunity provided for linking smallholder farmers with a private sector seed company
- The program is availing seed of improved OPVs to smallholder farmers in the dry SAT zones which would have otherwise not been available.
- Farmers in the Semi-Arid Tropics are very vulnerable to drought effects and this causes them remain food insecure. This has resulted in non-delivery of seed in preference for keeping it as food in seasons of severe drought. It is important that seed production areas are carefully selected to minimize risk of failure.

Examples under model I

Zimbabwe: The private sector have highlighted the difficulties of producing good quality seed of sorghum or pearl millet because of problems of bird damage if one attempts to provide these crops in isolated blocks. Small-scale farmers in the sorghum and millet growing areas own small plots, which do not provide for adequate isolation distances for seed production. Though individual farmers own small plots, due to the necessity to separate grazing areas from cropping areas, farms are organized into blocks. This arrangement provided for the opportunity to test the feasibility of producing seed for commercial sale in communal areas utilizing the idea of block farming. For this concept to work the community must agree to participate and grow only the identified variety of the selected seed crop. Small-scale farmers in two pilot districts in Zimbabwe have successfully used this concept to produce sorghum and pearl millet seed of designated varieties for the private sector seed companies. (Monyo *et al*. 2003).

Tanzania: the Christian Council of Tanzania (CCT), and the Diocese of Central Tanganyika (DCT) mobilized groups of

farmers and assisted them to register as Seed Associations. DCT operates only in Dodoma region but CCT operates nation-wide where they have facilitated registration of 11 farmer seed associations. The CCT concept is to support these associations to produce improved seed of open pollinated varieties (sorghum, pearl millet and maize) for commercial sale (Mwaisela, 1999, Mwaisela, 2000). These associations are reliant upon the communities for which they are located for their seed market and mostly on the contacts of their affiliated churches to find seed markets for them to sell their seed produce. A certain amount of money is retained through by CCT to ensure that the farmers continue to be supplied with fresh source of foundation seed. This model has been in operation since 1995. ICRISAT through the SMIP project started working with CCT during the 1998/99 seasons to provide technical assistance and identify associations, which can serve as successful case study for the purpose of improving the operations of others and or scaling up.

Nambia: The Northern Namibia Farmer Seed Growers Coop (NNFSGC) is another example of ICRISAT technical assistance in establishing viable seed delivery systems to small-scale farmers. Initially the founding members comprising 50 small-scale farmers were trained on aspects of good quality seed production through a training module organized by ICRISAT-Bulawayo and FAO-Namibia in 1994. It took four years for this group of farmers to develop into full-fledged registered Seed Coop – with capacity to produce adequate pearl millet seed for the needs of Namibia. (Lechner *et al.*1996).

Small seed packs

This is through selling seed in small packs, 500 g to 5 kg, instead of the usual 25 kg. ICRISAT and partners has demonstrated that farmers who cannot afford the large packs eagerly buy the smaller quantities, paying the full cost, without subsidy. ICRISAT working with private sector partners in

different countries have demonstrated that over 80% of the seed distributed in rural remote areas through the small seed pack program was purchased, helping to spread new varieties in drought-prone ―pilot" areas. The private sector – especially emerging small seed companies, retailers and agro-dealers have taken full advantage of this. As a result, TL-II partners in participating countries were able to distribute over 1 million small seed packs to smallholder farmers through seed retail outlets during 2012/13 season (Table 1).

Table 1. Amount of small seed packs distributed during 2012- 2013 crop season in TL-II target countries.

	Number of small seed packs per crop						
Country	Chickpea	Groundnut	Commonbean	Soybean	Pigeon pea	Cowpea	**Total**
India	1,237	4,375	0	0	2,574	0	**8,186**
Bangladesh	90	290	0	0	0	0	**380**
Ethiopia	424	0	5,075	0	0	0	**5,499**
Uganda	0	NA	NA	0	40	0	**40**
Tanzania	45	0	3,045	0	1,825	0	**4,915**
Kenya	3,568	0	50,500	13,566	0	0	**67,634**
Mozambique	0	NA	0	23,899	0	4,600	**28,499**
Nigeria	0	1,500	0	81,000	0	63,000	**145,500**
Niger	0	NA	0	0	0	63,000	**63,000**
Malawi	0	839,500	0	0	NA	0	**839,500**
Mali	0	5,290	0	0	0	15,000	**20,290**
Total	**5,364**	**850,955**	**58,620**	**118,465**	**4,439**	**145,600**	**1,183,443**

Seed production & distribution through primary schools

Primary schools in rural areas multiply seed of improved varieties, with technical and logistical support from ICRISAT, government agencies (Department of Research and Training, Department of Crop Development, Local Government), and other partners. The schools then distribute this seed to nearby communities, ensuring that smallholder farmers have access to affordable, high-quality seed within a convenient distance from their homesteads.

Rural primary schools were identified in two drought-prone districts (Dodoma and Singida) in Tanzania. Each selected school had over 500 students, and served 500-700 families, so there is a substantial demand for seed. Agriculture is part of the curriculum, and trained teachers are already in place. The schools are already engaged in agriculture, mainly cereals (sorghum, millet, maize), legumes (groundnut, cowpea) and vegetables some of which are used to feed students. The children are from farming families, and benefit directly from practical experience in seed production. Adequate land is available to ensure proper isolation distances where needed.

Strategy

- The selected schools are within 15-20 km of each other, so that each area has its own ~~"s~~eed production and distribution center", and farmers can get seed without having to travel long distances.
- The government assigned Ward Education Officers (WEOs) to supervise project implementation. Each WEO supervised seed production in ten schools.

- ICRISAT provided each school with enough breeder/foundation seed to plant 1 hectare of seed crop. The crop/variety was carefully selected for adaptability to local conditions.
- Training programs were conducted for one teacher per school, plus all supervising WEOs, covering seed production techniques, crop management, quality control, certification standards, and storage methods. Project partners (ICRISAT, DRD, Participating NGOs) provided funding and resource persons for the training; logistics were organized by the schools and the local community.
- Throughout the crop season, ICRISAT, government researchers, the local resident NGO (DCT), monitored crop management, pest control etc, providing advice on quality control.
- The village government and community elders through the Ministry of Local Government, ensured the program was successful by minimizing cross-contamination from other fields; and by organizing seed distribution after the harvest.
- Crops/varieties – sorghum (Pato), in different areas. pearl millet (Okoa), sesame (Ziada 94), groundnut (Pendo), pigeon peas (Mali) and maize (Kilima) were targeted.

Achievements

- The program was launched as a pilot scheme with 50 schools in one district but within 4 years expanded to cover 250 schools in eight drought prone districts of Tanzania.
- The range of crops has expanded; initially only sorghum and pearl millet seed were multiplied but the range of crops expanded to include sorghum, pearl millet, pigeonpea, sesame, groundnut and maize.

- Each school supplies approximately 0.5tons of high-quality seed to the surrounding community every year, at affordable prices. As a result, the area under improved varieties in these target districts increased 5-6 fold.
- This initiative was implemented under a SADC regional program executed project and following the success in Tanzania, similar initiatives were started in Malawi through NGOs.

Why did the program succeed?

Partnership: the program was led by the communities themselves. ICRISAT, government research and extension staff, and NGOs provided support (Monyo and Mgonja 2004). Two key government departments – the ministry of education and Local Government (the district administration) – were closely involved, ensuring that monitoring, logistics, coordination, and other issues (eg, certification, sale permits) were smooth.

Ownership: the community had a clear sense of ~~–o~~wnership" of the project. It was being implemented at community level, with benefits targeted at the community. So there was enormous popular support, mobilized by village leaders. For example, farmers with plots adjacent to the school's seed plot agreed to plant different crops to minimize cross-contamination and ensure genetic purity of the seed being multiplied for the crops that required isolation.

Promotion: field days were held at the schools, to demonstrate the benefits of the project. Over 1000 farmers from ~~–ta~~rget communities" on the average attended these field days: as well as farmers from nearby areas, from other districts in Tanzania, even from other countries. The visitors included representatives from the national programs and Seed Services Units from Botswana, Malawi, Mozambique, South Africa and Zambia. As a result, awareness spread rapidly. So, did interest from other communities in implementing similar schemes. Schools-based seed projects are being implemented in Malawi, in partnership with World Vision

International. The Mozambique government also expressed interest with a wider range of crops.

Seed production through community seed schemes

Community-based seed bulking: community-based seed production seeks to involve small-scale individual farmers, farmer groups, NGOs and governmental organizations in forming small but effective seed multiplication units with the objective of supplying quality seeds for farmers' own use and for sale to other farmers. Activities include the selection of farmers or farmer groups to be involved in seed bulking and training on seed multiplication techniques and marketing. The Seeds Technical Services Unit and other CGIAR institutions based at Chitedze Agricultural Research Station - Lilongwe provides all the required training and foundation seed to the community-based seed farmers.

Community-based grain banks: this is a system where the grains produced locally are stored and distributed to participating farmers as seed at planting time. Farmers manage community grain banks, with supervision from CBOs and local NGOs. If run properly, they alleviate shortages of seed and ensure timeliness of seed supply to rural farmers. They can also act as a safety bank for seed, especially in times of drought. The success and sustainability of these grain banks is of paramount importance for local seed security.

Seed recovery and banking program: in this system, farmers are facilitated to prepare a list of crops and varieties they require. The crops are procured from local seed merchants (local seed markets) and kept in a central store (seed bank) at village level. These are then distributed to farmers at planting time. After harvest, farmers return twice the amount of grain or seed given.

Village committees manage the seed recovery and banking with the assistance of location extension staff from the Ministry

of Agriculture and local CBOs and NGOs. These CBOs and NGOs usually give the communities initial funds for seed procurement. Each seed bank is run at village level. The village committees monitor the crop in the field and establish and manage the seed banks. Sub-locational committees monitor the village committees and provide a forum for sharing experiences.

Seed fairs: seed fair is a market where households purchase seed through a voucher system. It is organized on a specific day at a specific location, announced in advanced. The routine way of conducting seed fair has been in disaster-hit areas and using vouchers to target households, as an agricultural recovery mechanism. At the seed fair, vulnerable households are provided with vouchers worth specific cash value to purchase seed and tools from registered sellers in the community. Seed fairs aim to:

- Create awareness of alternative seed sources and varieties.
- Enable disaster-affected farmers to access crop/varieties in quantities of their choice.
- Strengthen and stimulate linkages and information sharing among farmers.

After a disaster or displacement, farmers often lack access to seed. The common assumption is that seed is not available within the community. The approach recognizes that farmer seed systems are robust and resilient, and even provide seed in emergency situations. This approach to seed aid focuses on farmer seed system and involves farmers in the procurement.

Seed fairs have been conducted where a need for seed aid has been identified as appropriate when populations are displaced, and/or do not have their own seed stocks. Seed purchase through seed fairs and vouchers can be used when:

- Farmers have suffered total crop loss as a result of conflict or natural disaster.

- Farmers were displaced due to conflict and were not able to harvest their crops.
- Farmers were unable to sow their crops due to an emergency-related disruption.
- Farmers‘ seed stocks were stolen as a result of rebel attacks.
- Internally displaced persons are returning to their homes or refugees are settling on land allocated to them.

The decision to conduct a seed and cultural fair should be based on proper assessment of the disaster-affected location, including the need for seed, availability of seed in the area, and overall security in the area. Seed fairs should utilize farmer seed systems because they offer the following advantages:

- Farmers access seed of their preferred crops and varieties
- Seed quality is left to the judgment of farmers.
- Local crop production is supported.
- Fairs can be planned and implemented in short period of time
- Communities are actively involved in planning and implementation.

They serve the needs of large numbers of families who find it difficult to access seed; the approach can be modified to suit the level of seed insecurity.

In short, seed fairs allow beneficiaries to access seeds and varieties that are locally available, of their preference, and meet their immediate needs (CRS *et al*. 2002).

Skills and knowledge enhancement: one of pillars of expanding and sustaining the outcomes/outputs of the Tropical Legumes Project is to build skills and knowledge of partners/actors along the seed value chain of various grain legumes. Table 2 illustrates the number of seed value chain actors and other partners trained between 2012 and 2013.

Table 2. Training of farmers and extension staff by region (2012/13)

Region	**Number of farmers & extension staff trained**		
	Farmers	Extension staff	**Total**
Eastern & Southern Africa	9,530	4,257	13,787
Western and Central Africa	6,800	418	7,218
South Asia	10,073	2,891	12,964
Total	**26,403**	**7,566**	**33,969**

Awareness creation: training modules, manuals, leaflets/flyers and information bulletins were produced. For instance, a training manual for chickpea production in Kiswahili language has been developed and was used for training in Kenya and Tanzania. A total of 8,000 leaflets with information on groundnut seed production (6,000 in Uganda, 2,000 in Malawi) were distributed. About 2507 bean seed production/business manuals in four languages (Amharic, Oromifa, Swahili and Luganda) were produced and shared with partners in Ethiopia, Kenya, Tanzania and Uganda respectively. Mass communication was also used to disseminate knowledge about new varieties and their seed source through several radio and TV programs and through publication of news articles on local newspapers. Over 21,000 legume seed producers (11,990 in Tanzania, 5,535 in Uganda, 2,300 in Ethiopia, 1,381 in Kenya, 677 in Malawi and 657 in Mozambique) participated in a total of 116 farmer field days and 27 farmers‘ fairs held at on-farm and on-station trial sites. Strategies that create variety awareness were implemented in Malawi (involving partnerships with agro-processors and traders), Tanzania (involving Dodoma transport and Kilimo markets), Ethiopia (awareness created by farmer cooperatives) and Uganda (in partnership with seed companies). Several production guides and technical manuals were

developed for all mandated crops. Several field days and farmers‘ fairs were organized and quite alarge number of users in partner countries was participated. In India and Bangladesh 3,106 farmers (2,365 men & 741 women) were trained on salient features of chickpea varieties, seed production and post-harvest technologies. Further, 135,000 farmers supported through TL-II participated in farm fairs organized by UAS-Dharwad and UAS-Raichur (In India).

Achievements & lessons from Tropical Legumes–II Project

Impressive seed production/supply levels were recorded in phase II. Most crops have surpassed the targeted milestones (based on already executed two year period of the project). For instance, quantities of chickpea seed produced (111,553 MT) surpassed the milestone (11,645 MT) by more than 900% (Table 3).

Table 3. Seed production (tons) across target countries, by crop and phase

Crop	Phase I (2007-2010)	Phase II (2011-2013)	Total
Chickpea	82,381	111,553	193,934
Common bean	9,030	18,451	27,481
Cowpea	604	1,445	2,049
Groundnut	11,977	15,685	27,662
Pigeon pea	921	3,644	4,565
Soybean	1,171	1,720	2,891
Total	**106,084**	**152,498**	**258,582**

Table 4. Crop specific lessons

Chickpea	Groundnut	Common bean
Smallscale farmers require complementary functional seed and product markets if sustainable seed production is to be achieved.	Sustained seed support is essential for large area coverage by FPVs and resultant enhanced productivity in groundnut	Farmers are willing to use new varieties once they are convinced the variety will meet their requirements.
Selection of a given chickpea variety by farmers is largely influenced by the market superiority of that variety.	Project interventions focusing on affordable seed production and delivery systems have a better chance of surviving beyond the lifespan of the project.	Identification of effective partners that share the same vision and interests is important for popularization of new technologies.
Participatory variety selection enhances cost effective testing and increases chances of varietal adoption.	Business-oriented smallholder farmers performed better in seed production, storage & dissemination than food security-oriented farmers.	Remedial training of farmers after some years is essential for enhanced technical capacity.
Strong policy support encourages several private seed companies, and is also crucial for quick dissemination of proven technologies.	Limited access to good land and farm equipment are the major challenges facing women farmers.	Seed loan and small seed packs approaches have proved efficient for variety promotion and dissemination especially for poor farmers and women (e. g. Kenya).
Market pull is the major key driver for success in Ethiopia that resulted in enhanced stakeholder participation and government‘s policy support.	The project involves many sites. Focusing on one key region per county will be the most effective in terms of resource use and sustainability. Successful interventions can be replicated in other regions.	Use of small packs started as a joint public –private initiative but with progress vision of empowering private sector to sustain and expand the approach.

Table 4. Continued…

Chickpea	Groundnut	Common bean
Poor product standardization and market unpredictability affects seed sector growth in ESA.		A multi-crop approach is important to expanding seed systems for crops of low commercial seed interest.
Farmers' awareness and availability of the seed are the key factors in technology dissemination		Decentralized bean seed production and use of small seed packs have improved seed supply capacity (e. g. Ethiopia)
PVS, field days, demonstrations and seed fairs wer very effective in awareness creation, fast adoption and dissemination of new technologies		Farmers' awareness on bean production and productivity improved - triggering increase in interest of individual farmers, private farms and farmers groups to venture in bean farming as a business.
		Strong partnerships cemented through formation of innovation platforms resulted in more effective and efficient bean seed system
		The sensitization of famers on the type and kinds of varieties enables the creation of market for seed companies especially for the new varieties.

Next steps

In all three countries of eastern and southern Africa where the project has been working, significant investments have been made particularly by non-governmental organizations in the promotion and dissemination of improved legume seeds. By partnering with these organizations the project has been able to leverage extra resources towards achieving the ambitious targets set for groundnut, pigeonpea and chickpea seed systems in ESA. The project should strive to engage with policy makers at both national and regional level to develop a coherent policy for open-pollinated crops – including legumes – so that investments made by the private sector maximize the benefits from investments in legume breeding.

The project has made progress in developing a sustainable system for the production of source seed by establishing seed revolving funds that overcome some of the bottlenecks faced by the NARS that are dependent on government treasuries for support. However, these mechanisms need to be properly established and managed as businesses if they are to be sustained beyond the life of the project. Source seed production should be open to other parties and not handled exclusively by the seed revolving fund, and there needs to be flexibility to allow for different models to evolve, co-exist and even replace this model as the seed system develops.

In the next phase much greater attention needs to be given towards establishing functioning legume value-chains and stimulating seed demand rather than focusing so extensively on seed supply. Support to entrepreneurs will probably best be provided through business development service providers that are becoming increasingly important, and offer services on a full-cost recovery basis.

References

CRS (2002) Seed vouchers and fairs: a manual for seed-based agricultural recovery in Africa. Catholic Relief Services developed in collaboration with International Crops Research Institute for the Semi-Arid Tropics and Overseas Development Institute, Nairobi, Kenya.

Monyo ES, Rohrbach DD and Mgonja MA (2004) New partnerships to strengthen seed systems in Southern Africa: Innovative community/commercial seed supply models. In *Successful Community-Based Seed Production Strategies*. Mexico, D.F., CIMMYT. **ISBN**: 970-648-115-X.

Monyo ES and Mgonja MA (2004) A community based seed production system—Schools for seed in Tanzania. In *Successful Community-Based Seed Production Strategies*. Mexico, D.F., CIMMYT. **ISBN**: 970-648-115-X.

Setimela PS, Monyo ES and Bänziger M (eds) (2004) Successful Community-Based Seed Production Strategies. Mexico, D.F., CIMMYT. **ISBN**: 970-648-115-X.