Review of Community Seed Production Practices in Africa Part 1: Implementation Strategies and Models

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Summary

This review is limited in scale and scope and covers five case studies in Africa. Two of the studies are classic emergency interventions: one post-conflict and one post drought. Three of the case studies are developmental in nature; one focused on different approaches to increase farmer access to recently released drought-tolerant cereal varieties, another looking at smallholder participation in legume seed supply, and one looking at three women's groups as seed enterprises. This review is based on an analysis of published and unpublished policy reviews, briefing and discussion papers, journal articles, meta-reviews, training material, strategy documents, evaluations, and case studies on seed production and seed delivery with a focus on the diverse but not well understood area between farmer seed management and commercial seed. This review has also been informed by discussion with seed system practitioners, particularly those involved in the case studies examined. This space between farmer seed management and commercial seed has been referred to as community seed production, smallholder seed enterprises, informal seed supply, and local seed system development programs. The objective of this review is to examine the status and trends in community seed production in order to identify key criteria for success and possible areas of improvement, including the role of community seed production in linking formal (public and private) seed sectors with the farmer seed system. The first section of the review (Part 1) details the five case studies in terms of major activities and implementation strategies.

1. Introduction

1.1. Context and framing

Farmers everywhere depend on seed as a fundamental input to crop production. The quality of seed and variety determines the success in productivity and stability (resilience to pests, disease, and drought). Agriculture accounts for ¼ of GDP and nearly 2/3 of the labor force and livelihoods in Africa and more than 60% of the rural population lives on less than $1.25 per day (Livingstone *et al*., 2011). An estimated 33 million small farmers in sub-Saharan Africa farm on less than 2 ha and rely on family labor with no mechanization (Wiggins 2009). Cereal yields have been stagnant in Africa since 1960 at roughly 1 MT per ha compared to 2.5 tons per ha in South Asia and 4.5 tons per ha in East Asia (Hunt 2011) whereas sub-Saharan Africa's population is slated to more than double by 2050 to 1.8 billion.

During the 1970s and 1980s, seed system support in developing countries focused on supporting the public sector via national research programs, extension services, crop protection departments, farm input supply, laboratories and equipment, seed production farms, and training (Venkatesan 1994). Challenges with state seed enterprises have been well documented and include: monopolistic behavior, low accountability, low amount of seed provision, and low responsiveness to farmer needs. Following structural adjustments in the 1980s and 1990s, state seed system support was increasingly dismantled through lower subsidies, concerted efforts to create private sector space, and an increase in project-based seed support to civil society organizations with public sector research linkages. The hypothesis underlining structural adjustment of agricultural reform in Africa was that public sector

focused agriculture was not cost-effective. The 1990s also saw the advent of large-scale emergency seed interventions in Africa that were responding to natural and man-made disasters (early 90s drought in southern Africa/Rwandan genocide). From 2000, there has been widespread agreement that the agricultural sector in Africa was under invested and in crisis, performing worse than the 1970s as measured in per capita production.

The last decade has seen an emerging consensus around 'market-led technology adoption in agriculture' as the path out of the abyss. This Green Revolution in Africa approach would occur through lowering yield gaps via planting new varieties of staple food crops, increasing yield potential with fertilizer and soil management, and making input markets more efficient and accessible and output markets easier to exploit so that surplus production can be converted to income and profits can be re-invested to further increase productivity (Scoones and Thompson 2012). Within seed systems, this Green Revolution orthodoxy − improving input (seed and fertilizer) and output markets to create effective demand − was clearly embodied in the Bill and Melinda Gates Foundation and Rockefeller Foundation-funded Agricultural Green Revolution for Africa Program for Africa Seed Systems (AGRA-PASS), which set a ten-year goal to introduce 400 new varieties of 10 staple crops contributing to poverty and hunger alleviation of 30-40 million people. Seed is the 'tip of the arrow' by which new knowledge is delivered to farmers and the point of entry for complimentary agricultural investment (PASS Strategy Memo).

Major risks and assumptions to the AGRA-PASS strategy included the expectation that smallholder farmers would be willing to pay a premium for certified seed with a 20-30% yield improvement, that the private sector would receive more support for production and distribution of seed than public sector institutions, that public sector breeding could engage effectively with private sector seed companies, that farmer adoption would be driven by a niche-focused breeding process creating varieties meeting smallholder demands, that output markets would develop to absorb generated surplus, and that policies would be implemented to enable input and output market development (PASS Strategy Memo). By 2012 some key AGRA-PASS investments rooted in these hypotheses were being actively re-evaluated, for example, maize hybrids as the overwhelming focus for AGRA-PASS seed investment and the agro-dealer networks as the preferred input delivery mechanism for farmers. While many activities in seed production and dissemination may (and should) be commercialized, most seed reproduces easily and is stable over multiple generations. This capacity of seed to effectively self-replicate while in the hands of the user significantly limits the opportunities for repeated and sustained sales of a single variety, that is, unless there is loss in genetic purity or physiological deterioration due to pest or disease which drive a repeat purchase. Thus, even in highly developed and efficient farming systems such as the United States more than 2/3 of wheat seed used each year is recycled from farmers' own fields (Minot 2007).

Outside of acute emergencies – such as war, resulting in displacement and abandoning of seed stocks, or other natural calamities, such as drought, flood, pest or disease, causing massive crop loss – the extent of farmer recycling drives seed demand for any variety. In non-emergency contexts, farmers' in Africa self-source upwards of 80% or more of annual seed needs and when they do source off farm it typically comes from a neighbor or from local grain markets. Reasons for self-sourcing as opposed to seeking seed from the formal (commercial or public) sector are many and may include: satisfaction (real or misguided) with own seed; lack of familiarity and/or appreciation for the 'value added' of new varieties or certified seed; no availability; not aware and/or not able to apply complementary technologies to maximize the benefit from the seed; cost (Muliokela 1998). Where shocks to the seed system reduce supply and increase demand due to drought, flood, or conflict; self-sourcing or sourcing from a neighbor may not be sufficient to meet sowing requirements. Where there is incipient demand for new varieties, due to traits such as drought tolerance and disease resistance or new output market opportunities demanding new traits (color, storability, size, processing quality), the commercial sector may not be nimble enough, alone, to meet farmer demand.

The seed business, for food crops, is generally low margin and high volume driven whereas transport and distribution costs are expensive in Africa. For the case of seed for major food crops, when there is limited varietal out-crossing or quality degeneration, the window for commercial opportunity is often short-lived because of the capacity of seed to quickly and effectively self-replicate in the hands of farmers. The formal commercial seed sector – unless there is a market making a subsidy from a government, foundation, UN/Agency, or NGO – is unlikely to address seed supply issues of food crops or crops in remote areas as it is not financially justifiable (Minot and Smale 2007). There is no pure business case to be made for commercializing seed for food crops where there are high operating costs and challenges to achieve scale in operation. Genetically modified crops may someday alter the market dynamics of commercializing seed by enabling a business model to be based on high margins and low volume. Specialty and niche seed markets exist and are exploitable in Africa. These tend to be dominated by very small entrepreneurial seed specialists and where there is scope for scale they require significant capital investment.

As this discussion illustrates, seed is complex and practical solutions aimed at enabling farmers to access and effectively utilize new and existing varieties in a sustainable and cost-effective manner are context specific. This calls for a pluralistic approach, involving multiple actors spanning the public and private sector, recognizing their unique roles and capacities (rights and responsibilities), functioning effectively at an organizational level closest to the problem (subsidiarity), and acknowledging self-limitations and actively seeking out synergies with other actors (solidarity for the common good). The necessity for cooperation and 'creative complementarity' is based on the premise that seed products, services, and policies beneficial to farmers cannot be developed though a disproportionate focus on the public sector (research organizations, plant health and seed inspectorates, government extension, government managed subsidy programs), the private sector (seed companies, agro-dealers, seed trade associations, for profit organizations), or farmer and civil society organizations (farmer cooperatives and associations, NGOs). A key challenge to 'pluralism' is in identifying each actor's unique gifts and establishing incentive structures that promote and reward collaboration across the public, private, and civil society spheres.

1.2. Definition of Community Seed Production

The public seed sector – composed broadly of national breeding programs, agricultural extension, national plant protection, and seed inspection agencies – focuses on the development of varieties for diverse agro-ecologies, the '*extension*' or delivery of those products to highly heterogeneous populations, and the creation of an enabling policy environment for this to occur. Ideally, the public sector fills a space in the seed system and responds to seed demand where private sector engagement is limited and where public sector efforts do not crowd out the potential for private sector profit.

The private seed sector is the most active and dynamic force in seed systems globally – investment in seed-related R&D dwarfs that of any government – and in Africa the commercial seed sector for botanical seed is growing with strong donor support. However, outside of hybrid maize and vegetable seeds, it is difficult to make a business case for pure private sector investment.

The civil society – independent of the private sector and government – has a unique role in promoting and advocating for the interests of small farmers in seed systems. Farmer groups, farmer associations, community-based organizations, and NGOs can support seed related activities that ultimately creates complementarities between the public and commercial sector. These activities may include farmer aggregation to lower input costs and raise extension impact, identification and early bulking of promising varieties in farming communities, training and quality control on

seed production and disease recognition, linking producers to markets that value specific varieties (product traits), and advocating for beneficial regulations and access to subsidies.[1]

This paper defines community seed production by what it is not – it is neither commercial seed production nor farmer managed seed production – and recognizes (and argues) that there is an important role and need for seed production that is not purely commercial nor farmer managed. In all of the case studies in this review, the community seed production has two objectives: to increase farmer access to varieties (often but not always new) and to increase quality of local and improved varieties through variety maintenance, selection, handling, and storage (Almekinder and Louwaars 1990).

While community seed production nearly always involves a subsidy and is predicated on the adage that seed is a public good with private benefits, this does not negate the role of incentives schemes and the profit motive to raise efficiency for different actors in the system. Community seed production occupies a middle ground between the farmer system and the public and commercial sector and its key challenge is in identifying where and how it can most effectively engage with the public and private sector to create an enabling environment that creates the most good for the most farmers and for society as a whole. Where there is less commercial opportunity, community seed production should be more developmental with higher subsidies and stronger links to the public sector. Where there is more commercial opportunity, community seed production should involve lower subsidies and explicit links to the private sector.

2. Materials and Methods

2.1. Criteria for Identifying Community Seed Production Case Studies

The case studies referenced in this review are based on a literature review dating back a decade and reflect the authors' definition of community seed production. Several dozen studies were identified and reviewed. Those referenced here were well documented, presented data, highlighted common challenges and opportunities in community seed production, and covered the main cropping systems in Africa that have been subject to project-based support for seed production, storage and marketing. Effort was made to include different regions, farming systems, and include conflict and post-conflict contexts.

1. **Farmer Seed Enterprises in Uganda – *Sonia David***
   Agriculture and Human Value 21: 387-397 (2004)

Three farmer group seed enterprises in Eastern Uganda produce and market two newly released bean cultivars over six seasons and three years. The groups were visited once a year by researchers and an extension officer conducted an impact evaluation after three years. Insights are drawn from project documentation and through follow up visits to these groups one year after project closure and to randomly selected households in the project area five years after project closure.

2. **Comparative Study of Three Community Seed Supply Strategies in Tanzania – *Rohrbach* et al.**
   ICRISAT (2002)

Three projects promote the production of certified or quality declared seed of sorghum and pearl millet in the same geographical area. All encourage small-scale farmers to produce and sell with mixed results. Training and seed quality control was a focus of all projects. Marketing and the relative value of certified versus foundation versus quality declared seed were main challenges.

1 The distinctions between public, private, and civil society spheres are not clear cut. Farmer cooperatives, commercial seed companies, public sector entities, and NGOs may at times be closely tied to and dependent on other 'spheres' for their survival. These categories are based on a working definition of 'public' being government run and mandated with an aim to protect and promote the public good and reinforce government legitimacy, 'private' being owned by individual(s), with a primary aim of making a profit, and 'civil society' being non-governmental with a primary aim to promote the public good but without precluding a profit motive.

3. **Community Based Seed Supply in Sudan – *A. Khidir Osman***
   Leisa Magazine 23 (2007)

Between 2002 and 2005, CARE International in Sudan implemented a project to enhance the food security status of approximately 65,000 rural families 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.

4. **Cooperative Community Based Seed Enterprise in Haraghe, Ethiopia – *Osman Ibrahim***
   Case Study from Farmer, Seeds, Varieties: Supporting Informal Seed Supply in Ethiopia
   Thijssen, Bishaw, Beshir, de Boef. Wageningen (2008)

This FAO project was funded by the Royal Norwegian Government with two aims: (1) crop production improvement through on-farm seed multiplication, production, storage and marketing of seeds of improved and local farmers' cultivars of selected food crops; (2) promotion of crop diversification through demonstration plots and the production of seeds of cash crops to increase the farmers' income.

This was a large-scale model termed 'Cooperative Community-based Seed Enterprises' (CCBSE) and discusses their establishment and results over a five year period in a drought-prone area of Ethiopia.

5. **Smallholder Farmers' Participation in Legume Seed Supply in Kenya – *Mburu et al.***
   ICRISAT: Project analysis of the USDA funded Lucrative Legumes Project (2007)

This three-year project aimed to identify and address constraints from production to market for pigeonpea, groundnut, and chickpea. The project was implemented by Techno Serve, Catholic Relief Services, and ICRISAT and carried out over three years and across two different agro-ecological zones and more than 17,000 farmers were supplied improved legume. More than 600 farmer groups were involved in the project as a conduit for seed production and training.

3. Case Study Key Summaries

3.1. Farmer Seed Enterprises in Uganda – *Sonia David*

1. **Agriculture and Human Value 21: 387-397 (2004)**

In the study area of Eastern Uganda beans are grown from March–May and September–November, with the first season being dominant due to more certain rains. Study sites were selected based on high demand for bean seed whereas groups' selection was based on having at least ten members, limited other activities and previous business experience. One group, IBFA, had previously produced bean seed and received training whereas the other two were trained over five days on pest and disease identification and management, agronomy for seed production, post-harvest handling of seed, simple methods for testing germination and moisture content, marketing and promotion, book keeping, costing, and group dynamics (Table 1)[2].

Groups were encouraged to multiply local landraces; however, no group expressed any interest because of anticipated low demand. Groups were provided with three pieces of equipment: a threshing rack to reduce loss/mechanical damage to seed, a sorter to enable work to be done while seated, black polythene sheets for drying. No financial assistance was provided to any group, equipment and seed was provided on a 'cost share' basis. Producers decided which varieties to multiply (Table 2).

2 The author of this case study eventually published three training handbooks on bean production, business skills for small-scale seed producers and an accompanying trainer guide: http://www.icrisat.org/tropicallegumesII/

Table 1. Characteristics of Three Farmer Group Bean Seed Enterprises in Eastern Uganda

	IBFA	MWG	BKTWG
Original members	10 household	10 women	12 women
Years established before working with project	1	5	1
Activities prior to seed production	None	Sales of food crops	Sales of food crops, piggery
Previous contacts with external agricultural agencies	High	High	Low
Production means	Communal then individual	Communal	Communal
Fertilizer or soil improvement	No	No	No
Spray against insects and hire oxen for land preparation	No	Yes	Yes

Table 2. Two bean cultivars released in 1994 were multiplied: K132 and K131

	K132	K131
Characteristics	Large red mottled – close resemblance to widely grown K20	Small beige – small in size – previously unknown in Uganda
Yield	500–1500 kg/ha on station / reported + 25% than K20	1200–2500 kg/ha on station / reported + 40% than K20
Disease tolerance	Susceptible to pythium root rot and common bacterial blight	Resistant to bean common mosaic virus, susceptible to angular leaf spot

Production for all three groups was considered low at less than four metric tons over 23 seasons (Table 3). Group members were expected to rogue for off-types and take note of disease. Individual growers were expected to return all seed produced for storage and marketing and received 25% of earning. David (2002) cites fluctuation in production as being related to sickness and labor availability than anticipated market demand with the exception of IBFA in 1995B. David (2002) cites a multitude of factors accounting for low yields (low fertility, late planting, and high disease incidence) but does not rank or otherwise measure these constraints and their likely effect relative to the Uganda seed enterprises production.

Table 3. Seed produced (kg) by three farmer group bean seed enterprises in Eastern Uganda

		1994A	1994B	1995A	1995B	1996A	1996B	Total
K132	IBFA	90	50	117	123	105	195	680
	MWG	n/a	n/a	300	0	55	40	395
	BKTWG	n/a	n/a	240	83	40	95	458
K131	IBFA	550	120	536	470	170	35	1881
	MWG	n/a	n/a	10	60	13	0	83
	BKTWG	n/a	n/a	67	0	10	0	77

All groups reported selling most of their seed within 2–6 months after harvest at prices of 600–1200 Ush, where the high price for grain was 700 Ush and the reported retail price of certified bean seed was selling for 600–800 Ush (Table 4). This suggests that farmers who did not value seed would not pay for certification. David (2002) notes that the average unit of sale was 3 kg in Mbale District and significantly less in Ikanga District due to generally lower demand for bean in the latter. All groups reported K132 selling faster due to strong consumer trait preferences compared to K131 although they were priced similarly. Groups were presented with the idea of selling through stockists and rejected it due to expected low prices and a desire to control sales. BFA and BTWG reported slower sales than MWG and cited lack of promotional effort, competition with Ugandan Bean Program, which distributed the same varieties for free in some areas.

Table 4. Gross Revenues (USD) for Two Farmer Group Bean Seed Enterprises in Eastern Uganda – 1995*

	Season A		Season B	
	MWG	BTWG	MWG	BTWG
Gross revenue ($)	207	213	40	63
Total production (kg)	310	307	60	83
Revenue per kg	0.67	0.69	0.67	0.76

*Exchange rate of 1050 Uganda Shilling (Ush) per United States Dollar is used for both seasons

Revenue may appear small but four years after the project ended, IBFA and MWG were still producing seed whereas BKTWG stopped, although production levels were not available. A random sample of households in the two project districts was conducted four years after project closure and 67% of households (n=30) knew the MWG name whereas only 11% (n=45) knew the IBFA name. Also, 23% of the households surveyed had purchased from MWG compared to 4% of the households surveyed purchased from IBFA.

3.2 Comparative Study of Three Community Seed Supply Strategies for the promotion of improved sorghum and pearl millet varieties in Tanzania – *Rohrbach* et al. *ICRISAT:* 2002

In the case study area of central Tanzania (Dodoma and Singida), the same varieties of sorghum and pearl millet were produced and marketed using three different models: lead farmer model, farmer groups, and primary school gardens (Table 5). The three programs had different geographical coverage but most of the analysis and findings presented here are where program coverage overlapped in Dodoma and Singida regions of Central Tanzania.

The Ministry of Agriculture and Food Security (MAFS) lead farmers program began in 1998 as part of a five-year DANIDA project aimed to rehabilitate key seed capacities in Tanzania: the national seed unit, seed farms, Tanzania Official Seed Certification Institute (TOSCI), Sokoine University of Agriculture (SUA), and district agricultural staff. One component of this program was the On-Farm Seed Production Program to support community seed production. The ICRISAT supported primary school gardens initiative was started in 1999 to promote the adoption of new sorghum and millet varieties developed by the regional Sorghum and Millet Improvement Program (SMIP). The Christian Council of Tanzania supported farmer group program was formally known as Sustainable Seed Multiplication Program and was initiated in the 1990s in response to drought and is church supported. The aim of this program is to increase seed availability and food security for rural poor in semi-arid areas.

Sorghum and millet are important traditional hardy cereal crops, notably in areas not suitable for maize. These areas are typically high in surface temperatures and low/erratic rainfall. Sorghum and millet account for about 25% of all cereals in Tanzania and central Tanzania, Dodoma and Singida,

account for roughly 1/4 of the total area allocated to sorghum in Tanzania. Average farmer yields are under 1 t/ha for sorghum and about 0.8 t/ha for pearl millet compared to nearly 1.4 t/ha for maize (Monyo *et al.* 2004).

Village selection for the lead farmer approach was identified by agricultural officials in each region to start after a baseline survey. Each village selected two farmers with the idea that at least one would be a lead farmer. For the farmer group approach, this was part of a large program started in the early 1990s focused on drought areas in five regions. Targeted districts were identified on the basis of drought. All interested farmers had to join or be a member of a farmer group linked with the Diocese of Central Tanzania. For the school program, five districts were identified and the two pilot districts chosen to start based on being most dependent on sorghum and millet. Schools were identified based on climate, having good land, access to population, and the willingness of an agricultural teacher to be the link at the school.

Table 5: Characteristics of Three Community Seed Supply Strategies in Central Tanzania

	Lead Farmer	Farmer Groups	Primary School Garden
Target direct participants	125	660	54
Target coverage	50 villages (3 regions)	40 villages (5 regions)	50 schools (2 regions)
Role of state extension	High	Low	More support in Singida
Lead funding source	DANIDA	Church	ICRISAT and USAID
Lead management	TZ Government	Church	Education Authorities

Training was big focus in all programs – accent of training was on seed production and on certification procedures. As discussed below, a big emphasis and challenge in all projects was working within and around what would seem to be arbitrary and unenforceable project guidelines regarding categories of seed and its purchase price.

From independence through the 1970s, only three varieties of sorghum/millet were released: Lulu and Serena in 1970s and for pearl millet, Serere 17 in the late 1960s. From the 1980s, with the advent of the Sorghum and Millet Improvement Program (SMIP), which was established by southern African governments in the early 1980s and backstopped by ICRISAT. Several varieties were released and promoted (Table 6) via SMIP: for sorghum: Tegemeo (1986), Pato (1995), Macia (1999) and for millet: Okoa (1994) and Shibe (1994).

Table 6: Sorghum and Pearl Millet Varieties Promoted

	Pato (SDS 2293-6)	Macia (SDS3220)	Okoa
Characteristics	Earliness, yield, cream/ mottled grain	Earliness, yield, white grain, much shorter – easy to scare off birds	Earliness, head length, yield
Yield over local variety	126%	139%	48%
Day to flowering	68 (85 for local variety)	64 (85 for local variety)	62 (68 for local variety)
Plant height (cm)	173	131	n/a
Year of release	1995	1999	1994

On-station trials were conducted over two years and nine sites for sorghum and four years and 14 sites for pearl millet

Source: Adoption of Improved Sorghum and Pearl Millet Technologies in Tanzania Monyo *et al.* ICRISAT, 2004.

Table 7: Estimated Seed Production of Three Community Seed Supply Strategies in Central Tanzania

	Lead Farmer	Primary School Garden	Farmer Groups
Dodoma Sorghum (99/00)	17 acres/5,947 kg*	Pato:31 acres/8,050 kg	Pato: 110 tons
Dodoma Pearl Millet (99/00)	8 acres/1,156 kg*	Okoa:29.5 acres/3,600 kg	
Singida Pato (99/00)	No production	69.75 acres/14,800 kg	
Singida Okoa (99/00)	No production	64.75 acres/14,200 kg	

*Production passing TOSCI inspection.

Sources: Seed Unit, Ministry of Agriculture and Food Security / ICRISAT /Christian Council of Tanzania

Seed production data from the three programs was limited to the year 1999/2000 (Table 7).

All programs were expected to source Foundation seed from the government run and DANIDA supported seed farm at a government set price of 5,000 TZ shillings per kg, which was ten times the highest price in rural market and fifty times the price of grain. The government set price for certified seed was 1,000 TZ shilling. The church farmer group and school programs complained about acquiring Foundation seed at 5,000 TZ shilling per kg while many of the lead farmers in the TZ government managed program were not sure what they paid for acquired seed.

A field survey of participants across the three programs was conducted in March 2001, after planting. Lead farmers (15) were identified only where they had harvested a crop and from 8 different villages, participating schools (23) were identified randomly from a sub-set of 50 in both Dodoma and Singida, and farmer group participants (33), with more than one year of program experience, were identified by farmer group leaders from three villages from a random sub-set of all participating villages. Dodoma was where all three programs had operated for at least two full years and was the focus. Singida was added because the school program was considered successful here. The focus of the survey was marketing, quality control, and implementation partnerships.

Prices were to be set after consultation with community leaders and farmers, reported unit seed prices ranged by 600%. School sales were reportedly strong (Table 8) because ¾ of seed produced was in Singida, which was a 'new market' and parents were cajoled to buy seed. Less than ¼ of farmer group members surveyed reported selling at local markets yet still sold 40% of seed produced. This was due to a church seed procurement contract with the FAO. Lead farmers were not allowed to sell outside of their village as the design of the program was for lead farmers to produce seed for their community.

Table 8: Reported Production and Sales: Program Participant Survey

	Lead Farmers (N=15)	School (N=23)	Farmer Group (N=33)
% visited by extension or to discuss production problems field (00/01)	69.2	46.7	9.1
HH mean harvest (00)	872 kg	742 kg	489 kg
% of harvest sold per HH	12%	70%	39%
% selling on local market	67%	76%	24%
% selling no seed	33%	24%	15%
Ratio of Dodoma grain price to mean HH selling price of seed	26%	43%	20%
% of 2001 harvest expected to be sold to external organizations	41%	n/a	84%

National seed regulations barred the sale of unpacked seed outside of the community. All programs had a focus on increasing access and availability of new varieties but there was limited emphasis of demand raising or of farm level support on seed selection, handling, treatment and storage (Table 9). Reported unit sale prices by all programs were more than two times the price of grain for unpackaged and untreated seed.

Table 9. Reported Seed Treatment of Sorghum Prior to Sale to Local Farmers: Program Participant Survey

	Lead Farmers (N=15)	School (N=23)	Farmer Group (N=33)
Insecticide	13%	61%	23%
Fungicide	0%	22%	0%
Packaging	14%	48%	18%

Across all three programs there were many reported changes in crop management practices for seed production (Table 10). It would be interesting to see, a decade on, if any of these practices have remained with farmers. Also, it is unlikely that the production investments cited below make sense for rural farmers. Despite regular extension support and TOSCI inspections, approximately 50% of the lead farmers surveyed (n=15) did not know the required field isolation distances and another 40% suggested it was 100 m or less. Among the school garden teachers and farmer group members surveyed, there was confusion on isolation distances.

Table 10: Reported Changes Cited in Seed Production Practices: Program Participant Survey

	Lead Farmers (N=15)	School (N=23)	Farmer Group (N=33)
Isolation of Field / Better Soil	87%	85%	85%
Space / Line Planting	100%	62%	75%
Use of any fertilizer	87%	71%	36%
Harvesting when completely dry	67%	29%	61%
Drying on elevated structure	85%	40%	69%

Farmers were advised to isolate 300 m for pearl millet and 200 m for sorghum. In 2001, TOSCA (national seed regulatory agency) announced a new quality declared seed standard for pearl millet and sorghum with an isolation distance of 100 m.

The farmer group initiative supported by the Diocese of Central Tanzania was seen as being independent, and received limited extension support from state actors. The lead farmer program was a focal point of extension support. Among the school programs, there was reported uncertainty on the role of state extension.

Despite the challenges, overall these programs appear to have been very successful in mobilizing the movement of SMIP varieties into areas of Tanzania that would benefit. An ICRISAT adoption study in 2001 estimated that in the mid 1990s approximately 5% of total sorghum and millet was allocated to improved varieties (Table 11). While the 2001 study was limited to 267 HH, of which 32 were in Singida and 40 in Dodoma, the results are encouraging.

The adoption study indicated that more than 2/3 of farmers surveyed in Dodoma and more than 1/3 in Singida were planting improved sorghum variety Pato while improved sorghum variety Macia was being planted by 1/8 of surveyed farmers in Dodoma but none in Singida. The study also indicated that pearl millet variety Okoa was being grown by more than 1/4 of surveyed farmers in both Dodoma and Singida (Table 12).

Table 11: Farmer Awareness and Use of New Sorghum Varieties (2001)

	Dodoma (N=40)	Singida (N=32)
Farmers aware of new sorghum varieties (%)	80%	60%
Farmers have grown improved sorghum varieties (%)	60%	38%

Source: Adoption of Improved Sorghum and Pearl Millet Technologies in Tanzania, ICRISAT (Monyo 2004)

Table 12. Knowledge Source of New Pearl Millet Variety Okoa (2001)

	Dodoma (N=40)	Singida (N=32)
Extension	58%	48%
Other farmer	39%	43%
Research or other	3%	9%

Source: Adoption of Improved Sorghum and Pearl Millet Technologies in Tanzania, ICRISAT (Monyo 2004)

The adoption study also estimated as of 2001, 42% of millet planting area in Dodoma was under new pearl millet varieties as compared to 13% in Singida.

3.3. Community Based Seed Supply in Sudan. *A. Khidir Osman, Agricultural Research Corporation / El Obeid Research Station. Leisa Magazine 23: (2007)*

The project was implemented by CARE International Sudan through community-based organizations called Village Agriculture Committees and with strong collaboration with the Ministry of Agriculture's seed management administration and the El Obeid agricultural research station. Activities were carried out in North Kordofan state, which is located in the central-western part of Sudan, at the northern edge of the savannah belt. The state has a total population of approximately 2.9 million and the two localities targeted by the program, Sheikan (540.918) and EL-Nehoud (256,482), account for more than ¼ of the state's population (UNDP 2010).

The area is traditionally agro-pastoral and is characterized by complex linkages between environment, poverty and conflict over natural resources that are becoming increasingly scarce (Table 13). In addition to raising animals and growing crops, a third source of livelihood is derived from the natural forests in the form of fuel wood production, building material, gum arabic and fruit harvesting from various trees. The state is famous for gum arabic (*Acacia senegal*) production and Sudan accounts for 70% of world production. The states export crops including groundnut, sesame, hibiscus, and watermelon seed. Sorghum and millet are the main food crops.

Seed insecurity is reportedly driven by recurrent drought and it is widely reported that the rainy season is becoming shorter which has impacted yields of millet, sorghum and cowpea. Farmers in the program were reported to have become dependent on relief programs for both food and seed. The

Table 13. Livelihood Profile for North Kordofan State- Sheikan and El-Nehoud

	Geo-location	Production system	Threats / hazards
Gum Arabic Agro-pastoral	Mid to South-Western North Kordofan State	Cash crops (groundnut and watermelon), livestock, gum Arabic production	Land conflict / access to water
Gurdood Agro-pastoral	Southern North Kordofan State	Clay and sandy soils / sorghum production and livestock	Land conflict / drought

Source: UNDP 2010: North Kordofan State Livelihood Profiles

author notes that surveys conducted in the area identified seed as the most important constraint, and seed as the input most needed to raise productivity. It is not known what quality of seed security assessment was conducted prior to this intervention.

The El Obeid agricultural research station provided CARE Sudan with all seed varieties in this project, developed an extension program and training manual, backstopped the training of village agricultural communities involved in seed production, and conducted on-station and on-farm trials. Varieties used in the project were reportedly selected and identified based on early maturity/drought tolerance. It was noted that these varieties were not used prior to this project because of '*non-availability, poor accessibility and lack of extension advice*.'

The project reported to serve 65,000 rural families in El-Nehoud and Sheikan over the course of three years with 136 tons of sorghum, 138 tons of millet, 447 tons of groundnut, 27 tons of sesame, and 9 tons of cowpea. Table 14 suggests that the recommended package per family was not achieved.

Table 14. Project Seed Provision for Two Localities in Northern Kordofan

	Sorghum	Millet	Groundnut	Sesame	Cowpea
Total seed distributed (kg)	136,000	138,000	447,000	27,000	9,000
Recommended amount per HH (kg)	2.5	1.5	15	1	2
Potential HH served	54,400	92,000	29,800	27,000	4,500

Seed was distributed through the Ministry of Agriculture, agricultural research stations, and community organizations. The project reported remarkable yield increases that do not seem feasible unless the baseline comparison was a drought year (Table 15).

Table 15. Project Estimated Yield Increases from Using Quality Seed of Improved Varieties

	Yield (kg / ha)		Yield Increase	
	El-Nehoud	Sheikan	El-Nehoud	Sheikan
Groundnut	588	779	30%	24%
Millet	393	264	66%	67%
Sorghum	321	452	27%	10%
Sesame	276	260	19%	57%
Cowpea	460	229	67%	52%

*One feddan =.42 hectare

The project also conducted trainings, with participation of researchers and specialists from local seed inspection services, to raise farmer knowledge on seeds and seed production. Topics covered included seed quality (varietal purity, germination, testing), agronomy, seed storage, and certification. The project reports that farmers have become more aware of the importance of high quality seeds, new varieties, and seed multiplication techniques.

Some of the trained farmers became seed producers. Their farms were inspected by the Seed Management Administration of the Ministry of Agriculture to guarantee production of quality seeds, and inspection fees were paid by the farmers. Other field inspection duties were shared between project staff and research staff. Some farmers who produced quality seeds of the improved varieties were able to sell their inspected seeds to the project, to individual farmers, and to formal seed sector companies.

To ensure the continued dissemination and supply of the improved varieties the project adopted a seed repayment system to promote seed exchange. The idea was that this would reduce dependence on external sources and promote self-reliance. However, total seed repayment rates were low, ranging from 29% for millet to 78% for groundnut. Reasons cited for low repayment were limited storage facilities, monitoring and follow up, and a general lack of awareness of how the repayment system functioned. In addition, several relief programs in the project areas distributed seed for free so the concept of repayment was not easy to understand.

Project Success Story

Khirat Salim Khirat, a 27-year-old farmer from Um Diresa Village, 35 km west of El Obeid town, is the head of the Village Agricultural Committee and has been involved in seed production for the last three years. He is one of 15 farmers in the '*seed multiplication business*'. Khirat believes this has opened a path to agricultural development in the area.

A participant in four of the project trainings on different aspects of seed production, he continues to follow the seed multiplication regulations and standards he learned such as recommended isolation distances and agronomic practices. His fields were inspected and he even received a certificate. He has sold seed to farmers in his community, projects, and even a local seed company (Table 16). Prices offered were reportedly 15% more than the regular grain prices. A manager of a seed company in El Obeid reported to purchase US$ 85,000 (17 million Sudanese dinar) worth of seed from producers during 2006.

Table 16. Khirat Salim Khirat's 2005/2006 Production

Crop	Local variety	Yield (kg)	Area (ha)
Sorghum	Yarwasha	4.14	497
Sorghum	Arf Gadmak	22.07	559
Groundnut	Sodiri	4.14	745
Groundnut	Guebish	2.76	931
Cowpea	Ainalgazi	1.38	414

The project established Village Agricultural Committees. These community-based organizations were responsible for record keeping, storage and redistribution of repaid seeds. The project reports that this system was very effective in improving the dissemination, accessibility and availability of quality seeds of the adopted improved varieties. A key challenge to this project was the low seed repayment rates.

This community-based seed supply project has brought many benefits. Farmers in El-Nehoud and Sheikan now have access to new varieties and can acquire them locally instead of buying externally where they may have little recourse if there are issues related to germination or not being true to type. In addition, the project strengthened links between a number of critical actors in the seed supply chain in North Kordofan: El Obeid Research Station, Village Agricultural Committees, seed inspection services and extension staff under the Ministry of Agriculture, local seed companies, and most critically local seed producers and farmers.

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. Hopes are high with the new IFAD project (Box 1).

Box 1. IFAD Seed Development Project in Sudan

In February 2012, the International Fund for Agricultural Development announced that they will provide a $10.07 million grant to the country's Seed Development Project. The project aims to help improve farmers' food security, income and resilience to environmental shocks, such as droughts. It will help farmers increase crop productivity through the use of certified seeds, and improve soil and water conservation techniques.

The project, co-financed by the Sudanese government, will be implemented in Rahad and Sheikan in North Kordofan, and Abbassiya and Abu Gubeiha in South Kordofan. More than 108,000 smallholder farmers — including young people and women — and 1,280 seed growers are expected to benefit from the initiative.

3.4. Cooperative Community Based Seed Enterprise in Haraghe, Ethiopia – *Osman Ibrahim* Case Study from Farmer, Seeds, Varieties: Supporting Informal Seed Supply in Ethiopia – *Thijssen, Bishaw, Beshir, de Boef. Wageningen (2008)*

In the drought-prone areas of Ethiopia, seed insecurity contributes a great deal to the inefficiency of the agricultural sector. This case study discusses an FAO and Government of Ethiopia implemented project entitled '*Strengthening seed supply systems at the local level in Hararghe zones in Eastern Ethiopia*', which established Cooperative Community-based Seed Enterprises (CCBSE) to support informal seed supply. With funding from the Norwegian government, this five-year project had two aims: (1) crop production improvement through on-farm seed multiplication, production, storage and marketing of seeds of improved and local farmers' cultivars of selected food crops: (2) promotion of crop diversification through demonstration plots and the production of seeds of cash crops to increase the farmers' income.

3.4.1 Seed security in Hararghe Zone in Eastern Ethiopia

The seed insecurity in the drought-prone areas of Ethiopia in general and Hararghe zone in particular, is created and aggravated by economic as well as environmental factors. The major constraints are lack of improved and adapted varieties, low levels of service provision and support from research, input suppliers, and extension. Many traditional semi-arid production areas are remote, causing serious marketing barriers for service providers and low access to markets for farm produce. Recurrent droughts and the need for repeated replanting in the same season have made traditional seed-saving practices an unreliable source for planting in subsequent seasons. Successive years of severe drought/erratic rainfall have necessitated repeated re-planting and farmer seed-saving practices have become unreliable.

Neither emergency seed supply interventions nor past seed multiplication projects have had a sustainable impact on seed insecurity and the informal seed sector has not been able to maintain a secure supply of appropriate seeds. A more sustainable seed security system will strengthen the production and income generation capacity of farmers. While the introduction of drought-tolerant and/or short-maturing local and improved varieties combined with crop diversification and informal on-farm seed multiplication schemes have been popular and appreciated in Haraghe, there is a need for varietal improvement (pure-line and mass selection) and on-farm seed multiplication of local varieties.

3.4.2. A twelve step strategy for the establishment of community-based seed enterprises

A systematic approach is critical in the assessment, planning and development of CCBSEs.

1. Establish CCBSE criteria with local authorities. In general, criteria include accessibility, resources, availability of land, and capacity for irrigation, functional community organization, a seed market, and the capacity of local authorities to assume leadership.

2. Train extension staff to conduct a survey to identify locations for CCBSEs.
3. Informal discussions with selected communities on establishing CCBSEs.
4. Conduct baseline survey, with local development agents, to select appropriate sites with a pre-existing and functional community organization.
5. Train and orient local authorities and community groups on group formation, the project strategies for on-farm seed multiplication, and marketing.
6. Establish CCBSE as a legal entity with a signed agreement with local government.
7. Identification and supply critical seed and equipment on credit basis with easy repayment terms.
8. Establish community seed stores.
9. Begin seed production and establish a revolving fund.
10. Capacity building: training, extension, field demos, professional workshops, study tours, etc.
11. Link CCBSE unit with key stakeholders: research and formal and informal seed suppliers.
12. Linking the CCBSEs with markets.

3.4.3. The model of community-based seed enterprises

The model for the CCBSE is simply the establishment of a cooperative at community level. Access to appropriate technologies and facilities will enable the cooperative to plan and handle seed production operations from planting to cleaning, marketing and distribution.

The CCBSE model has three major components.

1. Community organization and the operational and administrative establishment of the enterprise.
2. Development and dissemination of appropriate varieties and technologies.
3. Crop biodiversity maintenance and on-farm conservation.

3.4.4. Support in the establishment of the enterprise

The organization and establishment of a CCBSE unit includes setting-up a cooperative organization, establishing seed cleaning facilities, strengthening seed storage capacity. In addition, contractual arrangements between the CCBSE and individual farmers in the community need to be fostered. The CCBSE unit is community-based, owned and managed; it plays a major role in leading and running all the CCBSE activities. Planning and execution is in the hands of the community organization, with initial managerial and technical, support, guidance and supervision provided by the local government (woreda) extension agents and technical experts.

Simple, practical and affordable local technologies, inputs and procedures are used within the CCBSE operations for seed production, quality control, and postharvest cleaning, packaging and storage. The farmers concerned play the major role of establishing the enterprise's seed facilities and assets: they contribute all required agricultural land, labor, and construction materials.

Each CCBSE starts with the establishment of a more than five-hectares cooperative-owned seed farm. The project provides technical support, supervision, and guidance. In addition, the project furnishes the CCBSE with initial seeds, other agriculture inputs, necessary equipment for seed cleaning, and the construction and management of simple seed stores.

The project sees contractual seed production as the most important activity. CCBSEs advertise a contract for seed multiplication by interested seed growers in the community. The agreement or contract places particular emphasis on the major cereal food crops (maize, sorghum and wheat) and selected cash crops (potato, onion and haricot beans). Standard practices for seed crop establishment and quality control are performed under the direct supervision and technical

guidance provided by project field staff and the local government (woreda) development agents and technical experts.

In the course of project implementation (2002–2007), four CCBSE units were established, and four were under establishment as of 2007. Profile information on the project CCBSE units established in East Hararghe, and those under establishment in West Hararghe and East Shoa are summarized below: location, human resources, crops, facilities, and major constraints.

3.4.5. Seed production

The CCBSEs' seed production (Tables 17–19) data include the amounts of seed delivered, areas planted and estimates of total seed production over the period 2003 to 2007. Initially the activities of the CCBSEs were limited to the multiplication and demonstration plots of selected crop varieties at the CCBSE seed farms. This was for the following reasons:

a. severe scarcity and shortage of initial seeds (pre-basic and basic seeds);

b. emphasis on seed quality and demonstration of the standard practices for quality seed production;

c. need to familiarize members with the concept, arrangements and agreements of the CCBSE contractual seed multiplication scheme.

Actual yields were difficult to obtain due to several factors:

a. tendency of the seed growers not to abide by the terms of the contractual agreement, e.g., demanding higher prices than initially agreed upon, and giving priority to the distribution of the produced seed to relatives, friends and neighbors in the community;

b. need to reject a number of contractual seed fields because of poor seed quality;

c. insistence of the CCBSEs on involving all their members as contractual growers, often resulting in poor follow-up on the seed production, quality control and final collection;

Table 17. Estimated Seed Production (in quintals) of cooperative community-based seed enterprises in East Haraghe (2003-2007) West Haraghe and East Shoa (2006/2007) Zones

	Maize	Wheat	Sorghum	Teff	Pulses	Potato
Eastern Haraghe						
J. Gemechu	107.4	239.8	309.6	-	128.2	123.4
H. Gudina	37.5	131.5	501.0	-	161.0	237.0
J. Belina	1200.0	152.0	-	-	97.5	2.5
B. Jalala	-	105.0	-	-	-	245.0
Wonagle	960.0	-	5,190.0	-	197.0	-
Western Haraghe						
Hargeti	Na	-	Na	-	-	-
Bilibo	Na	-	-	-	-	-
Others*	1262.5	627.5	246.0	251.0	28.0	-
Eastern Shoa						
Biftu	-	2,188.3	-	-	410.0	-
B. Hawai	-	1,662.5	-	-	346.0	-
GRAND TOTAL	3,567.4	5,106.6	6,246.6	251.0	1,367.7	607.9

*Contracted seed growers at Koni, Dar, Labu, Tubu, and other locations.
Pulses= chickpea, haricot bean, lentil
Note: Seeds were provided in Hargeti and Biibo but not data yet available.

Table 18. Profiles of cooperative community-base seed enterprises in East Haraghe (2003-2007) West Haraghe and East Shoa (2006/2007) Zones

	J. Gemechu	H. Gudina	J. Belina	B. Jallalla	Wonagle
Basic General Data					
Foundation	Nov. 2003	Feb. 2003	June 2004	June 2004	March 2005
PA	Emerosudu	Ifa-Jallala	J. Belina	Fughan Bira	Wonagle
Woreda	Kersssa	Kersssa	Kurfachelle	Gursum	Gursum
Proximity to woreda main town	3 km	18 km	2 km	18 km	15 km
Accessability to zonal main town	41 km	58 km	57 km	93 km	80 km
Road condition	Good	Good	Good	Fair	Fair
Population PA	-	3,423	6,895	2,985	-
Population woreda	142,505	142,505	45,417	149,889	-
Human Resources					
WARDO experts	14	14	13	11	11
WRDO Das	16	16	19	13	13
CCBSE members	41	211	300	68	68
Members>4th grade	1	4	2	2	2
Crops and Facilities					
Major crops	Maize, potatoes	Maize, potatoes	Wheat, potatoes	Wheat, potatoes	Sorghum, maize
Communal seed farms	>5ha	>8ha	3.5ha	3.0ha	>10ha
Irrigation	Pump	Pump	Pump	Gravity	Pump
Seedling nursery	Yes	Yes	Yes	-	-
Processing equipment	-	Seed cleaner	Seed cleaner	-	Seed cleaner
Packaging and labeling	Weigh scale	Weigh scale	Weigh scale	Weigh scale	Weight scale
Seed storage	-	Seed store	Seed store	Seed store	Seed store
Village seed shop	-	Yes	-	Yes	-
Power source	-	Generator	Generator	-	Generator
Constraints (0=absent / 1 = low / 5 = high)					
Enforcement of agreements	4	5	5	0	0
Membership size	5	0	0	0	0
CCBSE leadership	2	5	5	4	2
Cooperative organization	2	3	3	0	5
Dependency syndrome	3	5	5	3	3
Contractual seed production	3	3	3	4	3
Communal land	0	0	0	5	3
WARDO technical support	4	4	4	3	4
Market orientation	0	1	2	3	0

d. CCBSE units' initial lack of financial capital to purchase all the seeds produced on a contractual basis;

e. priority to the collection of seed of improved crop varieties, primarily of cash crops such as potatoes and legumes, which have superior market value and generate better income;

f. poor follow-up by local government (woreda) staff coupled with the CCBSE members' initially limited experience of contractual seed production planning and management. However, during the last two years of the project the situation has improved, with the CCBSEs becoming more organized and accustomed to the seed production management, particularly in the new expansion areas in East Shoa zone.

Table 19. Profiles of cooperative community-base seed enterprises in East Haraghe (2003-2007) West Haraghe and East Shoa (2006/2007) Zones

	Hargeti	Bibilo	Biftu	B. Hawai
Basic general data				
Foundation	2006/07	2006/07	2006/07	2006/07
PA	-	-	-	-
Woreda	Mieu	Mieu	Lummee	Gimbichu
Proximity to woreda main town	25 km	13 km	5 km	2 km
Accessibility to zonal main town	50 km	38 km	60 km	90 km
Road condition	Seasonal	Seasonal	Good	Good
Population PA	-	-	-	-
Population woreda	-	-	-	-
Human resources				
WARDO experts	13	13	11	12
WRDO Das	23	23	26	31
CCBSE members	45	55	150	210
Members>4th grade	2	1	>10	>10
Crops and Facilities				
Major crops	Sorghum, maize, legumes	Sorghum, maize, legumes	Lentil, wheat, chickpea	Lentil, wheat, chickpea
Communal seed farms	>15ha	>15ha	5ha	2.5ha
Irrigation	Gravity	Gravity	-	-
Seedling nursery	-	-	-	-
Processing equipment	-	-	-	-
Packaging and labeling	-	-	-	-
Seed storage	-	-	-	-
Village seed shop	-	-	-	-
Power Source	-	-	-	-
Constraints (0=absent / 1 = low / 5 = high)				
Enforcement of agreements	3	3	0	0
Membership size	0	0	0	0
CCBSE leadership	2	2	0	0
Cooperative organization	3	3	1	1
Dependency syndrome	3	3	0	0
Contractual seed production	1	1	1	1
Communal land	0	0	3	3
WARDO technical support	4	4	3	3
Market orientation	2	2	0	0

3.4.6. Seed multiplication and varietal demonstration plots

Seed multiplication and demonstration plots were established, in cooperation with national technology generation and transfer institutes to enable participating CCBSEs to have access to improved varieties and other seed production technologies. The plots were useful for the selection of improved varieties and indigenous germplasm accessions of food and cash crops.

The trials were setup for testing maize, wheat, haricot bean, potato, chickpea and onions varieties and accessions. To demonstrate and promote crop diversification of export cash crops, seedling nurseries for vegetable and other horticultural and forest crops were established at each CCBSE seed

farm to provide planting material (seedlings) for orchards and gardens. Seeds of potential export vegetables, including carrot, onion, Swiss chard, eggplant, cabbage, tomato, cauliflower, beetroot, leek and lettuce were distributed for plantation and demonstration purposes. The numbers of seed varieties established in CCBSE multiplication and demonstration for the project's three zones are presented in the table below.

3.4.7. Crop biodiversity maintenance and on-farm conservation

On-farm conservation and maintenance of indigenous crops and local varieties is essential for stabilizing and improving crop productivity. It is a mechanism for coping with the risk of drought-induced crop failure and eventual seed insecurity. The project model emphasized on-farm conservation of crop biodiversity through on-farm multiplication of local varieties. In collaboration with the Institute of Biodiversity Conservation (IBC), the project collected, cleaned, and multiplied local varieties. These were then disseminated to farmers and this process was documented.

One-hundred and sixty one germplasm accessions were reintroduced that were originally grown in Kersa and other neighboring local government areas. These re-introductions included sorghum (48), maize (8), wheat (44), barley (10), fenugreek (22), haricot beans (9), field pea (8) beans (2), sesame (6) and sunflower (4). These accessions were included in a demonstration plot for farmer observation at *in east and West* Haraghe and East Shoa Zones between 2003 and 2007 (Table 20). The reintroduced local varieties were also used for participatory varietal selection, multiplication and utilization.

3.4.8. Lessons learnt and options for application of the model in other regions

A model for establishing CCBSEs was tested and refined on the basis of this project: community based, owned and managed schemes for seed multiplication that promote crop diversification, on-farm conservation of biodiversity, and use local resources as well as simple and affordable technologies. In a short time frame, CCBSEs have improved seed security for rural communities. They have contributed to increasing crop productivity, diversification, and seed system development.

The project model was highly appreciated among rural communities and good progress has been made in strengthening institutional linkages at the community level. This project proved that it is possible to establish CCBSEs with the full participation and ownership of the community. CCBSE success depends on communities with a strong history of working together in community activities. One community came to the project to request assistance and ended up being one of the most successful CCBSEs because of strong community leadership and cohesion.

Extension staff had a difficult time to collect and document precise data on seed production and marketing. Nearly all of the seed produced was marketed directly in the community served by the CCBSE.

An analysis of major differences between woredas and agro-ecological zones – in terms of the establishment of CCBSEs – indicated that the poorer and more drought-prone zones were less likely to establish viable CCBSEs. This was attributed to several factors, including the erratic nature of the rainfall, poor access to markets, and the lack of cash crops.

For CCBEs to be successful they need to collaborate with and develop strong working relationships with critical agricultural stakeholders at the local level (Bureau of Agricultural and Rural Development, Agricultural Cooperative Commission) as well as among formal seed system actors (Ethiopian Institute for Agricultural Research, Ethiopian Seed enterprise, and universities), and farmers in the informal seed system.

CCBSEs, and projects supporting their development, should maintain vital linkages and be integrated within the formal and informal seed system. Institutional sustainability at all levels is of vital importance for impact and scaling.

Table 20. Number of varietal seed multiplication/demonstration plots established by cooperative community-based seed enterprise in east and West Haraghe and East Shoa Zones (2003–2007)

	2003	2004	2005	2006	2007	Total	Source
Cereals							
Wheat	7	14	-	3	7	31	
Wheat*	44	-	-	-	-	44	
Durum wheat		-	-	-	2		
Maize	13	17	-	3	-	33	
Maize*	8	-	-	-	-	8	
Sorghum	11	14	-	9	-	34	
Sorghum*	48	-	-	-	-	48	
Teff	-	-	-	5	4	9	
Barley	-	-	-	2	-	2	
Barley*	10	-	-	-	-	10	
Legumes							
Haricot	6	19	-	12	-	37	
Haricot*	9	-	-	-	-	9	
Lentil	-	-	-	4	-	4	
Chickpea	3	1	-	4	-	8	
Faba bean	-	-	-	3	4	7	
Faba bean*	2	-	-	-	-	2	
Field pea	-	-	-	2	4	6	
Field pea*	8	-	-	-	-	8	
Fenugreek*	22	-	-	-	-	22	
Vegetables							
Potatoes	4	14	-	-	6	24	
Onion	1	4	-	-	-	8	
Oil crops							
Sesame	4	15	-	-	-	19	
Sesame*	6	-	-	-	-	6	
Groundnut	6	15	-	-	4	25	
Groundnut*	1	-	-	-	-	1	
Sunflower	4	-	-	-	-	4	
Grand total	217	119	-	47	31	414	

For building institutional sustainability, the following factors must be considered:

1. It is essential that there is substantial ownership, leadership and follow-up from the agriculture and rural development bureaus and offices at regional, zonal and woreda levels.
2. Integrating CCBSEs into relevant government (and other key stakeholder) structures will improve their effectiveness, sustainability, and expansion to new seed insecure areas.
3. CCBSE agreements should aim to foster and govern community participation and commitment.
4. There should be clarity on the concept of CCBSEs; they are private community-based, community-owned and community-managed businesses.

5. CCBSEs need to have strong linkages with the formal and informal seed systems: research, extension cooperatives, as well as credit and marketing systems.
6. Farmer capacity must be strengthened to organize, manage, and lead seed-related agro-business activities, with particular emphasis on the entrepreneurial skills of CCBSE members.
7. The prevalent dependency syndrome must change so that communities evolve from a relief mindset to a development/business orientation.
8. Simple and affordable local rural technology and inputs should be used as much as possible.
9. CCBSE expansion to new areas can be supported by ensuring that the government has a central role in project ownership, leadership, planning and management.

The experience of this five-year project should motivate other organizations supporting the development of small-scale and community-based seed enterprises.

Seed quality standards and certification should be part of the project, but this component needs more attention so that farmers will have confidence in certified seed. It is expected that acceptance of seed quality standards will eventually develop along with knowledge about seed, experience of seed production, and the competition between the CCBSE units and other seed suppliers.

The FAO 'Quality Declared Seed Standards' offer a reasonable option for dealing with seed quality in the context of informal seed multiplication. These standards should be formally recognized in national seed policy to promote informal seed multiplication.

These lessons learnt suggest that, to develop institutionally sustainable CCBSE units, it will be necessary to adopt a business model, and to transfer business skills to the units and help them to develop the marketing structures required for success.

For the CCBSEs to become economically viable organizations, they need to develop into profitable and effective business entities able to offer the required services to the target rural communities.

3.5. Smallholder Farmers' Participation in Legume Seed Supply in Kenya – *Mburu et al.* ICRISAT: Project analysis of the USDA funded Lucrative Legumes Project (2007)

The objective of the Lucrative Legumes Project (LLP) was to address constraints along the value chain from production to market while promoting the development of a seed supply to deliver high quality legumes to farmers. Funded by the United States Department of Agriculture (USDA), the project ran from 2005 to 2007, and was implemented by TechnoServe (TNS) in partnership with Catholic Relief Services (CRS) and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). Individual partners collaborated with a range of private and public institutions. The project was implemented in five districts in Western Kenya within the Lake Victoria basin (Siaya, Busia, Teso, Homa Bay, Suba, and Bomet) and four districts in Eastern Kenya (Machakos, Makueni, Kitui, and Mbeere). More than 17,800 farmers (65% of them women), formed into 679 farmer groups, were directly involved in this project. In the project's target areas, poverty is high (40–70%) with more than 50% of the households living below the poverty line. Soils are infertile and most farms are low in soil organic matter, nitrogen and phosphorous. Legumes are mainly intercropped with cereals (maize or sorghum) with no external fertilizer inputs on small-sized farms (<2 ha).

Groundnut and pigeonpea are important crops in western and eastern Kenya respectively whereas chickpea is grown in Bomet and parts of Mbeere. Eastern Kenya produces 99% of the country's pigeonpea (190,000 t), while Western Kenya (Nyanza and Western provinces) produces 59% of the national groundnut crop. Chickpea fits easily in the maize-based production systems of Mbeere and Bomet as a rotation crop that grows on residual soil moisture. Kenya is a net importer of chickpea; hence its promotion benefits both local and export markets. Legumes in Kenya are traditionally grown as a subsistence crop with seed supply dominated by the informal seed system. They are characterized by low yields and subsequently low volumes of marketable surpluses are produced,

making commercialization difficult. The key production constraints to legumes are the use of disease-susceptible (low quality) seed and poor crop management practices. Capacity building and improved linkages among producers, traders, and processors, combined with an increased availability and use of high-yielding disease-tolerant varieties (with traits acceptable to both farmer and the market) are necessary to increase yields and raise productivity.

Reliable production of high-quality legumes requires a stable supply of quality seed. The overwhelming majority of most smallholder farmers in the project area source legume seed from their own stock, social networks, or from local markets. Often, but not always, this local seed is of excellent physiological quality in terms of germination potential. However, to access high value legume markets farmers typically must source a specific variety possessing traits sought after in the market. One of the aims of this project was to increase farmer knowledge and access to new legume varieties. At project inception, there was low availability of improved legume varieties in target areas despite these regions having a comparative advantage for legume production and good access to urban markets. Farmer investment, labor – land – risk – money, in a new variety depends on their return on investment. To achieve an effective return on the investment of a new variety, farmers often need to make complimentary investments in production (labor, land, and other complimentary inputs to achieve the genetic potential of the germplasm). They may also need to make investments in post-harvest technologies to reduce loss, gain higher unit yields, and sell their increased marginal production.

ICRISAT developed pigeonpea, groundnut and chickpea varieties with desirable market traits that are tolerant to both the most prevalent diseases and drought. In addition to providing improved germplasm, ICRISAT was responsible for developing a functioning seed supply system and a basic agronomic package to accompany the seed. ICRISAT demonstrated that with right variety, promotion and price, farmers are willing to pay for small packs of high quality seed. Smallholder farmers can produce high quality legume seed if they have access to and knowledge on new varieties, can practice good agronomy, and are able to identify and manage common pests and disease. Collective action was the strategy used for seed distribution through a combination of capacity building and marketing with existing smallholder farmer groups and project partners adopted a participatory multi-institutional approach involving several collaborators from public and private sector institutions.

3.5.1. Seed supply model

The seed supply model combined informal farmer managed seed production with linkages to the formal system for new varieties. It included farmers and their institutions, i.e. groups and marketing associations, seed companies and research institutes (i.e., ICRISAT, Kenya Agricultural Research Institute) and quality regulatory bodies (i.e., Kenya Plant Health Inspectorate Services). The objective was to create a demand driven seed supply chain from breeding and seed maintenance to a commercial seed company marketing certified seed to farmers through the Kenya Smallholder Farmer Investment Company (KESFIC), who in turn sold seed to producer marketing groups (PMGs).

KESFIC maintained two supply channels, one for seed and one for grain, which supplied second and third generation seed to farmers. When the seed was no longer of acceptable quality, it was purchased from the commercial seed company. Groundnut, bulky with a lower seed multiplication rate relative to other legumes, is less commercially viable as seed. If farmers are to access high-value legume markets, there needs to be a system to efficiently renew seed stocks periodically (if the physiological degeneration to pest and/or disease warrants it) and/or access new varieties demanded by the market.

3.5.2. Project outcomes

The Lucrative Legumes Project mobilized more than 17,000 farmers and supplied improved legume seed to all of them over a period of two years. In turn, these farmers loaned, donated or sold the seed to non-participating farmers, which induced a ‘spill-over effect’. The project trained over 50% of participating farmers who demonstrated good crop husbandry practices, value addition, group

management and marketing. Farmers trained in seed production were contracted by a seed company to produce seed commercially. Groups were also trained in management, which was appreciated, but the impact of this training was not documented. Additionally, 11 post-graduate students participated in various aspects of crop productivity and marketing research. Most importantly, farmers were able to collectively market their produce at competitive prices. They also established direct links with grain traders. Table 21 below presents a number of constraints and opportunities that were identified in the project.

Table 21. Constraints and Opportunities Identified by the Project

Limited quantities of high quality seed were available from ICRISAT and the seed company.	Farmer multipliers were well identified and supported to produced quality seed.
Unreasonable farmer price expectations.	Seed supply through informal farmer network.
Poor distinction between grain and seed among farmers in the informal sector.	Need to train farmers on market forces and expose them to markets with structured visits.
Inadequate grain volumes to sell through formal marketing channels due to home consumption.	Develop links with commercial seed companies to produce high quality seed having a demand.
Documentation of actual production and marketed produce - farmers withheld information.	Farmers will pay more for seed if packed in small quantities and sold through formal channels.
High illiteracy levels among the farmer groups members compromised record keeping.	Increase production at HH level via raising productivity through better agronomic practices.
Seed consumed as food limited project expansion but improved HH food supply.	Develop M&E strategies at the onset of the production process, train farmers to keep records.
Not enough groundnut shellers.	Market opportunity to develop and sell shellers.
Farmers lack patience when formal collective marketing is done.	Mentor and link entrepreneurs to farmers and their associations.
Project was short duration – gains not consolidated.	Solicit more donor funds. Link groups to public and private institutions for continue service support.

3.5.3 Key outcomes of the forward

The project promoted an increased awareness among farmers of the performance and market for improved legume varieties. Farmers demonstrated a willingness to purchase seed, proving the commercial potential of legume seed, even among low-income farmers. But this commercialization process is not easy. It requires a strong working and effective relationship among both public and private actors and enabling policies that are relevant to small farmers who account for the bulk of legume seed production. A critical lesson from this project is the value of training farmers in production, processing, record keeping, business basics, collective marketing, establishing and managing contractual relationships with buyers, and in promoting linkages with research to increase access to new varieties and production enhancing technologies.

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