

IN THE FIELD

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Farmer seed enterprises: a sustainable approach to seed delivery?

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Abstract. A major reason for the low adoption of modern varieties among small-scale farmers in developing countries is the inability of formal, centralized seed production systems to meet their complex and diverse seed requirements. Drawing on experiences in Uganda with the common bean, the paper proposes seed production by farmer seed enterprises (FSEs) as a strategy for meeting dual objectives: to sustainably distribute and promote modern crop varieties and to establish a regular source of “clean” seed of either local or modern varieties. It reports on lessons learned from the Ugandan experience and offers a conceptual framework and guidelines for establishing economically and institutionally sustainable FSEs. While FSEs offer a potentially sustainable solution to the problem of seed supply, the challenge of implementing and scaling up this approach in Eastern and Southern Africa remains formidable. Collaborative linkages need to be fostered between farmers, researchers, agro-enterprise specialists, NGOs, and the formal seed industry. Seed policy reforms need implementing and more client-oriented research systems must be institutionalized.

Key words: Beans, Eastern Africa, Enterprise development, Seed systems, Technology dissemination

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Introduction

Government, private, and commercial seed companies in developing countries typically supply no more than 20% of seed of most food crops (Almekinders et al., 1994; Cromwell and Wiggins, 1993; Grossman et al., 1991). Such institutions typically produce certified seed in centralized facilities. This figure is even lower for self pollinating (e.g., the common bean, groundnuts, rice), vegetatively propagated crops (e.g., potatoes, sweet potatoes, cassava), and crops with limited seed demand (e.g., indigenous vegetables, forages, open pollinated maize). Crops in these three categories bring little profit to seed companies for several reasons: uncertain and fluctuating demand caused by competition from farm-saved seed (grain legumes), low multiplication rates (grain legumes), transportation and storage difficulties (soybean, root, and tuber crops), and strong regionally specific preferences (grain legumes, indigenous vegetables). Designing alternative seed production systems must therefore be of urgent priority if this bottleneck in commodity research is to be alleviated.

Recent years have witnessed a proliferation of NGO and research support to local level seed production and dissemination activities. These activities have a wide range of objectives including improved dissemination of modern varieties, preserving genetic diversity and quality, improving seed availability (time, place, quantity), and reducing the cost of seed and dependence on external sources. Typically, in Africa, local-level seed production projects can be grouped into three categories: seed production using contract growers, seed exchange schemes, and farmer seed enterprises (Cromwell and Wiggins, 1993; Gaifami, 1992). The last approach, being commercially oriented, appears to be the most sustainable, yet with a few exceptions (Lyon and Afikorah-Danquah, 1998; Bockari-Kubei, 1994; Anderson and Singh, 1990), farmer-led commercial efforts, are rarely documented. FSEs offer four main advantages over other provision approaches: sustainability by being market driven, decentralization of seed production to cater for regionally specific varietal preferences, possibilities for establishing linkages to formal institutions, and production of good quality seed --- an issue of concern in areas of high disease pressure. Studies to evaluate the success of commercial seed production by small-scale farmers conclude on the basis of existing projects that this approach is unlikely to be sustainable (Tripp, 2001; Tripp, 2000; Cromwell, 1997; Wiggins and Cromwell, 1995; Cromwell and Wiggins, 1993). Reasons for failure include poor project design (unclear objectives, failure to

build in sustainability), lack of technical expertise and institutional linkages to research and seed agencies, and lack of attention to marketing (Tripp, 2000; Wiggins and Cromwell, 1995). This paper reports on experiences by the International Center for Tropical Agriculture (CIAT) with developing farmer seed enterprises (FSEs) in Africa. Commercial seed production by farmers is proposed as a strategy for meeting dual objectives: to sustainably distribute and promote modern crop varieties and to establish a regular source of “clean” seed of either local or modern varieties. “Modern crop varieties” refers to those varieties produced by formal, scientific plant breeding methods. Local varieties or landraces, in contrast, are those materials traditionally grown by farmers. Secondary goals of this approach might include preserving varietal diversity through multiplying landraces, generating income, and farmer empowerment. CIAT’s main objectives in supporting FSEs are to promote the dissemination of modern varieties, foster farmer empowerment by providing specialized groups with skills in seed production, strengthen farmer-researcher linkages, and encourage farmer involvement in varietal selection. Although the project reported on in this paper ended in 1997, CIAT’s work on decentralized seed production is on-going and seeks to explore how to make local level commercial seed production sustainable and economically viable.

The study examines the process involved in developing FSEs and explores the prospects for replicating the approach in a wider regional context. A key premise of the discussion is that many of the weaknesses of small-scale seed production projects can be corrected through more careful assessment of seed demand prior to the start of seed production and more systematic project planning and design.

Using a case study approach, the study assessed the feasibility of developing small-scale seed production units in Africa by addressing the following questions:

Organization: what type of farmers can successfully produce bean seed? What scale of production can FSEs achieve? What are farmers' training and funding needs? Is suitable post-harvest equipment available and do they meet producers' needs?

Marketing and promotion: does demand exist for bean seed produced by FSEs and what is the nature of demand for new varieties? Can FSEs market seed on their own without external assistance?

Seed quality: what is the quality of seed produced by FSEs? Which quality standards should be applied to artisanal seed production?

The study focused on beans, but most of the principles and guidelines offered can be applied to developing farmer capacity to produce seed of other self-pollinating crops. During the course of the project, no institutional linkages were developed to ensure the sustainability of the enterprises initiated because it was envisaged that the research phase would be followed by pilot projects designed to implement and institutionalize the approach on a wider scale. The case studies presented and conclusions reached apply specifically to micro enterprises operated by smallholders; larger enterprises or other types of commercial ventures designed to accelerate varietal dissemination are not discussed.

The paper is divided into three parts. The first part describes demand for off-farm sources of bean seed and the methodologies used in initiating farmer seed production. Part two presents data on seed production and sale and highlights the major obstacles encountered in these areas and in marketing and promotion. The final section summarizes the lessons learned and offers a conceptual framework and guidelines for establishing economically and institutionally sustainable FSEs.

Bean seed sources in rural Uganda

Ugandan farmers, and indeed most small-scale farmers in other African countries, rely largely on home saved bean “seed” (actually grain saved from previous seasons) because of the self-pollinating nature of beans. However, as results from a 1993 survey shows (David, 1996), the degree of reliance on own stocks varies significantly across and within regions of the country and is influenced by season, household characteristics, such as wealth status, and the level of production relative to household usage (David and Sperling, 1999). In the main season of 1993, 85% of farmers in Mbale District and 94% of farmers in Mubende District obtained bean seed from their own stock. In Mbale District, beans are an important cash crop, in contrast with Mubende, where the crop is mainly grown for household consumption. Commercial sources (local markets and shops) were second in importance to farm-saved seed in both districts: 30% of

surveyed households in Mbale and 14% of households in Mubende obtained seed from this source. Seventeen percent of households in Mbale farmers and 9% of farmers in Mubende obtained more than half of the seed sown in the first season of 1993 from shops and markets. On average, farmers purchased 21 kg of seed in Mbale and 7 kg in Mubende. A significant percent of farmers in Mbale (44%) purchase seed annually compared to 17% of farmers in Mubende. While farmers commonly give each other gifts of seed, relatively few farmers purchase seed from other farmers (David, 1996; personal communication. C. Mukankusi, CIAT, April 2002) and farmer seed “experts” (farmers known for having good quality seed) exist in some, but not all, Ugandan communities.

Prior to the mid 1990s, the formal seed sector in Uganda produced insignificant amounts of bean seed. Thereafter, formal sector bean seed production increased with the Uganda Seed Project (USP) selling an estimated 3,200 metric tons of bean seed between 1994 and 1999 (USP, 2000). The USP sells bean seed through district based stockists, government agencies (Office of the Prime Minister), agricultural projects, and NGOs. Although the absence of nation-wide adoption surveys makes it difficult to ascertain the proportion of USP seed used for non-relief purposes, that figure is thought to be relatively low. In 1999, 61% of bean seed sales went to three relief agencies (USP, 2000). More recently, following efforts to privatize the USP in 2000, a number of small seed companies began producing bean seed. Certified seed of modern varieties is also disseminated through the research and extension system.

Initiating Farmer Seed Enterprises

Three farmer groups in Eastern Uganda participated in the present study between 1994 and 1997. These were the Ikulwe Bean Farmers' Association (IBFA), which is a mixed group located in Iganga District, the Makhai Women's Group (MWG) in Mbale District and the Budama Kyelema Turbana Women's Group (BKTWG) also in Mbale District. Table 1 provides background information on each group. A fourth group in Mukono District dropped out after completing training in seed production because of internal group problems. Although the project was undertaken with farmer groups rather than individuals, this was only intentional in Mbale and Mukono, where the objective was to investigate the feasibility of women's participation in small-

scale commercial seed production. In Eastern Africa, women often organize themselves in groups in order to improve their access to resources. The project deliberately focused on women because throughout Eastern and Southern Africa their labor contributions to bean production surpasses that of men and they are solely responsible for seed maintenance.

By local standards, group members were average or above average in terms of resources, skills, educational level, and prior business experience (Table 1). The BKTWG was the only group that had no previous contacts with external agencies. Unlike the other two groups, which were recruited to participate in seed production, the IBFA initiated seed production on its own in 1993, prior to the start of the study. Farmers involved in bean varietal trials with CIAT formed the group, intending to multiply and sell seed of test varieties. The IBFA had longer involvement in seed production and was composed of both male and female farmers, all of whom had worked closely with researchers in a participatory research project. This helped make the group distinctive and affected its achievements.

(Table 1 about here)

A sociologist undertook the research with technical input from pathologists, entomologists, agricultural engineers, and seed technologists. Two government extension agents regularly monitored the Mbale groups. Members of IBFA chose to discontinue working with the extension agent due to a conflict of interest over his technical role and business interests.

Identification of study sites and producers

Level of demand for bean seed was the single most important criterion in selecting study sites. However, factors such as altitude, rainfall, incidence of seed-borne diseases, and other production constraints were recognized as important for successful seed production. In all localities, beans are grown during two seasons: March-May (season A) and September-November (season B). Production during season B is riskier because of heavy and unpredictable rainfall. Mbale represents an area of high demand for bean seed, with demand being typically lower in Iganga District. It was anticipated that other CIAT research on local bean seed systems

and varietal distribution in Mbale and Mukono Districts would complement the study (David et al., 1997; David, 1996).

The MWG and BKTWG were selected after discussions with three other women's groups identified by extension agents. The major criteria used in group selection were the following: 10+ members, no or few other group activities, and previous business experience.

Except for the IBFA, whose activities predated the study, seed production activities began with a 5 day training workshop. The following topics covered were the following: disease and pest identification and management, agronomic practices for seed production, post-harvest handling of seed, testing germination and moisture content using simple methods, marketing and promotion, book keeping, costing, and group dynamics. Training workshops were held again in 1997 and additional training was offered on an *ad hoc* basis on disease and pest identification and management and business skills. Groups were provided with three pieces of equipment: a threshing rack to minimize loss and mechanical damage to the seed, a sorter to facilitate the work and allow sorting to be done while seated, and black polythene sheets for drying. The fields of seed producers were not inspected, but seed health testing was conducted over 3 seasons (incomplete for some groups) to assess pathogen infection levels and germination.

Producers multiplied two bean cultivars released in 1994: K132 and K131. Farmers throughout Uganda highly appreciate K132, a large, red mottled seed type, because of its close resemblance to the widely grown, highly marketable K20 variety. On-station yields for K132 range between 500-1500 kg/ha, 27% above the yields of K20. The variety is susceptible to two seed borne diseases: pythium root rot and common bacterial blight (CBB). K131, a small, beige seed type previously unknown in Uganda, is high yielding (1200-2500 kg/ha or 40% above the yields of K20), but its small size, type II growth habit, and low market demand make it less popular with farmers. This variety is resistant to bean common mosaic virus (BCMV) but susceptible to angular leaf spot (ALS). Although producers were encouraged to multiply seed of local varieties, they showed little interest because of the low productivity of landraces and an anticipated low demand.

A participatory approach was used in training and in all aspects of developing FSEs. The role of researchers was to facilitate the learning process and to support and encourage farmers'

decision-making, problem solving, and empowerment. Producers made all decisions, including which varieties to multiply. A second element of farmer participation was the focus on farmers' indigenous knowledge of bean diseases and pests. Because their knowledge was limited, farmers were encouraged to coin names for major diseases and pests. To minimize the farmers' risk-taking, stress ownership of the business, and to avoid creating a dependency mentality, equipment and seed were provided on a cost-sharing basis between farmers and CIAT. No form of financial assistance was provided because of the absence of suitable NGO partners who could administer loans.

Researchers visited the groups at least once each season to monitor and plan activities and discuss problems. Extension agents visited the groups more frequently, particularly during field operations, to offer technical advice and collect data. Impact among producers was investigated through an evaluation exercise conducted in 1997 by MWG and BKTWG. An extension officer facilitated the evaluation.

The three FSEs differed with respect to resources such as education, access to land and labor, prior training, group cohesion, business experience, and mode of organizing production and distributing assets, all of which affected their achievements. For example, the dynamism of the MWG in selling and promoting their seed may be attributed to the higher educational levels of its membership, previous training from an NGO in group dynamics and bookkeeping, stronger group cohesion fostered by that training, and the group's longer history. It is probably no coincidence that the BKTWG, a more recently formed group with no prior contact with external agencies, experienced a high drop-out rate and made little effort to market and promote their seed. By 1996, five members had left the group disappointed because of unmet expectations of financial assistance from CIAT.

Production was organized on either a communal or individual basis. From 1993B to 1994B members of the IBFA planted seed on a communal plot but shifted to individual production in 1995A because motivation was lacking for communal work and land rental costs were high. Individual growers (2-4 each season) were responsible for post-harvest tasks. A committee of members conducted inspections of individual fields to check for off-types and diseases. Growers

were expected to return all seed produced to the group for storage and marketing and received 25% of the earnings thereof.

Both Mbale groups grew seed on a communal plot (borrowed or rented from neighbors) where all members were required to contribute labor. The Mbale groups hired oxen for land preparation, which delayed planting at least once. Both the MWG and the BKTWG sprayed the crop against insect pests, a task the IBFA omitted. No group used fertilizer or other soil improvement measures. All producers tested the germination and moisture content of the seed before storage and treated it with “Actellic powder” (pirimiphos-methyl) to control storage pests. Seed was bagged and labeled (in some instances) using locally purchased plastic bags. Because the plastic was weak, bagged quantities weighed either half a kilo or one kilo. In all cases, group members exclusively provided labor for all activities. The IBFA and MWG retained group funds, which, in the latter case, were available as credit to members. The IBFA was the only group to open a bank account.

Production and seed quality

Production and productivity by all three enterprises was disappointingly low: IBFA produced the most seed over seven seasons (2561 kg) followed by BKTWG (535 kg produced over four seasons) and MWG (478 kg produced over four seasons) (Table 2). Yields per unit area (689-866 kg/ha for K132 and 369-610 kg/ha for K131) and multiplication rates (a range of 5-9 for K132 and 7-9 for K131) were modest for sole cropping. Both cultivars out-yielded K20: K132 by 34% and K131 by 14%.

All producers sowed a larger total amount of K132 compared to K131, reflecting market demand. But despite slow sales of K131, IBFA members continued to grow significant quantities of that variety, surpassing the amount of K131 sown in three seasons. Fluctuations from season to season in the amount of seed sown by all groups did not necessarily reflect anticipated demand but resulted from personal mishaps such as illness. Only the IBFA pursued a strategy of planting larger quantities in season B (1995/1996), anticipating higher demand for K132 in the following season A

Table 2 here.

Economic analysis of production by the two Mbale groups during the first two seasons of production revealed four important findings (Table 3). First, labor constituted the highest single cost. Second, returns were better during season A because of lower yields in season B, attributed largely to agro-climatic factors. Third, except for MWG in the second season, the cost of seed production by FSEs is lower than on-station production (estimated at \$1 or Ush. 1000 per kilo). Unfortunately, because of lack of data, the study was unable to compare the efficiency of FSEs with contract and non-specialized farmers. Fourth, judging from output-to-input ratios (excluding season B for MWG), both groups covered their cost of production, showing that seed production by farmers is a potentially viable enterprise. However, more discussion is needed to explain the low production by all three groups, and by the Mbale groups after 1995.

Five factors account for the low yields of seed growers:

1. adverse climatic conditions (drought, hailstorms, heavy rains);
2. high disease and pest incidence (CBB, ALS, root rots, various insect pests);
3. poor cultural practices (poor land preparation, late planting, wide spacing);
4. lack of access to resources such as land, oxen;
5. poor soils and/or low soil fertility.

(Table 3 about here)

Although little can be done about unfavorable climatic conditions or the lack of resources by targeted groups, suitable interventions and criteria for selecting producers can alleviate the remaining production constraints. High seed loss caused by diseases (a mean range of 13-37% for K132 and 19-28% for K131) suggests that, in the absence of fungicides, to achieve economic returns, FSEs should limit multiplication to resistant varieties and maintain good crop husbandry. Other suggestions for increasing seed production include targeting farmers with sufficient resources to hire labor and purchase oxen to alleviate labor bottlenecks, purchase land specifically for seed production, practice crop rotation, and use fertilizer or other soil

improvement amendments (e.g., green manures). Poor cultural practices highlighted the need for closer supervision of field activities by technical support staff.

Farmers' poor cultural practices also underscored the conflict that smallholders, women in particular, experience between business and household or personal interests. Invariably, the members of the two women's groups attended their household fields before the communal field, resulting in late planting and weeding. Notably, the labor bottlenecks faced by the women's groups were not experienced by the IBFA, whose male members had access to household labor for both food and seed production. This factor, coupled with production on individual plots, explains IBFA's higher production capacity. Because African women usually do not own land, have limited access to household labor, and experience difficulties in preventing male appropriation of their business profits, communal seed growing and group activity appears to work best for them, despite several drawbacks (e.g., access to land and low motivation to contribute to group work).

The quality of seed produced by the three FSEs surpassed that of seed sold in nearby shops and markets in 1995A in terms of germination rate and disease levels. The germination rate for seed produced by the FSEs averaged between 85-94% compared to 72-74% for other commercial sources. A relatively low level of fungal bean pathogens was observed in samples from shops and markets located near FSEs (e.g., 1.8% for *Fusarium oxysporum* f. sp. *phaseoli*), but the level of infection in IBFA seed was negligible. Some samples from seed enterprises showed relatively high levels of saprophytic infection, indicative of poor drying or storage. No attempt was made to compare the quality of seed produced by FSEs with seed obtained directly from non-specialized bean farmers.

The higher proportion of rejected seed from the samples obtained from markets and shop compared with seed produced by IBFA (a mean of 36% compared with 4%) (Buruchara and David, 1995) further confirms the superiority of seed from specialized producers. It also highlights the monetary savings likely to be gained by farmers who buy from FSEs. The improved quality of FSE seed is attributed to the groups' use of better field and post-harvest practices and skills (i.e., rouging, drying, sorting, and seed treatment).

Sale and promotion

Nearly all the seed produced by FSEs was sold locally, usually within 2 to 6 months after harvest for Ush. 600-1200 per kilogram (US\$1= Ush. 920). These prices are up to nearly twice the highest price of grain at planting time (Ush. 700), and comparable with, or higher than, the retail price of certified bean seed (Ush. 600-800 per kg). Sale prices, however, may express farmers' willingness to pay for new varieties as opposed to paying a premium for "clean" seed. The quantities of seed purchased demonstrate the ability of FSEs to meet the specific needs of smallholders. More than 30% of Mbale buyers bought 3 or more kilos and most Iganga farmers purchased smaller amounts, confirming differences among districts in demand for seed. Some buyers reserved seed in advance from the MWG because they preferred to buy just before planting to avoid the temptation of eating it. Because all transactions involved cash sales, FSEs do not appear to significantly facilitate the equitable spread of new varieties. In the short-term, local (i.e., in nearby villages) demand for seed, K132 in particular, was modest (IBFA) or high (MWG and BTWG), but it remains to be seen if and how quickly localized demand will decline. All groups sold K132 more quickly than K131, but rejected the idea of charging a lower price for the latter variety to encourage sales.

Given fluctuating demand for seed, and in the absence of a specialized market for seed among Ugandan smallholders, seed entrepreneurs must actively engage in promotional and marketing activities. Although efforts in this area differed between groups, marketing was hardly ever a constraint, given the limited quantities of seed produced. Although agricultural input suppliers could provide a reliable market for farmer seed producers, in contrast to FSEs in Tanzania (P. Ndakidemi, personal communication, Arusha, Tanzania, 2000), all groups rejected this strategy because of the low price offered by stockists and traders. The MWG gained visibility by participating in the district agricultural show (they won second prize) and even composed a song about the new varieties. The IBFA advertised its product at farmer meetings, through local authorities and traders, and sold seed through door-to-door canvassing to schools, a rural development project, the district agricultural office, and, on one occasion, to an NGO identified by CIAT. Factors accounting for slower sales by IBFA and BTWG include the

following: lower demand, limited promotional efforts, farmers' reluctance to buy K131 due to its small size and lack of market, high prices (IBFA), competition with free seed of the same varieties distributed by the Uganda National Bean Program (IBFA), and farmers' tendency to confuse K132 with a local variety (IBFA).

Impact of seed enterprises

The impact of the three seed enterprises can be assessed at two levels: among producers and in the wider community. Seed production had a positive impact on the producers in the areas of financial improvement and empowerment. Earnings by the FSEs during the study period (1994-1997) surpassed income from traditional income earning activities such as the sale of food crops: about US\$1700 for IBFA, US\$337 for BKTWG and US\$272 for MWG. The MWG also used seed sales to establish a loan fund for family emergencies. During a newspaper interview (New Vision, April 11, 2000), a member of the MWG reported that due to increased income from seed production, "I no longer have to wait for my husband to provide for everything. I clothe myself and also buy clothes for my seven children." In light of declining productivity after the first year, it is unclear whether continued production reflects perceived business profitability or other factors such as the prestige of working with researchers or having access to new varieties.

Both women's groups felt that they had satisfactorily achieved the objectives of the project, although compared with MWG, members of BTWG rated their achievements more modestly. Both groups realized the need to increase production. They appreciated the participatory approach used by researchers; noted members' increased confidence as a valued output of being involved in seed production, but identified the need for more training.

Lack of business profitability and sustainability are a frequently cited weakness of local level seed production activities (Tripp, 2000). Follow-up of the groups after the end of the project in 1997 and community surveys conducted in 2001 indicate both positive and negative trends in business success and also show important differences between the two project sites. Both the IBFA and the MWG were still producing seed in 2001, 6 to 8 years after they started, but the

BKTWG had stopped. Although production figures are unavailable, anecdotal evidence suggests that the groups' level of production and sales have not increased significantly over the years. A 2001 survey of a small sample of randomly selected households in nearby villages showed significant differences in the two sites in awareness of the groups and the seed purchasing behavior of local farmers. Sixty seven percent of 30 surveyed households had heard of MWG, while only 11% of 45 households had heard of IBFA. Twenty three percent of surveyed farmers had bought seed from MWG compared to 4% that had obtained seed from IBFA. Even in the absence of financial data from the groups, this evidence questions whether sites with low production and therefore low seed demand, such as Iganga District, can support profitable seed enterprises. In 2000, in response to continued low demand from local farmers, IBFA began selling bean seed to the district farmers' association and multiplying cassava planting material.

Significantly, in both sites, the majority of surveyed FSE customers were one-time buyers. This finding, the ability of MWG to sell seed to farmers from nearby areas and the spontaneous emergence of another seed production group in a district near MWG, are all indications that demand exists for new varieties but not necessarily for clean seed. This preliminary discussion of sustainability issues confirms that demand for seed is a serious constraint to small-scale seed businesses and proposes that successful enterprise development requires specific market conditions and/or crop characteristics. Potatoes are a good example of a crop with high seed demand attributed to several factors. Demand for potato seed derives from yield declines caused by seed and soil borne diseases such as bacterial wilt. Additionally, in the Ugandan case, demand for potato seed is linked to the time lag caused by seed dormancy and the timing of planting in wetlands. Farmers' response, as described here, suggests possible solutions to the problem of low demand for seed produced by specialized seed producers, such as selling seed to formal institutions or seed merchants and product diversification through the production of multiple crops or regular introduction of new varieties. Before FSEs are dismissed as unviable, there is a need for detailed and systematic investigations of well selected, well designed case studies involving different crops to assess profitability and sustainability issues.

Lessons from the Ugandan case studies and future challenges

Research on modalities for developing farmer seed enterprises provided valuable lessons that are summarized below. The discussion also makes suggestions for scaling up this approach in Eastern and Southern Africa.

Organizational issues

The Ugandan cases show that farmers can be trained, organized, and motivated to produce and market good quality bean seed. However, smallholders' capacity to produce seed efficiently and on a modest scale may be limited by their lack of resources (land, labor, time, and capital). The few documented cases of successful seed production by poor farmers involved crops with time consuming production processes (Tripp, 2001: 121). Large-scale farmers may be more capable of achieving modest production levels (e.g., >1-2 tons of bean seed per year) and may be better placed to establish commercial contacts. FSEs may, therefore, not be appropriate for all crops that receive low priority from the formal seed sector, agro-climatic environments, or indeed, all dissemination objectives. Table 4 outlines major crop dissemination objectives and proposes other approaches.

(Table 4 about here)

Depending on various social (level of trust between people, history of working in groups), financial, and resource considerations, either individual farmers or groups can be involved in specialized seed production. Smallholders' production and motivation to produce are influenced by the mode of organizing seed growing (individually versus communally) and arrangements for remunerating individual growers. An arrangement that allows for individual production and collective post-harvest handling may be optimal from the production side, but for socio-economic reasons may be unsuitable for certain farmers. Women seed growers face specific production constraints because of their limited access to resources (land, labor, capital) and difficulties in controlling their own resources (labor, capital).

Repeated training on various aspects of seed production, agronomy, business skills, and marketing is key to successful enterprise development. In this regard, the development of simple training materials for farmers is essential (David, 1998; David and Oliver, 2002). To improve crop management, seed producers may also require close and regular field supervision by technical support staff for an initial period.

Supporting seed production efforts by farmers requires technical and business-related expertise and enormous time investments for monitoring producers and developing institutions and institutional linkages. Because of the need for strong business related skills and the initially high supervision cost, agricultural researchers may have difficulty in initiating this approach. Instead, interested NGOs should start programs with technical support from agricultural researchers. The initial high transaction costs of such programs should pay off in the long-term, assuming that the system is sustainable.

As the bean case reported here shows, although local demand exists for seed of *new* varieties produced by specialized producers, creating long-term, continued demand for good quality seed for certain commodities is more problematic. To achieve both objectives, FSEs must devise proactive marketing and promotion strategies aimed at larger markets to ensure long-term business success. Related to demand is the issue of price. For some crops, such as beans, seed producers may face difficulties in selling seed at a high enough price to cover production costs. The reasons are twofold in the case of beans. First, farmers cannot easily distinguish between seed and grain. Second, they are not aware of the importance of or many of the aspects of seed quality and thus are unwilling to pay a premium. Customers of Ugandan FSEs mentioned germination, physical cleanliness, and large seed size as advantages of purchased seed but did not attach direct importance to disease related aspects. Education efforts by specialized producers and formal institutions (government agencies, NGOs, etc.), as supported by a recent CIAT project (“Enhancing seed production capacity of small-scale bean farmers in Eastern and Southern Africa”) might help to create a better awareness and appreciation for good quality seed.

Policy issues

To encourage decentralized seed production, national seed authorities must designate a new class of seed with less stringent quality parameters

The "truthfully labeled" designation could be proposed as an alternative to the existing system of centralized public certification. In this case, no field inspection is made, producers are wholly responsible for seed quality and are required to describe certain quality aspects on the

label (Tripp and Van der Burg, 1997). However, under such as system there is need to develop enforcement mechanisms. Alternatively, independent certification at a decentralized level can be explored (cf. Garay et al. [nd], for the Bolivian case). Such a system might operate either by involving individuals (possibly extension agents) who have been trained by the public certification agency in field inspections for artisanal quality seed, or by shifting the responsibility for quality control to an autonomous or local level public institution. In both cases, producers should pay for field inspection services.

Scaling up

Promoting farmer-led seed production activities is challenging and no single approach or model exists for success. Key elements needed to ensure the successful development of FSEs include,

- A range of superior varieties (from farmers' perspective) being regularly available. Strong institutional support for some years to develop farmer capacity for seed production, small enterprise development, and establishing a sustainable system for supplying source seed;
- A flexible quality control system; and formal institutional linkages to insure the last two.

Figure 1 shows a conceptual model of the key linkages and institutions needed to establish a network of FSEs. The main features of the model may be summarized as follows:

1. NGO projects are established in several areas of a country; agricultural researchers are closely involved in project design and provide technical training to project staff. Farmer seed producers may be involved in participatory varietal selection with plant breeders or offer feedback on newly released varieties. Projects recruit, train, advise, and monitor producers for three years. Where necessary, producers receive credit from independent credit facilities. Producers obtain source seed initially from the project, but later from the national seed company or on contract basis from commodity research programs. Independent certification inspectors may inspect fields on a payment basis. The national seed authority authorizes and trains them. Producers are organized into seed growers' associations, which arrange provision of source seed and other inputs, assist in marketing, and represent members' interests.

Avoiding the documented pitfalls of NGO involvement in seed production seriously challenges all agencies concerned with varietal promotion and seed production. Other commercial decentralized approaches, such as contract farming involving a partnership among traders, stockists, or seed merchants, and farmers and seed production by institutions, such as schools and churches, have only recently been initiated in Eastern and Southern Africa. National and international research institutions can play both a catalyzing and technical role. For example, they could help other agencies to design sustainable programs, establishing informal national level bodies to bring together agencies involved in community-level seed activities to avoid duplicating efforts, facilitate networking, coordinate nation-wide activities, and lobby for policy reforms.

Figure 1 about here)

Conclusion

The Ugandan case studies confirmed that small-scale African farmers can be organized and motivated to produce and sell good quality bean seed. However, because of the pilot nature of the project, many of the problems encountered could not be resolved. Nevertheless, the study provided valuable guidelines and lessons for future initiatives. While FSEs offer a potentially sustainable solution to the problem of seed supply, the challenge of implementing this approach in Eastern and Southern Africa remains formidable. Collaborative linkages need to be fostered among farmers, researchers, agro-enterprise specialists, NGOs, and the formal seed industry. Seed policy reforms need implementing and more client-oriented research systems must be institutionalized.

As the model proposed here suggests, FSEs must be developed within the context of an integrated seed supply system. This runs the spectrum from unspecialized seed production at the farm level to the formal seed industry with each element playing well defined, sometimes overlapping, roles. Guidelines offered in this paper need to be tested and new approaches devised in line with national conditions. It remains to be seen whether farmer-led seed provision systems

can provide the impetus for revolutionizing national breeding procedures, varietal testing and release systems, and seed policy.

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Table 1. Characteristics of bean seed enterprises

	IBFA	MWG	BKTWG
Sex of members	Men and women	Women	Women
Year established	1993	1990	1994
Original membership	10 households	10 women	12 women
Percent of members in average and poor wealth categories ¹	87	50	62
Percent of members with upper primary and above education	80	90	54
Activities prior to seed production	None	Sale of food crops	Sale of food crops, piggery
Prior contact with external agencies	High	High	Low

¹ Wealth classification of group members is based on wealth ranking exercises conducted with key informants

Table 2. Quantities (kgs) of clean seed produced by farmer seed enterprises, 1994-1996

Season

	1994A	1994B	1995A	1995B	1996A	1996B	Total
<u>K 132</u>							
IBFA	90	50	117	123	105	195	680
MWG	Na	Na	300	0	55	40	395
BKTWG	Na	Na	240	83	40	95	458
<u>K131</u>							
IBFA	550	120	536	470	170	35	1881
MWG	Na	Na	10	60	13	0	83
BKTWG	na	na	67	0	10	0	77

Table 3. Costs of seed production (Ush. per kg) by farmer seed enterprises in Mbale, Uganda, 1995

	SEASON A		SEASON B	
	MWG	BTWG	MWG	BTWG
Inputs	64	88	218	146
Labor	211	249	1,058	392

Variable costs	275	337	1,276	537
Fixed costs	35,175	45,125	32,375	24,875
Gross value of output (Ush./acre)	217,000	223,273	42,000	66,400
Gross margin per unit of bean seed	491	493	418	365
Output-to-input ratio	1.80	1.50	0.39	0.96

Table 4. Strategies and guidelines for selecting varietal dissemination approaches

Objective	Strategy	Where appropriate	Concerns
Initiate varietal dissemination and promotion	Seed multiplication and marketing by formal institutions	Project-driven, quick impact needed	<input type="checkbox"/> Sustainability <input type="checkbox"/> High establishment
Non-market driven system for dissemination	Multiplication of <u>grain</u> by farmers working with formal institutions	<input type="checkbox"/> Project-driven, quick impact needed <input type="checkbox"/> Low/medium and irregular demand for seed	<input type="checkbox"/> Slow diffusion <input type="checkbox"/> Sustainability
Sustainable, market-driven system for dissemination	<input type="checkbox"/> Small FSEs ^a	<input type="checkbox"/> High and regular demand for seed	<input type="checkbox"/> External intervention
	<input type="checkbox"/> Small seed companies	<input type="checkbox"/> Farmers willing to pay for premium seed	<input type="checkbox"/> High establishment
	<input type="checkbox"/> Decentralized contract farming	<input type="checkbox"/> High disease pressure	<input type="checkbox"/> Requires farmer resources
	<input type="checkbox"/> Micro FSEs ^a	<input type="checkbox"/> High and regular demand for seed	<input type="checkbox"/> Technical supervision required
	<input type="checkbox"/> Support existing farmer seed entrepreneurs ^b	<input type="checkbox"/> Farmers willing to pay for premium seed <input type="checkbox"/> High disease pressure	<input type="checkbox"/> Sustainability <input type="checkbox"/> Economic viability questionable

^a The difference between micro and small FSEs is the scale of production which is related to the scale of demand for seed and the resources available to the producers.

^b In some settings, some farmers specialize in seed production and may be known as seed “experts” by their community

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Figure 1. A conceptual model of farmer seed enterprises

