DEVELOPING FARMER SEED ENTERPRISES IN AFRICA: CASE STUDIES FROM UGANDA

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ABSTRACT

A major reason for the low adoption of modern varieties throughout the developing world is the inability of formal, centralized seed production systems to meet the complex and diverse seed requirements of small-scale farmers. 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 Uganda 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 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: Agro-enterprise development, bean production, seed systems, technology dissemination

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 crops such as the common bean (*Phaseolus vulgaris* L.) which bring little profit to seed companies because of uncertain and fluctuating demand caused by competition from farm-saved seed. Only 1-5% of 360 farm households surveyed in Uganda, for example, planted certified bean seed in 1995 (ADC/IDEA, 1996). Designing alternative seed production systems must therefore be of urgent priority if this bottleneck in commodity research is to be alleviated.

This paper reports on experiences by the International Center for Tropical Agriculture (CIAT) in Uganda with developing one such approach: farmer seed enterprises (FSEs). 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 produce by formal, scientific plant breeding methods. Local varieties or landraces, in contrast, are those materials traditionally grown by farmers. Secondary goals of this approach include preserving varietal diversity through multiplying landraces, generating income and farmer empowerment.

In recent years, there have been numerous efforts to evaluate the success of local level seed production activities (Tripp, 2001, Tripp, 2000, Cromwell, 1997; Wiggins and Cromwell, 1995; Cromwell and Wiggins, 1993). Most studies conclude on the basis of existing projects that commercial seed production by small-scale farmers is unlikely to be sustainable. 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). The premise of the current study is that many of the weaknesses of previous local level seed production projects can be corrected through more careful situation analysis, planning and design. This study is one of the few attempts by researchers in Africa to support and document farmer-led seed production efforts. It examined the process involved in designing sustainable approaches to seed supply systems on a commercial, but small scale and the prospects for replicating the approach in a wider regional context. 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. 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.

Some successful efforts in decentralized seed production have been documented in Asia and Latin American, although few involved the common bean (Cromwell, 1997; Lepiz, 1996; Ashby et al., 1995; Garay et al., n.d., Bal and Rajbhandary, 1987). Typically, in Africa, local-level seed production projects involve contract growers and seed exchange schemes. (Cromwell and Wiggins, 1993; Gaifami, 1992). With a few exceptions (Lyon and Afikorah-Danquah, 1998; Bockari-Kubei, 1994; Anderson and Singh, 1990), farmer-led commercial efforts, such as a World Vision International project in Rwanda and government projects in Eastern Kenya and South-western Uganda, are rarely documented (WVI-Rwanda, per. comm. ASAL-Laikipia, per comm., Uganda National Potato Program, per comm,). Successful approaches used in Latin America and Asia may, however, be inappropriate for African conditions, given poor infrastructural development, small markets for agricultural services, often weak national agricultural research systems (NARS) and the absence in some cases of suitable implementing agencies such as cooperatives, farmer associations and non-government organizations (NGOs).

Using a case study approach, the present study aimed to assess 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? Are 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?

No institutional linkages were developed to ensure the sustainability of the seed production activities 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 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, offers a conceptual framework and guidelines for establishing economically and institutionally sustainable FSEs.

Bean seed sources in rural Uganda. Because of the self-pollinating nature of beans, Ugandan farmers rely largely on home saved bean "seed" (actually grain saved from previous seasons). However 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). A 1993 survey of 235 farmers (David, 2001) showed that in the main season (March-May), 85% of farmers in Mbale District (a site of the present project where beans are an important cash crop) and 94% of farmers in Mubende District (where beans are largely grown for subsistence) obtained bean seed from their own stock. 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. On average, farmers purchased 21 kg of seed in Mbale and 7 kg of seed in Mubende. 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. A significant percent of farmers in Mbale (44%) purchase seed annually compared to 17% of farmers in Mubende.

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 make 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 privitize 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.

METHODS

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 Mayuge 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 focussed 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 work closely with researchers in a participatory research project. This helped make the group distinctive and affected its achievements.

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 Mukono and Iganga Districts. 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: 10+ members, no or few other group activities and previous business experience.

Training and equipment. Except for the IBFA, whose activities predated the study, seed production activities began with a 5 day training workshop. The following topics were covered: disease and pest identification and management, agronomic practices for seed production, post-harvest handling of seed, testing germination and moisture content using simple methods, market research, marketing and promotion, book keeping, costing and group dynamics. Training workshops was 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. 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.

Mode of operations. 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.

We 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. The evaluation was facilitated by an extension officer.

Group organization. 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 disappointedly left the group 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 (pirimiphos-methyl) to control storage pests. Seed was bagged and labelled (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.

RESULTS

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 outyielded 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.

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 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.

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 puchase 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 (Wachtel, 1976), 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 (a mean of 85-94% for FSEs compared to 72-74% for other commercial sources) and disease levels. No attempt was made to compare the quality of seed produced by FSEs with seed obtained directly from non-specialized bean farmers. A study conducted in Rwanda observed that, although pathogen infection levels were low in seed produced by both farmers and local seed "experts", the latter were slightly more skilled at sorting out visibly affected seed (Sperling et al., 1995).

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 oxysorum* 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.

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. This improved quality of FSE seed is attributed to the groups' use of better field and post-harvest practices and skills (i.e., roguing, 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 (i.e., US$0.66-1.33 per kg). 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 prefer 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, per comm.), 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: 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 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). Preliminary follow-up of the groups following the end of the project in 1997 and community surveys indicate both positive and negative trends in business success and also shows 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 purchasing behavior of local farmers. Seventy 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 Mayuge 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.

DISCUSSION

Research on modalities for developing farmer seed enterprises provided valuable lessons and recommendations for the Eastern and Southern Africa, as summarized below:

Organizational issues. FSEs offer four main advantages over other provision approaches: sustainability by being market driven, decentralization of seed production to canter 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. This approach may not, however, be appropriate for all crops which receive low priority from the formal seed sector, dissemination objectives or agro-climatic environments. Table 4 outlines considerations of dissemination objectives and proposes other approaches.

Farmers can be trained, organized and motivated to produce and market good quality bean seed. However, as the Ugandan case shows, 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.

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 renumerating 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. 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, NARS may have difficulty in initiating this approach. Instead, interested NGOs should start programs with technical support from NARS and IARCs (international agricultural research centers). The initial high cost needed to initiate 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: farmers cannot easily distinguish between seed and grain, and are not aware of many aspects of, and the importance of seed quality, to be willing 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, 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 labelled" 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 exits 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 to establish 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. Projects by NGOs are established in several areas of a country; NARS are closely involved in project design and provide technical training to project staff.

2. Projects recruit, train, advise and monitor producers for 3 years. Where necessary, producers receive credit from independent credit facilities.

3. Producers obtain source seed initially from the project, but later from the national seed company or on contract basis from commodity research programs.

4. Independent certification inspectors may inspect fields on a payment basis. The national seed authority authorizes and trains them.

5. 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 between 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. Research institutions (both NARS and IARCs) can play a catalyzing role in addition to a technical role. For example, they could help other agencies to design sustainable programs and 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.

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 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.

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[a]	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

[a]Wealth classification of group members is based on wealth ranking exercises conducted with key informants.

Table 2: Seed production (kg) by three farmer seed enterprises, Uganda, 1993-1996

Quantity of seed sown/produced by farmer groups	Season							
	1993B	1994A	1994B	1995A	1995B	1996A	1996B	Total
K132 seed sown								
IBFA	40	50	10	20	82	12	66	280
MWG				15	0	18	22	55
BKTWG				15	10	10	11	46
Clean seed produced of K132								
IBFA	0	90	50	117	123	105	195	680
MWG				300	0	55	40	395
BKTWG				240	83	40	95	458
K131 seed sown								
IBFA	10	50	20	69	34	15	10	208
MWG				0.5	9.5	8	0	18
BKTWG				10	0	1.5	0	11.5
Clean seed produced of K131								
IBFA	0	550	120	536	470	170	35	1881
MWG				10	60	13	0	83
BKTWG				67	0	10	0	77

Table 3: Costs of seed production (Ush[a] per kg) by farmer seed enterprises in Mbale, Uganda, 1995

	SEASON A		SEASON B	
	MWG	BTWG	MWG	BTWG
Inputs	58	80	201	138
Labor	211	249	1058	392
Variable costs	269	329	1259	529
Fixed costs[b]	96	111	440	264
Production	366	441	1698	793
Gross margin per unit of bean seed	431	471	-559	271
Output-to-input ratio	1.91	1.82	0.41	1.01

[a] Ush=Uganda shillings
[b] Excludes the cost of land, as land was obtained free during both seasons

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	□ Sustainability □ High establishment cost
Non-market driven system for dissemination	Multiplication of grain by farmers working with formal institutions	Project-driven, quick impact needed	□ Slow diffusion □ Sustainability
Sustainable, market-driven system for dissemination	□ Small FSEs[a] □ Small seed companies □ Decentralized contract farming	□ High and regular demand for seed □ Farmers willing to pay for premium seed □ High disease pressure	□ External intervention needed □ High establishment cost □ Requires farmers with adequate resources
	□ Micro FSEs[a]	□ Medium to low demand for seed	□ Technical supervision required
	□ Support existing farmer seed enterpreneurs[b]	□ Farmers willing to pay for premium seed □ High disease pressure	□ Sustainability □ 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.

Fig. 1: A conceptual model for farmer seed enterprises