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Comparative Study of Three Community Seed Supply Strategies in Tanzania

International Crops Research Institute for the Semi-Arid Tropics

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Abstract

Community seed production projects are being implemented throughout Africa. This case study compares three such projects in central Tanzania. All three programs seek to encourage small-scale farmers to produce and sell sorghum and pearl millet varieties, but use different approaches to solve the common problems of seed multiplication and distribution.

The three projects were relatively successful in promoting seed production. Training was provided in seed quality control, and growers generally understood the differences between seed and grain. However, questions remain about the practicality of producing certified seed, quality declared seed, or common grade seed. External investments remain necessary for the production and delivery of source seed. The biggest threat to the viability of these programs is the problem of seed marketing. While farmers are expected to sell seed to their neighbors, most sought marketing assistance from external buyers. Further investments are still needed in testing alternative marketing strategies.

This study highlights a number of policy issues. None of the three programs is likely to continue without external technical support and funding. The appropriate, long-term levels of public investment need to be defined. In addition, the relationship between public and private sector investments in seed production and distribution needs to be more explicitly defined.

Zusammenfassung

Vergleichende Untersuchungen über drei genossenschafliche Saatgutbereitstellungs-Strategien in Tansania. Genossenschafliche Saatgutproduktions-Projekte werden gegenwärtig flächendeckend in Afrika implementiert und die hier vorgestellte Arbeit vergleicht drei dieser Projekte in Zentral-Tansania. Jedes dieser drei Projekte sucht Kleinbauern zum Anbau und Verkauf von Sorghum- und Perlmilletsorten zu motivieren, aber die Projekte verfolgen unterschiedliche Ansatzpunkte um die mit Saatgutvermehrung und Verteilung verbundenen Probleme in den Griff zu bekommen.

Bezüglich der Promotion von Saatgutanbau waren die drei Projekte relativ erfolgreich. Die Anbauer wurden in Saatgutkontrolle geschult und verstanden die Unterschiede von Saat – und Getreideproduktion. Allerdings verbleiben Zweifel hinsichtlich der Produktion von Zertifikatssaatgut und Qualitätssaatgut. Für die Produktion und Auslieferung von Quellensaatgut werden auch zukünftig externe Investitionen nötigt sein. Probleme in der Saatgutvermarktung stellen die grösste Bedrohung für die Überlebensfähigkeit des Projektes dar. Zwar wird erwartet dass Bauern Saatgut an Nachbarn liefern, aber der weitaus grösste Teil der Bauern suchte über externe Bezieher nach weiterem Marktzugang. Es werden auch künftig Investitionen zur Untersuchung alternativer Marktstrategien benötigt.

Es ist unwahrscheinlich dass eines der drei Projekte ohne fortwährende externe technische und finanzielle Unterstützung überlebensfähig ist. Das Ausmass der angemessenen und langfristigen öffentlichen Unterstützung muss definiert werden. Es ist weiterhin nötig die Beziehungen zwischen den Investitionen aus öffentlichen und privatwirtschaflichen Sektoren hinsichlich Saatgutproduktion und Verteilung genauer zu untersuchen.

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Acronyms

ASPS	Agricultural Sector Programme Support
BMZ	Bundesministerium für Wirtschaftliche und Entwicklung Zusammenarbeit
CCT	Christian Council of Tanzania
DANIDA	Danish International Development Agency
DCT	Diocese of Central Tanganyika
FAO	Food and Agriculture Organization of the United Nations
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
MAFS	Ministry of Agriculture and Food Security
NGO	Non-governmental organization
NPGRC	National Plant Genetic Resource Centre
QDS	Quality Declared Seed
SADC	Southern African Development Community
SMIP	SADC/ICRISAT Sorghum and Millet Improvement Program
Tanseed	Tanzania Seed Company Ltd
TOSCA	Tanzania Official Seed Certification Agency
USAID	United States Agency for International Development

Executive Summary

This report summarizes the results of a comparative assessment of three community seed production programs being implemented in Tanzania. These programs are similar to many community seed projects being promoted in Africa (cf. Rohrbach et al. 1997, Tripp 2000). They encourage small-scale farmers to produce seed of new varieties for sale to neighboring farmers. All three programs have successfully expanded access to new varieties and helped improve food security, but remain challenged by questions of sustainability.

The largest problem faced by these and similar programs elsewhere Africa is the difficulty of building a sustainable seed market. Small quantities of seed are being profitably sold within the village community. Sales are strongest for newly introduced varieties. But most small-scale farmers are unwilling to pay premium prices to their neighbors for seed they can obtain from their own harvests. Correspondingly, most small-scale seed producers prefer the assistance of outside agencies to market their seed. Further investments are still needed in testing alternative marketing strategies.

The three programs experience similar problems of access to foundation or source seed. One program has invested substantial resources in upgrading national capabilities to produce breeder and foundation seed. All three programs facilitate the distribution of this seed to their respective seed producers. The challenge is to build a sustainable system of source seed delivery that will last beyond the period of these projects.

The programs encounter similar questions about seed quality. All three initiatives promote the production of certified or quality declared seed, and offer training to farmers and extension staff to improve their knowledge of seed standards. But implementation of national regulations for seed quality control has proved expensive. The willingness of farmers to pay the costs of inspections remains uncertain. While strict quality controls may remain important for the national market, common grade standards may be adequate for localized seed trade.

The study highlights the range of actors involved in seed projects. Each initiative expects support from local extension personnel, foundation seed farms, national research institutes, national seed inspectors, and seed policy officers; and it has proved difficult to coordinate these efforts for multiple projects. While Tanzania has gained considerably from the diversity of community seed production experiences, these initiatives could benefit from more deliberate efforts to share plans, experiences, and lessons.

This study raises a number of policy questions about the longer-term contributions of community seed schemes to national seed supply. As currently constituted, these seed programs are not sustainable without a continuing donor subsidy. At a minimum, such public investments need to be more carefully evaluated for cost effectiveness and impact.

More importantly, the relationship between Tanzania's public and private efforts to supply seed to small-scale farmers still needs to be defined. Public investments are currently being promoted to fill the gap in private sector efforts, and may be justified as a means to get new varieties to small-scale farmers more quickly. Yet care needs to be taken that public investments do not inhibit the development of private seed trade. Dialog between the public and private seed sectors may reveal an evolving niche for each.

Introduction

Over 80% of Tanzania's population lives in rural areas and depends on agriculture as the main source of livelihood (Mwaisela 2000). Most of these farmers use traditional production methods on small farms of 2 to 5 ha. Less than 30% of this acreage is planted to new varieties of maize, sorghum, and pearl millet. Less than 10% of these farmers have ready access to seed of these new varieties. In consequence, most of the seed being planted in Tanzania is derived from the previous year's harvest. The lack of access to and adoption of modern[1] varieties contributes to the persistence of low crop productivity and food insecurity in much of the country.

Historically, improvements in agricultural productivity have been founded on the identification, distribution, and adoption of modern varieties. Modern varieties generally offer higher yield potential (Maredia and Howard 1998, Cromwell 1990), and are more responsive to complementary improvements in crop management practices such as fertilizer application. They may also offer valued traits such as drought tolerance and disease or pest resistance (Ministry of Agriculture and Cooperatives 1997, World Bank 1994).

Limited adoption of modern varieties has contributed to the limited growth in crop yields in Tanzania during the past 20 years. According to data supplied by Tanzania to the Food and Agriculture Organization of the United Nations (FAO), national maize yields have increased at an average rate of only 0.3% per year (FAO 1999). Sorghum and pearl millet yields have been declining. One consequence of the limited growth in productivity is that Tanzania has become increasingly dependent on cereal grain imports.

Several strategies have been pursued to promote seed multiplication and distribution of improved varieties. In 1973, the government created the parastatal Tanzania Seed Company Limited (Tanseed) with monopoly rights to produce, process, and distribute or market the seed of most major cereal crops (Minja and Shuma 2000, Ministry of Agriculture and Cooperatives 1997, Due 1988). But Tanseed never met more than 10% of national seed requirements, and faced particular difficulty trying to commercially distribute seed beyond a few urban areas. In 1990, the seed sector was liberalized. At least 14 companies are registered to sell seed in the country (Mbwele et al. 2000), but most of these have concentrated on importing seed of a few horticultural crops. A few are selling seed of staple cereal crops, but access to improved seed remains limited in most of the country.

In order to fill this gap, a number of community seed projects have been established by governmental and non-governmental organizations to multiply and distribute improved seed. The Danish International Development Agency (Danida) is supporting a national project for expanding seed production and distribution through the Agricultural Sector Programme Support (ASPS). This finances revitalization of state seed farms, training in seed production techniques, and improved seed access through community seed production (Ministry of Foreign Affairs 1997). These activities are being implemented by the national Seed Unit in the Ministry of Agriculture and Food Security (MAFS). Related community seed projects are being implemented by the Christian Council of Tanzania (CCT), Lay Volunteers International Association, and the Sokoine University of Agriculture.

Support for community seed production schemes is justified by their success in distributing new varieties. Yet these programs are heavily subsidized, and will be hard to sustain without government and donor support. Assessment of these programs is further complicated by the fact that they are still developing solutions to an evolving set of implementation problems. Ultimately, success will depend on the programs' capacity to recognize problems and test a range of alternative solutions.

1. The term *modern* is used for new varieties developed by formal crop breeding programs. This does not imply that traditional varieties are primitive, or that modern varieties are necessarily better than traditional ones.

Tanzania's community seed programs each have their own strategies for seed production, quality control, distribution, and sales. Yet many of their problems are common. These programs tend to be better at seed production than at seed distribution or sale. They face difficulties accessing high quality source seed and ensuring seed quality control. They face similar uncertainties about the profitability of seed production. Ultimately, community seed production programs may complement the efforts of private seed companies to multiply and distribute new varieties. They provide a means to test the demand for new varieties. They may ultimately offer an economical means to multiply seed of varieties of limited interest to commercial firms, and distribute this in outlying parts of the country. However, the many difficulties being encountered in organizing and implementing these programs must first be confronted.

This study reviews three distinct community seed programs being implemented in one part of Tanzania – the central regions of Dodoma and Singida. All three programs support the multiplication and distribution of the same new varieties of sorghum and pearl millet. While two programs are at an early stage of implementation, the overlap in geographical and crop coverage offers an excellent opportunity to compare these approaches.

This report summarizes the initial results of this comparison. Section 2 briefly describes the three programs. Section 3 reviews the study methods employed to assess program performance. Section 4 examines how farmers were chosen to participate in each program as seed producers. Section 5 reviews how these programs obtain and distribute source seed. Later sections summarize how each program deals with key problems: quality control (Section 6), seed marketing (Section 7), and links with local authorities to ensure the availability of technical and managerial support (Section 8). Section 9 examines policy issues arising from each community seed project. Section 10 discusses profitability and financial sustainability. Finally, Section 11 compares the advantages of each program, and Section 12 summarizes the lessons drawn from the study.

Three Approaches to Community Seed Production

The three seed supply projects being pursued in the Dodoma and Singida regions of central Tanzania offer a valuable opportunity to compare alternative approaches to community-based seed supply. Each of these programs aims at promoting the adoption of new varieties in order to improve food security. During the period of this study, the three initiatives were promoting the production and sale of the same new varieties of sorghum and pearl millet, but used different strategies for implementation.

In the first program, a few well-trained farmers in each village produce small quantities of seed of a range of varieties. Seed sales are targeted at neighboring farmers. This On-Farm Seed Production Program is being implemented by the Seed Unit of MAFS with financial support from Danida under the Agricultural Sector Programme Support. This is a nationwide program, though the pilot 3-year phase targets three regions – Morogoro, Dodoma, and Iringa. This study examines the results of the first year of this program in Dodoma Rural District. In this report this initiative is referred to as the *MAFS program*.

In the second project, primary schools produce moderate quantities of seed of new varieties. Sales are targeted at the parents of school children, and farmers in communities near the schools. This Primary School Seed Multiplication Program is being implemented by regional agricultural and educational authorities in Dodoma and Singida. The initiative was planned by, and has received technical and financial assistance from ICRISAT. The study examines the results of the first full season of this program as well. This effort is referred to here as the *ICRISAT program*.

The third community seed project encourages groups of farmers to bulk larger quantities of seed of new varieties for sale to their neighbors, and to more distant communities. This Sustainable Seed Multiplication Program is being implemented by the Diocese of Central Tanganyika (DCT) with support from CCT, which has promoted the development of similar seed production groups in drought-prone districts in other parts of the country. This program has been operating for more than 5 years. It will be referred to as the *DCT program.*

On-farm seed production program (MAFS program)

The Danida-funded ASPS project was launched as a 5-year initiative in Jan 1998 (Ministry of Foreign Affairs 1997). It supports the upgrading and rehabilitation of key institutions including the national Seed Unit, national foundation seed farms, and the Tanzania Official Seed Certification Agency (TOSCA). Additional support is provided to national research institutes, the Sokoine University of Agriculture, and district agricultural authorities. This includes support for international training, and local training for farmers and extension staff. One component of this program, the On-Farm Seed Production Program, supports the development of community seed production capabilities. This component is being implemented by the MAFS Seed Unit. As such, this is the main seed program supported by the government of Tanzania.

The Danish government initially financed the program with DKK 38 million (US$ 5.6 million). Part of this directly funds the community seed production initiative. In addition, ASPS's training and rehabilitation activities help ensure that community seed initiatives have access to foundation seed and technical support for seed quality control.

Objectives. The overall objectives of the ASPS are to increase yields of field grain and vegetable crops, improve food security at household and national levels, and increase the income of smallholders, particularly women farmers. Distribution of new varieties is considered essential to these objectives. The specific objectives of the On-Farm Seed Production Program are to:

- Increase use by smallholder farmers of superior quality seed of varieties well adapted to the local agro-ecology
- Improve the availability of better quality seed at costs affordable to farmers.

Coverage. The On-Farm Seed Production Program is expected to eventually cover the entire country. Program activities are being developed and tested in pilot areas in three regions (Dodoma, Morogoro, Iringa). In each region, the project planned to work with approximately 20 villages, though by 2001 this had increased to 50 villages. Within each village, two or three farmers are being chosen for training and technical assistance in seed production. Activities will expand to other parts of the country in 2002, with further expansion if the program is successful.

Seed activities. This project started with a baseline survey to document current levels of crop productivity, crop and variety choices, seed selection and storage practices, and the marketing situation for grain and seed in the target districts. In addition, the program initiated in-country and overseas training in seed production and quality control, and started the rehabilitation of various agencies: the Seed Unit, the Horti Tengeru Vegetable Centre, three foundation seed farms (Msimba, Arusha, Dabaga), TOSCA, national research stations in Morogoro, Njombe and Tengeru, and the National Plant Genetic Resource Centre. On-farm seed production began in the 1999/00 season.

On the basis of the baseline survey, regional and district agricultural officials chose 20 target villages in each region. The villages were visited to determine farmers' interest in participating in small-scale seed production. Each village was asked to identify two farmers to participate. The project

expected that at least one of these farmers would be a woman. These farmers were then trained and supervised to produce seed on behalf of the community. The village participated in choosing what varieties to plant for wider distribution.

The project provided farmers with foundation seed, fertilizer, and pesticides during their first year of production of any particular variety. In the second year, farmers were expected to purchase their own inputs, and use the quality declared seed they had produced. In the third year they were expected to buy new foundation seed (or certified seed) as well as other inputs.

Field supervision is provided by district and village extension authorities, with strong technical support from TOSCA and the Seed Unit. The MAFS project pays transport costs and field allowances for staff from the Seed Unit, TOSCA, and district extension offices.

The farmers are not allowed to sell any seed outside their communities. This ensures that the community will benefit from the program, and avoids contravening national seed regulations barring the sale of unpackaged seed outside the community where it is produced. Individual producers may set the price of seed, but are expected to consult community leaders and neighboring farmers.

Institutional partnerships. The MAFS program relies on close working relationships with several government institutions.

a) TOSCA supervises and monitors quality of seed production, and provides training to district extension officers and Seed Unit staff. The MAFS program pays for these services.
b) The foundation seed farms at Msimba, Arusha, and Dabaga are expected to provide foundation seed for the initial seed production plots in the villages. The project paid for the rehabilitation of the seed farms, and provided a grant for the initial production of foundation seed. This is expected to be a revolving grant, replenished when seed is sold to participating farmers. The project also pays for the initial allocation of foundation seed to participating farmers.
c) National crop breeders are expected to provide breeder seed to the Msimba Seed Farm every year. Breeder seed of all released varieties has been purified and maintained through program support. However, national agricultural research institutes will be responsible for maintaining a continuing supply of breeder seed.
d) District extension officers are expected to train ward and village extension officers, village government officials, and farmers. District and village officials collectively identify the participating villages and monitor seed production.

Results. The participating farmers are expected to successfully produce a seed crop suitable for sale within the community. They are also expected to adopt improved crop management practices both to ensure a pure seed crop and to improve grain yields. In the first year of the program, average yields were low due to drought (Table 1). However, most of the participating farmers successfully produced a saleable seed crop.

Primary school seed multiplication program (ICRISAT program)

The Primary School Seed Multiplication Program was organized by ICRISAT in 1999, in conjunction with CCT. ICRISAT developed this program as a means to stimulate adoption of new sorghum and pearl millet varieties; efforts to promote adoption are mandated under ICRISAT's regional Sorghum and Millet Improvement Program (SMIP) funded by the United States Agency for International Development (USAID). Correspondingly, these effort are externally funded by ICRISAT at a cost of about US$ 12,000 per year. This does not account for many of the local costs of implementation.

Table 1. Seed production under the MAFS On-Farm Seed Production Program, 1999/00 season.

Region	Area planted (acres)	Seed production (kg)*
Dodoma		
Maize	6	2200
Sorghum	17	5947
Pearl millet	8	1156
Morogoro		
Maize	29	8150
Sorghum	1	560
Iringa		
Maize	17	Not available

* This only includes production that has been inspected and accepted by TOSCA
Source: Seed Unit, Ministry of Agriculture and Food Security

SMIP activities are planned on an annual basis. Financing for the primary schools program is similarly determined in annual workplans; there is no explicit multi-year plan for this activity. Nor is the program integrated into development programs of the Ministry of Agriculture and Food Security. Nonetheless, participants expect the program to expand and be sustained by the government of Tanzania.

Objectives. The main objectives are to increase access to improved seed among smallholder farmers in rural communities, increase adoption of improved varieties, and impart practical knowledge about seed production to primary school students.

Coverage. The pilot phase is being conducted in Dodoma and Singida regions, with one pilot district per region. Dodoma Rural and Singida Rural districts were identified, because these are the districts most heavily dependent on sorghum and pearl millet, SMIP's 'mandate' crops. Fifty schools were targeted for participation in each district.

Though the program is at an early stage of implementation, ICRISAT has already been encouraging visitors from other parts of Tanzania (as well as other SADC countries) to implement similar activities. Representatives of five districts where sorghum or pearl millet are grown have been invited to participate in project field days. One district in Shinyanga has already initiated the program with 35 schools. Two others, in Same and Mtwara, have submitted primary school seed projects for funding through competitive grants under the national extension program.

Project activities. This program targets the production of small quantities of seed for sale to neighboring farmers. ICRISAT facilitates access to seed of the targeted varieties, sorghum Pato and pearl millet Okoa. One criterion for participating in the program is to have a teacher and a regular class in agriculture. These agriculture teachers were asked to lead the initiative, and sent for a week of training in seed production techniques. In addition, four crop specialists (2 each from Dodoma and Singida) were sent for a 3-week seed production and technology training program to supervise the school activities on behalf of TOSCA.

Each school was asked to allocate part of its land to a seed plot. Most primary schools in Tanzania grow field crops either for their own consumption or for sale. Commonly the main crop being produced was already sorghum or pearl millet; schools simply needed to shift part of this land into a seed crop. The main constraint was to identify a piece of land distant from other fields in the community, to ensure the level of

isolation necessary to achieve seed purity targets. ICRISAT and local education or agricultural extension authorities periodically visited the plots to check isolations and production practices.

In many cases the seed production effort has been integrated into the school curriculum, though there is no explicit course material offered by the project. Children help provide labor for the program. The project expects that seed harvested will be sold first to the parents of the school children, and then to other members of the community. Any unsold seed may be used by the school for food.

Institutional partnerships. The major implementers are the students and teachers at the selected primary schools, ward educational officers, and village extension workers.

a) ICRISAT helped organize the program and choose the crops and varieties to be multiplied. ICRISAT provides limited technical supervision of the program.
b) Regional, district, ward, and village extension officers – regional extension officers provide technical supervision for the program. However, this support seems to be stronger in Singida than in Dodoma.
c) Regional, district, ward, and village education officers – regional educational officers provide managerial support and supervision. This seems similarly seems to be stronger in Singida than Dodoma.
d) TOSCA has supervised the training of school teachers and extension supervisors.

Results. In the first year of the program, over 40 t of sorghum and pearl millet seed were produced (Table 2). Yields and production levels were substantially higher in Singida than in Dodoma, partly because support from regional/local extension and education staff was stronger in Singida.

Sustainable seed multiplication program (DCT program)

The Sustainable Seed Multiplication Program was initiated by CCT after serious food shortages in semi-arid areas of central Tanzania during the early 1990s (Mwaisela and Simbeye 2000, Mziray et al. 1999). In 1992/93, churches in Europe and America provided funding for drought rehabilitation programs in Tanzania. CCT started distributing relief food in several regions – Mara, Mwanza, Tabora, Shinyanga, Kilimanjaro, and Ruvuma. Between June 1993 and June 1995, CCT also distributed seed of improved varieties.

However, CCT realized that seed of drought-tolerant crops was not readily available to most of its target farmers. In 1995, it launched a program to encourage farmers to produce their own seed of improved maize, sorghum, and pearl millet varieties. By 1996, it began encouraging groups of farmers to grow larger quantities of seed for sale to other farmers in their village, and to neighboring communities.

Table 2. Estimated seed production in 1999/00 and 2000/01.

District	Variety	Planted area (acres), 1999/00	Actual production (kg), 1999/00	Target area (acres), 2000/01
Singida	Pato	69.75	14,800	200
	Okoa	64.75	14,200	200
Dodoma	Pato	31.0	8,050	50
	Okoa	29.5	3,600	50
Total		195	40,650	500

Source: ICRISAT

This was scheduled to run until 1998, but continued until 1999 because additional funding became available.

The seed production program was implemented under the auspices of local church dioceses. In Dodoma, seed production was supervised by DCT. The local diocese used its own resources to supplement financial support from the national church group. Though the national support has now ended, DCT continues to support the program on its own.

Objectives. CCT and DCT initiated the Sustainable Seed Multiplication Program in order to improve seed availability, food security, and standards of living of the rural poor in the semi-arid areas of the country, and promote more reliable and adequate food supply in these areas.

Coverage. Sustainable Seed Multiplication Programs have been implemented in the Mara, Mwanza, Tabora, Shinyanga, Singida, Dodoma, and Kilimanjaro regions. Altogether, these efforts have reached 10 districts, 40 villages, and 660 farmers. Most of the participating districts were chosen because of high likelihood of drought.

Seed activities. Organizing seed production and sale by groups of farmers, as opposed to individuals, allows easier supervision and backstop support for the production efforts. The groups generally range in size from 15 to 35 farmers.

Farmers are encouraged to grow their seed in an isolated block of land in order to avoid contamination with other varieties. This also facilitates inspections by field officers and extension workers. However, all fields are farmed individually, and many farmers simply look for a relatively isolated piece of land. Farmers plant 0.5 to 2 acres of seed crop depending on land availability and their ability to purchase foundation seed and other inputs. Sowing decisions also depend on the market prospects for a variety. The majority of farmers sow approximately one acre of seed.

The seed crop is inspected by extension agents who have received training from TOSCA. Occasionally, TOSCA inspectors visit the production plots, but such visits are uncommon due to financial constraints. Expenses for the TOSCA visit must be paid by the church or the local community.

While the program targets the production of seed for local sale, CCT and DCT have been facilitating the assembly and sale of seed to more distant communities. In 1999 and 2000, DCT supervised the sale of over 500 t of seed to FAO for distribution through national drought relief programs. The favorable prices paid by FAO encouraged the expansion of seed production as a cash crop.

Institutional partnerships. The main partners involved in the implementation of this program include CCT, DCT, ICRISAT, and village extension workers.

a) CCT and its dioceses provide backstop administrative, financial, and technical support for district seed production programs. This includes assistance with delivery of foundation seed, training for local extension workers, formation of farmer groups, and seed marketing.
b) ICRISAT provides assistance with the sourcing of breeder seed and technical backstopping in seed production. ICRISAT has also supported the training of a field officer to help supervise farmer groups on behalf of TOSCA; facilitates links between CCT and the ministry's Seed Unit; and provides indirect links with other community-based seed production projects in southern Africa.
c) Village extension workers provide technical assistance for seed production. This includes inspection of seed isolations and production practices.

Results. Data on earlier production levels are not available. However, following the successful 1999/00 harvest, over 100 t of seed was produced (Table 3). Most of this was sold to FAO for national drought relief programs.

Table 3. Seed production and sales of sorghum variety Pato under the Sustainable Seed Multiplication Program, 1999/00 season.

Region	Production	Sales
Dodoma	110 t	89 t

No data available on area planted
Source: Christian Council of Tanzania

Summary

The three community seed supply programs all pursue the same main objective of improving farmers' access to seed of new varieties (Table 4). Each seeks to train farmers to produce higher quality seed crops. The MAFS program plans to cover the widest range of crops and varieties. Farmer selection of preferred crops and varieties for multiplication is a unique element of this program.

The CCT program covers the largest numbers of farmers and has produced the most seed. Improvement of farm incomes is a relatively more important objective in this program. This strategy encourages seed production as a cash crop. However, the continuation of these efforts is uncertain.

The ICRISAT program produces moderate quantities of seed for village sale. Insofar as this replaces alternative income earning activities of the school, the relative returns on investments of school land and child labor are important.

Study Methodology

The implementation of three similar community seed supply programs in the same part of the country offers a unique opportunity to compare program strategies and identify common problems of implementation. While the three programs targeted the same crops and varieties, they had different levels of experience. One program had been operating for 5 years and was in the process of phasing out. The other two were only in their second season of seed multiplication, and had experienced only a single season of seed sales. While concerns were raised about the 'early' evaluation, the following discussion takes account of the fact that these programs may still be evolving. The objective of this review is to compare experiences, not to judge success or failure.

Table 4. Comparison of the objectives of three small-scale seed production programs.

MAFS program	CCT/DCT program	ICRISAT program
• Increase availability and adoption of new varieties	• Increase availability and adoption of new varieties	• Increase availability and adoption of new varieties
• Introduce new varieties to farmers	• Improve incomes of seed producers	• Train agricultural teachers in seed production techniques
• Provide training in seed production techniques	• Improve village food security	• Improve village seed security
• Improve food security and nutrition		

The comparative review examines:

- How and why the programs' strategies differ
- How each strategy has sought to resolve key problems like source seed supply, quality control, and seed distribution
- How each strategy copes with problems of technical and financial sustainability
- Lessons for Tanzania and other countries interested in pursuing similar programs.

The review was initiated in July 2000, with an informal diagnostic reconnaissance survey of the three seed projects in Dodoma (Kiriwaggulu et al. 2000). Representatives from the main implementing agencies collectively visited regional officials and farmers participating in each program. The reconnaissance visit examined the strategies being pursued, identified common problems of implementation, and outlined a more detailed study plan.

Based on the initial field visit, the team agreed to focus on a sample of participants involved in the three programs in Dodoma. A sample of seed producers in Singida was added, because the primary schools program had been significantly more successful in this region. The team agreed on the outline of the study and the main issues to be covered. Three issues were viewed as particularly important: seed marketing, seed quality control, and the strength of implementation partnerships.

JAB Kiriwaggulu and K Mtenga were asked to lead the study on behalf of the reconnaissance team. However, the reconnaissance group agreed to provide technical support for the investigation, acting as an informal steering committee.

Two formal field surveys were planned. The first survey was targeted for Feb-March 2001, just after the 2000/01 planting season. This aimed to collect data on seed production and sales in 2000, as well as data from the 2000/01 planting season. A second survey was planned for Sep-Oct 2001 to gather data from the 2000/01 harvest. However, this had not been implemented by the time this report was prepared.

The formal field survey targeted interviews with key informants, and with the farmers and primary school teachers participating in seed production and sale. Ultimately, this required three distinct but related questionnaires – one for farmers, one for school teachers, and one for key informants. The sampling plan sought to cover as wide a range of farmers and schools as was logistically feasible (Table 5).

Table 5. Population of seed program participants and sample frame, 2001.

	MAFS program		ICRISAT program		DCT program	
Region, district	Participating farmers	Sample	Participating schools	Sample	Participating farmers	Sample
Dodoma						
Dodoma Rural	6	4	50	12	60	33
Kongwa	4	4	0	0	0	0
Kondoa	12	4	0	0	0	0
Mpwapwa	8	3	0	0	0	0
Singida						
Singida Rural	0	0	50	11	0	0
Total	30	15	100	23	60	33

Table 6. Number of key informants interviewed, 2001.

	MAFS program	ICRISAT program	DCT program
Dodoma	8	4	3
Singida	0	6	0

Due to drought during the 1999/00 cropping season, many farmers in the MAFS program failed to produce a harvest. Since seed sales strategies had been identified as a key issue, the study targeted interviews with farmers who had successfully harvested a seed crop. Two villages were selected in each district and two participating farmers were interviewed in each village. The planned sample was 16 farmers in 8 villages, but only 15 of these farmers were available for interview.

The ICRISAT program (primary school) sample targeted a random selection of 12 of the 50 schools in each implementing district. This was compiled from a complete list of participating schools in each district. Ultimately only 23 schools were interviewed.

The sample for the DCT program similarly targeted a random selection of participating villages and households. First, three villages were randomly chosen from a list of all villages with seed production groups in Dodoma Rural. Next, lists of participating farmers were obtained from group leaders. Farmers with less than a year of experience with seed production were excluded. Twelve farmers were then randomly selected from each list. Ultimately, 33 of the planned 36 farmers were interviewed.

In addition, a cross section of 'key informants' involved in program implementation were formally interviewed (Table 6). These included regional, district, and village level extension workers, education officers, and project staff. Less formal interviews were also conducted with program leaders and implementing agents.

This report summarizes the results of the review of available literature on these programs, field interviews with participants, and formal and informal interviews with key informants. Unless otherwise indicated, all data are drawn from the surveys implemented under this case study.

Determinants of Participation

The success of the program can depend on selecting the right farmers. In some cases farmers become involved hoping to receive free seed or similar advantages from outside agencies. These farmers may have lesser farming skills or a limited incentive to produce a seed crop per se. In other cases participation is more strictly determined by outside agencies. This may improve the chances of identifying better-than-average seed producers, but if the selected farmers are not well integrated in their community, seed sales may be difficult.

In Dodoma and Singida, a broad range of external people were involved in selecting farmers and schools to participate in the programs (Table 7). According to the interviews with participants, these included village, ward, and district extension officers, district education officers, officials of village governments, farmer group members, and representatives of DCT, ICRISAT, and MAFS.

Village governments were closely involved in selecting the majority of participants in the MAFS program. This is because the farmer was expected to produce seed for the benefit of the village. In effect, the respondent was deemed to represent the village in the program. The survey respondents understood they were chosen because they were hardworking, had a good knowledge of farming, and had adequate resources to participate in the program.

Table 7. Participants' understanding of who chose them to produce seed, 2001 (% of responses).

	MAFS program (n = 15)	ICRISAT program (n = 23)	DCT program (n = 33)
Farmer's own initiative	0.0	0.0	63.6
Village government	53.3	0.0	15.2
Village/ward/district extension or education officials	20.0	56.5	6.0
MAFS	20.0	0.0	0.0
ICRISAT	0.0	21.7	0.0
DCT	0.0	26.0	15.2
Unknown	6.7	0.0	0.0

Multiple responses are possible
Source: Comparative seed study surveys, 2001

Farmers were more likely to volunteer for participation in the DCT program. However, all participants first had to agree to join DCT-linked farmer groups. Some farmers said they had been selected by district officials or the DCT. More likely, they were simply encouraged to join the farmer groups. The main criteria for participation were otherwise similar to those for the MAFS program – a farmer had to be hardworking, knowledgeable about agriculture, and have adequate resources.

The views of district officials were perceived to be particularly important in selection for the ICRISAT schools program. Schools were deliberately chosen by district councils or education officers based on their climate, soil fertility, accessibility, and availability of an agriculture teacher. Many of the schools in Singida understood that ICRISAT was involved in their selection, while in Dodoma, DCT was said to be more commonly involved.

The aggregate gender profile of participants was not available. However, the survey results suggest that men were more likely to participate in the DCT program than women (Table 8). The MAFS participants were deliberately chosen to include at least one female farmer (out of 2 participants) in each village. In both programs, however, some husbands insisted on participating together with their wives, both in the training and in the program meetings. There were more male agriculture teachers than female.

Limited information was collected on the drop-out rates in the three programs. The fact that communities participated in choosing the MAFS participants implies a higher likelihood of success. However, many of these participants were unhappy with restrictions on how they could market their seed (discussed below). As a result, there may be more changes in program membership than originally anticipated.

Table 8. Number of respondents interviewed, by gender.

	Male	Female	Both*	Total
DCT program	23	10	0	33
MAFS program	6	6	3	15
ICRISAT program	16	7	0	23
Total	45	23	3	71

* Both husband and wife were interviewed and involved in decision making

There was significant rotation in and out of the DCT farmer groups. The limited information available suggests this may have also depended on the success of individual farmers in marketing their seed. Farmers who were more successful in producing and marketing seed were more likely to remain involved.

The continuing participation of primary schools appears more likely to depend on the availability and interest of agriculture teachers than on seed production and sales problems per se. By the second year of the program there were already signs of significant turnover among school staff. Participation in the second year was also discouraged by the costs and problems of access to foundation seed. As a result, only 37 of the 50 schools originally designated for participation in Dodoma, planted a seed crop in the second season.

Summary of issues

Selection of participants was generally biased in favor of better-than-average farmers deemed more likely to be successful at seed production. This is a logical decision made by external investors. However, participating farmers must be sufficiently interested to make a commitment to change their production practices. They may also need to have better-than-average marketing skills, and by implication, wider community contacts. Seed sellers must also be viewed to be fair and trustworthy in their trading practices. In view of this, selection of participants by outside agencies may be more prone to error.

Since two of the three projects were in their second year of implementation, it is too early to draw conclusions about the strategies for choosing successful participants. The levels of, and factors underlying, participant turnover need further investigation. Nonetheless, the limited data indicate that participants are more likely to continue their seed production investments when they are profiting from seed sales. In effect, sales skills may be just as important as production skills for the success of these programs.

The evidence of participant turnover also suggests the need to maintain ongoing training programs. Though the DCT program has been running for 5 years, participation is still evolving. By inference, program development requires a continuing, and much longer term, investment than these programs have identified thus far.

Seed Sources, Consistency, Quality, and Price

Community seed schemes commonly experience difficulty ensuring access to high quality foundation or source seed to their producers. The national research service, or a related seed farm, must first be enlisted to produce the needed quantities and types of source seed. This must then be paid for and delivered to the participating farmers. Small-scale farmers are unlikely to organize this on their own, so some sort of external institution must retain this responsibility.

Variety choice

These programs first needed to decide what seed crop to grow. The MAFS program planned for the consultation of farmers and community leaders in the choice of seed crop, and demonstration trials were organized to facilitate the choice of varieties. The DCT and ICRISAT programs offered farmers less choice, deliberately targeting sorghum and pearl millet because these are drought-tolerant food crops.

For most crops, the choice of variety was limited by the availability of pure foundation seed. Small seed stocks were available of a few varieties of maize, sorghum, pearl millet, rice, and beans. The MAFS program has accordingly financed national research institutes to produce breeder seed of a wider range of varieties and crops.

Partly because of limitations in foundation seed availability, the survey respondents generally perceived that outsiders had chosen what crop and varieties they should multiply for sale (Table 9). Most participants in the MAFS program believed the Ministry had chosen what crop and variety they should grow. About 20% understood that the decision was in fact made by their village government. The majority of participants in the ICRISAT program believed ICRISAT had chosen the crops and varieties. If they had limited contact with ICRISAT, they more alternatively perceived that the variety had been chosen by government officials or the DCT. Similarly, almost all farmers involved in the DCT scheme claimed DCT had told them what variety to grow.

In practice, variety choices in the DCT and ICRISAT programs were influenced by ICRISAT's efforts, in collaboration with national breeders, to promote the adoption of new sorghum and pearl millet varieties. ICRISAT had been promoting the production and distribution of foundation seed of these varieties for several years. The community seed programs were viewed as a means to further stimulate multiplication and distribution, and ICRISAT encouraged all three programs to target the distribution of the same varieties.

Though most farmers perceived that the seed variety was chosen by others, they were generally satisfied with these choices. Those expressing dissatisfaction were most likely to be concerned with the difficulty they experienced marketing the chosen crop. They sought alternative, more marketable seed crops. Thus, one-quarter of the participants in the DCT program indicated a desire to shift to other crops – particularly to sesame seed, which is viewed as a more viable cash crop in Dodoma. If the seed cannot be sold, the grain has a ready market.

Similarly, one-quarter of the MAFS participants interviewed sought to change their seed crop. Farmers growing maize were more likely to be satisfied than those growing sorghum or pearl millet. Two-thirds of sorghum seed producers sought to shift to other crops including maize, beans, sunflower, and green gram; 40% of pearl millet seed producers sought a shift to other cereal grain crops. The interest in changing crops was stimulated by difficulties encountered in selling sorghum

Table 9. Participants' understanding of who chose the seed crop and variety for them to produce, 2001 (% of responses).

	MAFS program (n = 15)	ICRISAT program (n = 23)	DCT program (n = 33)
Village government	6.7	0.0	0.0
Village/ward/district extension or education officials	0.0	34.7	0.0
MAFS	80.0	0.0	0.0
ICRISAT	0.0	52.1	0.0
DCT	0.0	12.0	90.9
Self	13.3	8.6	3.0
TOSCA	0.0	4.3	0.0
Unknown	0.0	4.3	6.1

Multiple responses are possible
Source: Comparative seed study surveys, 2001

and pearl millet seed, and by awareness that alternative crops were being grown in demonstration trials.

Most of the schools accepted the choice of sorghum and/or pearl millet, but several also expressed interest in growing maize seed.

Seed sources and costs

In order to ensure their source seed was of high quality, all three programs sought to obtain foundation seed from the government-run Msimba Seed Farm. Fortunately, the operations of the seed farm were strengthened by technical support from ICRISAT, and a rehabilitation grant from Danida. Technical and financial support also helped ensure that the seed farm had access to high quality breeder seed. Sustainability of the seed farm and the linkages to national breeders will need to be monitored and evaluated.

During the 2000/01 season, Msimba Seed Farm provided the three programs with foundation seed of two varieties of sorghum (Pato, Macia), one pearl millet variety (Okoa), and two maize varieties (Katumani, TMV 1) (Table 10). Because foundation seed was used, as opposed to certified seed, farmers were able to produce a certified seed crop the first season, retain seed from the harvest, and use it to produce a quality declared seed crop the following season.

Each program then had to develop a strategy for purchasing foundation seed and distributing it to participating farmers. One key issue was seed pricing. The government decided that seed prices would be set at levels approximating the costs of production. However, high production costs threatened the viability of these programs (Table 11). Many farmers complained that foundation seed was priced at least *ten times* the price of the seed they were able to obtain in their rural market. Even so, most farmers benefited from the free collection and transport of this seed to their communities. If they had to pay the full distribution costs, the cost of foundation seed would be substantially higher.

Table 10. Crops and varieties planted, 2001 (% of responses).

	MAFS program (n = 15)	ICRISAT program (n = 23)	DCT program (n = 33)
Sorghum – Pato, Macia	53.3	100.0	100.0
Pearl millet – Okoa	33.3	50.0	0.0
Maize – Katumani, TMV 1	13.3	0.0	0.0

Multiple responses are possible
Source: Comparative seed study surveys, 2001

Table 11. Prices of sorghum and pearl millet seed and grain, 2001.

Seed class	Price (Tsh kg^{-1})
Breeder seed (from breeders)	30,000
Foundation seed (Msimba)	5000
Certified seed (Msimba)	1000
Seed sale price in rural market	100-500
Grain price in rural market	50-100

Source: Comparative seed study surveys, 2001

During the 2000/01 planting season, all participants in the ICRISAT primary schools program had to pay the full cost (Tsh 5000 kg^{-1}) of the foundation seed. The majority of respondents indicated that their seed had been supplied by extension officers or ICRISAT. However, DCT was also involved in providing foundation seed to schools in Dodoma Rural. Approximately half the schools had their seed delivered; the remainder had to send someone to town to pick it up.

Though the DCT program was being phased out, almost 90% of respondents claimed to have obtained their foundation seed from the Diocese. In three-quarters of these cases, the seed was delivered to the farm or the village. Most respondents were not sure how the seed was paid for, and many were uncertain of the price. In fact, DCT purchased the foundation seed from Msimba Seed Farm at Tsh 5000 kg^{-1} and provided it to farmers at Tsh 2000 kg^{-1}. The difference was deducted from the sale price offered by DCT to farmers marketing their seed through the Diocese. Thus, farmers failing to market seed through the church received a price discount.

Roughly half the farmers in the MAFS program claimed to obtain seed from Danida. Generally this was delivered to the farm, though approximately one-quarter of the recipients traveled to Dodoma to obtain foundation seed. Most of these respondents were uncertain what they paid for it. The other half of respondents obtained seed either from their own stocks or from neighbors.

In practice, MAFS farmers were given an initial allotment of foundation seed free of charge during the first year of the program. They were expected to obtain the second year's planting seed from their first year's crop. However, a few farmers whose crops had failed due to drought during the first year were provided a second free allotment. During the third season, these farmers are expected to purchase foundation seed on their own, from the profits made from their seed sales.

The high costs of foundation seed were most obvious to the participants in the ICRISAT primary schools program. Many schools complained about the cost of foundation seed. This has led ICRISAT to consider using certified seed rather than foundation seed for multiplication. Certified seed is substantially cheaper (Tsh 1000 kg^{-1}), yet provides starting seed of enough purity to meet the needs of the local market. ICRISAT has suggested that DCT also consider this option.

Future seed requirements

A key problem with source seed supply is the need to predict program requirements at least a year or two in advance. Breeder seed must be available, and then foundation seed must be bulked up to provide adequate supplies for distribution to farmers. This is relatively easy for most grain crops with high seed-to-grain multiplication ratios. It will be more difficult for some legume crops.

The MAFS program has a well planned strategy for ensuring that adequate supplies of source seed are available for its farmers. National breeders are being contracted to provide breeder seed to Msimba, Arusha, and Dabaga Seed Farms for multiplication. These farms are then informed of the quantity of seed required by the program, and plan their production accordingly.

Contacts between Msimba Seed farm and the ICRISAT and DCT programs appear less formal. ICRISAT has been encouraging the production of growing volumes of foundation seed for new sorghum and pearl millet varieties for several years. However, there appears to be no advance planning of the exact seed requirements of these programs. In practice, the seed farm produces larger quantities of sorghum and pearl millet foundation seed than can be sold. The MAFS program paid for these losses. However, there are no plans to offset such losses in the future.

Due to problems in estimating foundation seed demand, Msimba Seed Farm has encouraged buyers to register their orders for source seed well ahead of the planting season. Msimba has also started to produce this source seed on contract if the buyer is willing to pay 10% of the production

costs at the time of the order. The remainder is paid when the seed is collected. But only a small share of Msimba's production is contracted in advance. This is likely to present an increasing problem as seed demand becomes more diversified.

If the programs switch to using certified, as opposed to foundation seed, this may also present a problem. Msimba currently produces a small quantity of certified seed, but may be reluctant to increase output because foundation seed is more profitable. Again, better planning is needed.

Summary of issues

Overall, questions arise about the sustainability of these arrangements to supply foundation seed. In each of the programs, participating farmers depend on the delivery of foundation seed from Msimba. The projects must carry this seed at least part of the distance to the farmer. Many farmers will drop out of the program if seed is not delivered to the farmgate.

Key informants supporting the three programs generally acknowledge that foundation seed is too expensive for these programs to become self-sustaining. Farmers will simply not pay the mandated price for this seed, unless they are required to do so and provided support with seed marketing. Even then, it is unlikely that farmers will continue to pay for source seed that costs at least 10 times the price on local markets. Key informants have suggested that farmers use cheaper certified seed as source seed, but even here, sustainable delivery mechanisms and acceptable pricing need to be worked out.

It appears that farmers are prepared to purchase higher quality source seed as an investment in producing a cash crop of seed. But if the market is uncertain for this cash crop, interest in making this investment will sharply diminish. Farmers are unlikely to pay a premium price for source seed if they cannot obtain a premium price for their own seed harvest.

Finally, it is not clear whether Msimba can sustainably produce foundation and certified seed of a range of different crops. Development of this capacity will require substantially more planning than at least two of the three programs have pursued. Mechanisms for more consistent advance contracting and purchase of source seed still need to be worked out.

Quality Control

One of the most contentious issues in community seed production is the question of what level of seed quality to maintain. National seed laws may only allow sale of certified seed, as was the case in Tanzania until 2000. Yet even when sales are allowed of common or quality declared seed, questions remain about isolation distances required for seed purity. These concerns lead to investments in seed production training, seed production monitoring, and stipulations about the registration of seed crops.

Most of the farmers and school teachers in the three seed projects received at least a few days of formal training in seed production techniques: all farmers participating in the MAFS program, 70% of the DCT farmers, and 96% of the representatives interviewed from participating primary schools. The agriculture teacher was sent for training in almost all the schools. In some cases he or she was joined by the headmaster, or a teacher of environmental studies. Virtually all the training for the MAFS and ICRISAT programs was conducted in 1999. Unexpectedly, DCT farmers were still receiving training in 2000.

Most respondents stated they had received training in general crop husbandry. This included advice on seed production management as well as isolations. A few respondents also reported receiving training in variety identification, pest and disease management, and marketing. The training curriculum in the three programs appears to have been similar.

Table 12. Changes in crop management practices for seed production compared with grain production cited by participating farmers, 2001 (% of positive responses).

Crop management practice changed	Changes commonly cited	MAFS program (n = 15)	ICRISAT program (n = 23)	DCT program (n = 33)
Field choice	Isolations, better soils	86.7	85.0	84.7
Land preparation	Ox-plow, manure	92.9	65.0	56.8
Planting	Spacing, line planting	100.0	61.9	75.0
Weeding	More weeding	93.3	50.0	55.1
Fertility	Use of manure, fertilizer	86.7	70.5	36.4
Harvesting	Harvest when completely dry	66.7	28.6	60.6
Grain drying	Dried on elevated structure	84.6	40.0	69.0
Grain processing	Process on clean floor	84.6	not asked	71.9

Source: Comparative seed study surveys, 2001

Improved seed management

One test of the efficacy of training is what changes farmers made in their seed production practices compared with their normal practices in grain production. Most respondents claim to have made significant changes (Table 12). These included the selection of isolated fields with better fertility or drainage, the use of oxen for plowing, stricter plant spacing and line planting, an additional weeding, use of manure and/or chemical fertilizer, harvesting only when the crop is completely dry, further drying on elevated structures, and grain threshing on clean floors 'cemented' with cow dung. Some of these responses may have been given because respondents were keen to prove they were correctly managing their seed crop. These changes were not confirmed with field observation. Nonetheless, most farmers clearly realized the need to take greater care of a seed crop.

Most of these changes will add significantly to the costs of seed, as opposed to grain, production. This issue is discussed in a later section.

Field isolations

One of the key seed production requirements – reviewed in detail in both the training courses and field discussions – was the need to maintain adequate isolation distances. Farmers were being advised to isolate at 300 m for pearl millet and 200 m for sorghum. Yet many farmers appeared confused about these requirements (Table 13). Among the agriculture teachers, estimates of the required isolation distances ranged from 50 to 500 m for sorghum, and 20 to 500 m for pearl millet. Interestingly, despite the wide range of answers, most teachers were satisfied that they had achieved the required isolation distance.

At least half the seed producers in all three programs either did not know what isolation distances to maintain or thought this should be less than 100 m. This may simply reflect the perception that seed of 'reasonable' quality can be readily obtained from one's own un-isolated fields. After all, few farmers worry about any kind of isolation when obtaining seed for their own planting purposes. Seed is commonly drawn from the previous harvest, even when multiple varieties are planted in the same plot. Similarly, farmers have historically obtained seed from their neighbors, without worrying about isolations or strict standards of quality control. If most sales are to continue to be made to neighbors, many participants may see little justification for this added expense. Some farmers may become

Table 13. Farmer perceptions of field isolation distances required, 2001 (% of responses).

	MAFS program (n = 15)		ICRISAT program (n = 23)		DCT program (n = 33)
	Sorghum	Millet	Sorghum	Millet	Sorghum
100 m or less	46.7	40.0	34.7	30.3	21.1
101-200 m	6.7	0.0	26.0	21.7	9.1
201-300 m	0.0	0.0	30.4	8.7	24.2
301 m or more	0.0	0.0	4.3	4.3	0.0
Unknown	46.7	60.0	4.3	34.8	15.4
None because plant in block	0.0	0.0	0.0	0.0	12.1

Source: Comparative seed study surveys, 2001

concerned about isolation distance only if it qualifies the resulting seed crop for sale at a premium price outside the community. Heretofore, this has not been the case.

What isolation distance is necessary? The national regulatory authority, TOSCA, has recently declared the acceptance of a new class of seed called 'quality declared seed'. This requires an isolation distance of 100 m for both sorghum and pearl millet. Yet even this may be stricter than the standards farmers find acceptable on their own. If this standard is enforced for sales to the wider national market, seed farmers may take this into account. Otherwise, farmers may use isolations only if they have easy access to remote plots.

Monitoring seed quality

As a further check on strategies to maintain the quality of the seed crop, respondents were asked whether they were being visited for inspection, or to discuss production problems. By the time of the survey in 2001 (just after the planting period) two-thirds of the MAFS farmers had been visited compared with only 9% of DCT farmers (Table 14). The limited visits to DCT farmers are not surprising since the NGO was in the process of phasing out assistance to this program. The previous year, over 70% of DCT farmers had been visited at least once whereas all MAFS farmers were visited at least twice. Just under half the schools claimed to have been visited by extension or TOSCA staff for

Table 14. Proportion of respondents visited for field inspections or to discuss production problems, 2000/01 (% of positive responses).

	MAFS program (n = 15)	ICRISAT program (n = 23)	DCT program (n = 33)
Visited during 2000/01 season	69.2	46.7	9.1
Visited during 1999/00 season			
Once or more	100.0	95.2	72.8
Twice or more	100.0	56.5	54.6
Three times or more	86.7	26.1	27.3
Four times or more	46.7	17.4	3.0

Source: Comparative seed study surveys, 2001

Table 15. Proportion of visits made by various external agencies during the 1999/00 season (% of visits).

External agency	MAFS program (n = 15)	ICRISAT program (n = 23)	DCT program (n = 33)
Extension	50.9	77.7	23.6
TOSCA	32.1	4.4	7.3
Danida	11.3	2.2	0.0
DCT	3.8	6.7	56.4
ICRISAT	1.9	6.6	7.3
Other	0.0	6.6	1.8
Do not remember	0.0	0.0	3.6

More than one response may be possible
Source: Comparative seed study surveys, 2001

inspection purposes following planting in 2000/01, though most had been visited during the 1999/00 season.

The record of visits during the 1999/00 season suggests that all three programs were being managed fairly intensively. Extension agents were closely involved in supervising implementation of the ICRISAT and MAFS programs (Table 15). TOSCA was most strongly involved in implementing the MAFS program, and DCT was involved in more field visits for its own program. In comparison, virtually all the visits recorded during the early 2000/01 season were by local extension agents.

The decline in visits during the 2000/01 season in all three programs may partly reflect the fact that the survey was conducted early in the cropping season, after planting had been completed. However, this could also reflect uncertainty about the responsibilities of regional and district extension staff for program implementation. Each seed program expects extension staff will help supervise quality control. Extension workers are expected at least to check isolations, disease incidence, and plot purity. However, these responsibilities do not seem to have been formally integrated into regional and district extension programs.

Ultimately, TOSCA expects extension workers to take greater responsibility for quality control – particularly for monitoring the production of quality declared seed. It is simply too expensive for TOSCA personnel to visit hundreds of individual seed plots during the course of the season. Small-scale farmers certainly cannot afford to pay for these visits. However, the modalities for extension workers to take on these responsibilities remain unclear. Nor are plans in place to monitor the activities of these extension workers. While some local extension staff have been trained, field visits still appear to be scheduled ad hoc, and dependent on the interest of the local officer.

Summary of issues

The three programs initially aimed to produce certified seed, but this does not appear feasible. Recognizing this, the Ministry of Agriculture and Food Security created the category of quality declared seed in 2000. This involves the use of certified seed (as opposed to foundation seed) for planting, and less rigorous standards for isolation distances and field and post-harvest inspections. This standard is being most actively pursued by the MAFS program. Much of the seed being produced by the DCT and ICRISAT programs might best be categorized as common grade seed. TOSCA retains discretion regarding legality of the sale of common grade seed within and across communities, though in practice, strict trade restrictions are difficult to enforce.

Questions remain about what quality standards are necessary for these programs. If the objective is primarily to get new varieties to farmers, there may be good justification for promoting the production of large quantities of cheaper, common grade seed. Stricter quality standards make the seed more difficult to produce and expensive in the market. Given a choice, most small-scale farmers are more likely to pay a lower price for adequate quality seed, than a high price for more pure seed. At least they should have this option.

If stricter seed production requirements are to be pursued, substantial additional investments will be required to train and monitor the activities of field staff, ie village extension workers. This includes the development and monitoring of new work programs. An evaluation system will need to be established to check whether extension workers understand the seed production requirements and enforce them correctly. However, given farmers' preference for cheaper seed of 'adequate' quality, the payoff to these investments needs to be evaluated.

Seed Marketing

Following the initial diagnostic survey, seed marketing was identified as likely to be the greatest problem for seed producers. Questions arose about appropriate strategies for seed treatment, packaging, and pricing. In general, the community seed projects were arguing for larger investments to be recouped through premium prices, but expressed uncertainty about the returns on these investments. Farmers also expressed concerns about the size of local seed markets.

The results of the surveys confirm some of these concerns. While most farmers were able to sell some seed, sales opportunities on the local market were more limited than expected. Seed prices were highly variable. And most farmers remained with unsold seed at the end of the year. The highest sales were achieved by farmers with access to an external market. However, this access was only available through the mediation of an external organization, DCT.

Seed sales

Only two-thirds of the MAFS farmers who produced a seed crop sold were able to sell seed (Table 16). All of these farmers remained with unsold seed stocks. Their disappointment was compounded by the knowledge that DCT has assisted DCT farmer groups to sell seed at premium prices to outside buyers. Some MAFS farmers complained about the prohibition on sales to external organizations demanded by their program. These farmers argued that seed demand in their own villages was limited, and the only way to cover their production costs was to sell externally.

Table 16. Proportion of sorghum seed producers who sold seed to local community and external organizations, 2000 (% of respondents).

Percent of seed producers:	MAFS program (n = 15), sorghum only	ICRISAT program (n = 23), sorghum and millet	DCT program (n = 33), sorghum only
Selling on local market	66.7	76.2	24.2
Selling on external market	6.7	0	84.8
Not selling	33.3	23.8	15.1
Remaining with some seed unsold	100.0	94.1	88.8

Source: Comparative seed study surveys, 2001

Table 17. Sorghum and millet seed harvested and sold in 2000, mean kg per household.

Quantity of seed (kg)	MAFS program (n = 15), sorghum only	ICRISAT program (n = 23), sorghum and millet	DCT program (n = 33), sorghum only
Harvested	871.8 (668.6)	741.7 (867.0)	488.7 (844.7)
Sold locally	106.9 (280.2)	466.4 (461.8)	33.3 (102.1)
Sold to distant villages	0.0	84.7 (353.9)	0.0
Sold to external organizations	0.0	0.0	265.7 (405.0)
Balance of seed retained	764.9	224.9 (339.7)	189.7

Figures in parentheses are standard deviations
Source: Comparative seed study surveys, 2001

Reinforcing this view is the fact that only 24% of DCT farmers were able to sell seed on the local market. While most were able to sell seed through the DCT, the majority of farmers still had unsold inventories. This too was a source of disappointment.

The significance of the MAFS prohibition on external seed sales, and the value of the DCT intervention, are apparent in Table 17. Farmers in the MAFS program were only able to sell 12% of their total sorghum seed production, and virtually no pearl millet. Similarly, DCT farmers were able to sell only 7% of their production on the local market. In contrast, external sales organized through DCT accounted for 83% of the seed sales by farmer groups. Even so, almost 40% of the seed harvested by farmer groups in the 2000 season remained unsold at the time of the survey – after the 2001 planting season.

The schools program did somewhat better. The schools managed to sell two-thirds of their production on the local market, either within their community or to neighboring communities. This may partly be due to pressures on parents of the school children to purchase seed. But it also resulted from the fact that the Singida market was new. Sales outside the school communities were more difficult in Dodoma, where DCT had already been selling sorghum seed for several years. This suggests the need to monitor changes in seed demand over time.

Seed prices

At the time of the initial diagnostic survey, there was substantial confusion about the appropriate level of seed prices to charge. Many observers were aware that DCT had purchased seed from farmers at Tsh 500 kg^{-1} following the 1999 harvest. This set a target for local prices. High prices were also justified by the high cost of foundation seed. The schools had been told to expect a charge of Tsh 5000 kg^{-1} during the next planting season. DCT farmers were being charged Tsh 2000 kg^{-1}, with additional charges to be deducted during seed sales. Farmers also noted that they incurred additional costs with the adoption of improved management practices.

Unfortunately, most neighboring farmers within the target communities were unwilling to pay this cost. A review of local grain prices helps explain why. The prevailing price for sorghum in the Dodoma market was Tsh 102 kg^{-1} (sd 41.6). (The price cited in the survey of farmers was slightly higher than that cited in the survey of schools.) Evidence from related marketing work in the region indicates that traders were purchasing larger quantities of sorghum grain for as little as Tsh 50 kg^{-1}. These grain prices roughly represent the minimum opportunity cost of seed. Traditionally, farmers who are short of seed will turn to the grain market to resolve their deficits. They may pay a premium for higher quality seed, but the size of this premium is likely to be limited.

Most efforts to demand Tsh 500 for a kilogram of seed failed. Few of the DCT farmers sold any seed on the local market. While a higher proportion of MAFS farmers sold seed, they only sold a small part of their inventories.

When farmers realized they were not able to sell anything at the prices offered in 1999 by DCT, they quickly reduced their prices. Correspondingly, the record of prices charged to neighboring farmers varied considerably – ranging from as little as Tsh 50 up to a high of Tsh 800 kg^{-1} (Table 18). Mean prices ranged around Tsh 200-300 kg^{-1}. The higher median price among DCT producers reflects their proclivity to hold stocks until they could be sold through the church group. They were then disappointed when DCT finally offered to purchase their sorghum seed on credit for only Tsh 350 kg^{-1} (Table 19).

Though the DCT purchase price for sorghum seed was much lower than following the 1999 harvest, the opportunity to sell to external organizations again saved the DCT seed producers. This price was still higher than most transactions available on the local market. Many DCT farmers were simply disappointed that they could not sell more of their seed through this channel.

Again, the schools program was an exception. Mean and median prices for sorghum seed were lowest, but most schools were able to sell at least half their grain on the local market. If their seed prices had been lower, they may have been able to sell more.

Pearl millet seed was sold only by the ICRISAT schools program. According to available data, schools are selling pearl millet seed for the same price, or a marginally higher price, than sorghum seed. The median price for both crops is Tsh 200 kg^{-1} (Table 20).

Finally, the 1999/00 season was heavily affected by drought. Even so, the local market for seed produced by the community schemes was limited because most farmers in Dodoma had previously obtained the new sorghum and pearl millet varieties. Since these varieties matured earlier than traditional varieties and were thus more likely to escape end-of-season drought, many of these farmers were able to retain planting seed despite the drought. Though regional authorities expressed great

Table 18. Sorghum selling prices (Tsh kg^{-1}) to neighboring farmers, 2000.

	MAFS program (n = 15), sorghum only	ICRISAT program (n = 23), sorghum and millet	DCT program (n = 33), sorghum only
Mean (standard deviation)	384.4 (185.2)	235.0 (146.4)	494.3 (213.8)
Median	300	200	500
Range	110-650	50-500	110-800

Source: Comparative seed study surveys, 2001

Table 19. Sorghum selling prices (Tsh kg^{-1}) to external organizations, 2000.

	MAFS program (n = 15), sorghum only	ICRISAT program (n = 23), sorghum and millet	DCT program (n = 33), sorghum only
Mean (standard deviation)	No sales	No sales	349.5 (123.6)
Median			345
Range			66-800

Source: Comparative seed study surveys, 2001

Table 20. Pearl millet selling prices (Tsh kg^{-1}) to neighboring farmers, 2000.

Quantity of seed	MAFS program (n = 15), sorghum only	ICRISAT program (n = 23), sorghum and millet	DCT program (n = 33), sorghum only
Mean (standard deviation)	No sales	243.6 (152.0)	No sales
Median		200	
Range		50-500	

Source: Comparative seed study surveys, 2001

concern about seed shortages, evidence of these shortages was limited. Thus, the local seed market was limited even in the event of drought.

Future seed sales

This raises the question – how do these seed producers find buyers? The DCT farmers have grown dependent on the Diocese to find buyers for most of their seed, and seem to make little effort to find buyers on their own. If neighboring farmers come to request seed, a trade may occur. However, there was little evidence of advertising. The participating farmers expected this to continue following the 2001 harvest. The survey respondents anticipated that at least 80% of their seed would be sold to external organizations, through DCT (Table 21), and less than 10% to neighboring farmers.

The MAFS farmers are more uncertain about market prospects. Many expressed the hope that most of their seed would be sold through external organizations, even though this practice was prohibited following the 2000 harvest. These farmers also anticipate difficulties selling even one-quarter of their seed crop.

The perceptions of participants in the ICRISAT schools program differ in the two regions. In Singida, where there are no competing seed programs, most participants expect to sell most of their seed within their own communities (Table 22). In Dodoma, in contrast, many school teachers hope to take advantage of the opportunity to sell to external organizations like the DCT. In either case, the schools expect to be able to sell only about 75% of their seed stock.

Seed packaging and treatment

A common question raised by farmers during the diagnostic survey just after the 2000 harvest was whether the seed needed to be treated and specially packaged prior to sale to other farmers. Some observers argued that pesticide treatments and packaging were necessary to differentiate the seed from

Table 21. Distribution of seed sales expected by farmers following the 2001 harvest, March 2001 (% of harvest sold via alternative channels).

	DCT program	MAFS program
Neighboring farmers	7.5	35.0
External organizations	83.8	41.3
Seed retained	8.7	23.6

Source: Comparative seed study surveys, 2001

Table 22. Distribution of seed sales expected by schools following the 2001 harvest, March 2001 (% of harvest sold via alternative channels).

	Dodoma Rural	Singida Rural
Neighboring farmers	43.0	71.9
External organizations	23.9	0
Others	8.0	3.4
Seed retained	25.1	24.7

Source: Comparative seed study surveys, 2001

grain. If neighboring farmers could not see an obvious difference between seed and grain, they would be unwilling to pay a premium price. Others argued that the additional costs of pesticide treatments and special packaging would push the cost beyond the means of most neighboring households.

In view of this controversy, the survey asked respondents how potential seed buyers can tell the difference between seed and grain. Seed sellers across the three programs commonly cited the distinguishing traits of seed size and physical purity as characteristic of quality seed. These sellers also noted that most farmers in their community knew they were producing a special seed crop with the assistance of external training and supervision. Therefore, specialized treatments and packaging were not necessary.

Each project provided limited assistance to farmers to allow the purchase of insecticide and/or fungicide. The MAFS program recommended the use of Super Actelic Superdust since it was readily available in nearby towns. The program did not recommend the use of fungicide because of its expense and limited availability. However, the final decision on seed treatments was left to the discretion of participating farmers.

Only a minority of DCT and MAFS farmers used seed treatments or specialized packaging for local sales (Table 23). Most sales were in small transactions wherein a buyer appeared with his or her own container, and was provided with untreated seed.

The ICRISAT primary schools project appears to have provided the most assistance. Correspondingly, more than half the schools interviewed applied insecticide seed treatments, and almost half used some sort of packaging for local sale. A few of the schools also applied fungicide, though it was very expensive and not readily available.

In contrast to their practice for local market sales, most DCT farmers (79%) applied insecticide to the seed they were selling through the Diocese. They generally delivered this seed in grain bags.

Table 23. Seed treatments for sorghum prior to sale to local farmers, 2000 (% of respondents applying).

Treatment	MAFS program (n = 15)	ICRISAT program (n = 23)	DCT program (n = 33)
Insecticide	13.3	60.9	23.3
Fungicide	0	21.8	0
Packaging	14.2	47.8	17.8

Source: Comparative seed study surveys, 2001

Table 24. Major marketing problems cited, 2001 (% of respondents).

Problems commonly cited	MAFS program (n = 15)	ICRISAT program (n = 23)	DCT program (n = 33)
Lack of market	84.6	55.6	25.0
Preference for other crops	7.7	0.0	0.0
Low seed price relative to production costs	7.7	0.0	15.0
Delayed payments	0.0	0.0	55.0
Farmers unaware of variety	0.0	38.9	0.0

Multiple answers are possible
Source: Comparative seed study surveys, 2001

Marketing problems

Seed producers were asked to identify their most difficult marketing problems. Producers in each of the three programs expressed concern about the limited demand for their products (Table 24). This was a particular concern among MAFS farmers, even though they had relatively smaller quantities of seed to sell. Some MAFS farmers would prefer to grow seed of alternative crops with a better grain market, like maize. The DCT farmers were most concerned about delayed payment from the Diocese. Some argued that the price offered for their seed was too low relative to production costs. The primary school teachers believed that seed demand was limited partly because farmers were unfamiliar with the new varieties.

Summary of issues

The formal surveys confirm the conclusions of the initial reconnaissance survey: that seed sales were one of the greatest concerns of most seed producers. It is obvious that the demand for improved seed in village communities depends considerably on whether the variety is already readily available. Once a community is saturated with seed of a new variety, demand will fall sharply. This implies the need to concentrate on two marketing options: (i) produce seed as a cash crop for sale to distant communities, or (ii) produce small quantities of a continually shifting array of varieties for sale to neighboring farmers.

Few farmers are good at identifying and exploiting distant markets, and it is not reasonable to expect seed producers to develop wider retail trading links. The MAFS program recognizes this problem and thus encourages only enough production for sale within the community. The DCT and ICRISAT schools programs need to consider how to build sustainable marketing links to more distant communities. The DCT program currently purchases most of the seed produced by its growers. In effect, seed is being produced as a premium cash crop. However, the DCT program depends on continuing purchases by external agencies for drought relief. If there is no drought, as appears likely in 2001, this market will collapse. The seed producers will be disappointed and many may drop out of the program.

Efforts to encourage the production of larger quantities of seed must be linked with efforts to develop wholesale and retail seed market linkages. This implies larger investments in seed marketing per se. Ideally a marketing plan – including budgets for trading and advertising costs – should be in place before any seed is multiplied.

The MAFS program has chosen to pursue the second option of selling locally, smaller quantities of seed of a shifting array of varieties. However, this requires more complicated advance planning to ensure that new varieties acceptable to local communities are available for multiplication. The MAFS program allows for a year of demonstration plots from which farmers can choose the varieties they want. However, the marketing problems experienced by MAFS farmers in 2000 indicate that more care is needed in evaluating local seed demand.

The marketing experience to date also indicates that seed prices must be kept as low as possible to attract local sales. Most neighboring farmers will not pay extra for specialized seed treatments or packaging. Distant companies may expect treated, packaged seed, but not buyers in the local community. Neighboring farmers are more likely to judge seed quality on the basis of the appearance of the seed and the reputation of the seller. They appear satisfied using local containers and seed treatments to transport and protect their purchases if this allows them to buy cheaper seed.

In addition, the three programs appear to have over-estimated the premium farmers are willing to pay for pure seed. Seed producers are commonly unconcerned about field isolations, and farmers rarely worry about this in their own production. By inference, after the first year or two of sales of a new variety, seed prices will need to be maintained at levels close to the price of high quality grain to remain competitive in the local market. Farmers appear likely to purchase high quality *grain* for use as seed, if seed becomes too expensive.

Partnerships for Implementation

Strong implementation partnerships are essential to ensure both the success and sustainability of these seed projects. The roles and responsibilities of each implementing partner need to be clear, both to the partner and to others involved in the project. The full team should know who to call upon when problems or disputes arise. Clear responsibilities help ensure consistent implementation of the mandated program, and eventually the sustainability of these efforts.

Table 25 summarizes the main agencies involved with the implementation of each project. The programs were conceptualized and led by different agencies. Insofar as the three programs were alternative models for achieving the same basic objectives, the programs could be viewed as competitors. However, there was substantial communication between the three groups. They were more likely to cooperate in resolving common implementation problems than to compete. Nonetheless, a few areas of jurisdictional confusion did arise.

Table 25. Range of external agents involved with implementation of seed projects, 2001.

	MAFS program (n = 15)	ICRISAT program (n = 23)	DCT program (n = 33)
Leadership	MAFS/ASPS	ICRISAT	DCT
Implementation – primary agent	Village extension officers, TOSCA	District education officers, village ext officers	DCT
Implementation – secondary agent	District ext officers, village govt	District ext officers, TOSCA, district govt	Village ext officers, TOSCA

Source: Comparative seed study surveys, 2001

The district and village level extension programs were most directly linked with the government-run MAFS program. Both district and village level authorities perceived themselves to be directly responsible for the success of this program. TOSCA also considered supervision of the MAFS program to be a primary component of its field activities.

In contrast, the DCT program was largely seen as an independent NGO initiative. While DCT linked with the local extension authorities, the Diocese provided much of its own supervision and management. Extension workers were occasionally asked to assist with field inspections.

The ICRISAT program was unique in that it was primarily organized through the district level education (as opposed to extension) authorities. The extension authorities were aware of the program, but were more involved in implementation in Singida, than Dodoma. In some communities, there was confusion about the differing responsibilities of education and extension officers.

The most common concerns, arising in discussions with key informants, related to competition for the time of extension staff in Dodoma. While these staff were primarily mandated to work on the MAFS program, they were expected to also assist the schools and DCT programs. Some staff were aware of these programs, but less sure of their expected roles. It appears that regional and district extension staff would work with the DCT or ICRISAT programs when directly called upon, and financed to do so. Otherwise they concentrated on supporting the MAFS program.

The performance of village level extension staff was difficult to assess. Since the MAFS project had the most frequent supervisory field presence, it was probably more successful in ensuring stronger village extension support. The ICRISAT schools program, with more limited supervision, had greater difficulties getting help from local extension staff. In some villages, there was confusion about the roles of extension versus education authorities. It should be noted, however, that this program seemed to work much more smoothly in Singida, where there were fewer competing demands on district and village staff.

These constraints may have reduced the success of the schools program in Dodoma. However, they do not seem to have jeopardized the overall efforts of the three pilot programs. These problems can be resolved by improving program planning and supervision. Collaboration across the programs provides a good foundation for building stronger partnerships in implementation. This can be strengthened through such practices as sharing detailed workplans and scheduling joint planning meetings. The three programs would also benefit from sharing and discussing annual results. Currently, information and workplans are shared on a limited and unplanned basis.

Summary of issues

The most significant partnership problem relates to the sustainability of the three initiatives. If regional, district and village extension staff, education officers, and school teachers are expected to continue to assist in implementation beyond the initial period of these projects, position descriptions may need to be redefined. Field staff should be consulted about how they view their roles and responsibilities. Ongoing training programs can then be crafted that take account of these needs. This training will need to be consistently pursued given the prevailing levels of staff turnover.

The largest investment in building local institutions has been made by the government's MAFS program. This includes substantial commitments to improve the strength and sustainability of foundation seed production and seed quality control. The other two projects are taking advantage of these initiatives. They might be asked to contribute more to such institution building.

Finally, these projects need to acknowledge the fact that staff commitments and partnerships are easier when all partners have access to the supplementary resources inherent in special projects, but

will become more difficult as these resources are shifted to new activities. The financial constraints affecting most government institutions encourage staff to allocate their efforts to projects offering more operational support, including payments for field visits. When project-specific payments disappear, attention may shift. Greater clarity of roles, responsibilities, and objectives, along with a common recognition of the impacts being achieved, may limit the proclivity to 'follow the money'. Again, this can be fostered by encouraging dialog about implementation strategies and problems across projects and among all relevant partners.

Policy Issues

Seed legislation first appeared on Tanzania's statute books in 1921 (The Plant Pests and Diseases Ordinance, Chapter 38 of 1921). This legislation established rules on the introduction of exotic seed and seedlings. Its main focus was on phytosanitary controls for seed imports. (The initial part of this section draws heavily on Rutabanzibwa and Kirenga 2000.)

In 1973, the government began establishing a special institutional framework for national seed production. A Seed Unit and TOSCA were established within the Ministry of Agriculture and Livestock Development with mandates to control the quality of locally produced and imported seed. A national Seed Act was passed creating restrictions on the sale, import, and export of seed without permit. The Act calls for the appointment of inspectors, outlines their general authorities, and establishes a framework for penalizing non-compliance. The Seed Act was marginally revised in 1978, and further (limited) revisions are currently being proposed in order to facilitate seed trade across the East African Community.

During the 1970s, the government received support from the United States Agency for International Development (USAID) to establish its own formal seed sector. Project funding and technical assistance supported the:

- Establishment of foundation seed farms at Arusha, Dabaga (Iringa), Msimba and Kilangali (Morogoro), and Mwele (Tanga)
- Enactment of national seed legislation, ie the Seed Regulation of Standards Act (No. 29 of 1973) and Seed Regulation of 1978
- Formation of the government parastatal Tanseed in 1973
- Establishment of TOSCA and its seed testing laboratories at Morogoro, Njombe (Iringa), and Tengeru (Arusha)
- Establishment of the Seed Unit at the headquarters of the Ministry of Agriculture in Dar es Salaam.

In 1993, the government decided to liberalize the production and sale of all agricultural inputs, including seed. Discussions were initiated to privatize Tanseed and all state-run foundation seed farms. Though decisions are still pending about the privatization of Tanseed, more than 14 private seed companies have been registered to produce and/or sell seed in the country.

Despite the liberalization of national seed markets, few farmers have gained access to seed of improved varieties. In fact, access may have worsened as a result of the decline in operations of Tanseed and the agricultural cooperatives. The new seed companies have concentrated on hybrid maize, sunflower, and various horticultural crops; and even here, seed distribution remains largely limited to urban markets.

Concerns about limited seed availability and low adoption rates have increased interest in alternative seed supply strategies. Tanzania's agricultural policy statement of 1997 recognizes the value of farmer participation in the development and distribution of new agricultural technologies.

The Ministry of Agriculture was again mandated to ensure a continuous flow of new varieties to farmers. However, the specific initiatives for government investment remained to be defined.

When Danida offered assistance in developing a new seed supply strategy in 1999, the government was receptive to exploring public initiatives to improve the distribution of new varieties. By this time several NGOs were also taking an interest in community level seed production. An action plan setting specific targets for seed system development was drafted in late 1999 (ICRISAT 2000).

In 2000, TOSCA announced that it would allow the production and sale of quality declared seed (QDS). In addition, Tanzania has agreed to help promote freer seed trade in the East African Community. Phytosanitary requirements governing seed imports have been reduced, and trial results from neighboring countries may be considered in decisions to release a new variety.

Seed quality standards

TOSCA is responsible for establishing standards for all seed traded in the country, including trade between neighboring households. These standards stipulate minimum rates of seed purity, disease contamination, and germination; maximum allowable moisture content; isolation distances and inspection schedules. The primary aim is to promote the production of certified seed for sale by formally registered seed companies. However, seed that does not meet these standards can be classified as 'common grade seed' at TOSCA's discretion. However, the regulatory agency discourages the production and sale of common grade seed, except in the event of emergencies.

TOSCA recently established a set of standards for quality declared seed in order to encourage community seed production (Table 26). These relax certification standards, recognizing that such inspections are expensive to implement and not economical for many smaller producers. The main changes allowed by the new QDS standards are a more limited sampling of seed fields and harvest lots. Isolation distances have been reduced to more practical levels for small-scale farmers. However, most of the physical standards remain the same for certified and quality declared seed.

All three community seed programs are targeting the production of quality declared seed. However, most of the field personnel remain uncertain about the exact level of standards they are supposed to be pursuing. Many of the key informants thought they were promoting the production of certified seed. Most cannot tell the difference between certified, quality declared, and common grade seed.

Table 26. Sample of regulatory requirements for certified and quality declared sorghum seed, 2001.

	Certified seed	Quality declared seed
Field isolation	200 m	100 m
Moisture content	13% maximum	13% maximum
Germination	70% minimum	70% minimum
Physical purity	98% minimum	98% minimum
Disease incidence	0.1% maximum	0.1% maximum (different for different diseases)
Sampling required		
Field visits	3 visits to each seed field	10% of all fields
Post-harvest sample	Sample from every seed lot	10% of all samples

Source: TOSCA

In practice, the MAFS program is the only one funding the stipulated level of inspections necessary to meet the certified or quality declared seed class. While some extension workers have been trained to offer inspection support to the DCT and ICRISAT schools programs, these arrangements appear ad hoc in formulation and implementation. Correspondingly, these programs appear, in practice, to be producing common grade seed.

One example of the difficulties in ensuring high quality seed production in Dodoma is the response to the high incidence of smut during the 2000 and 2001 harvest seasons. A significant portion of the sorghum seed crop may have been infected at levels above the 0.1% stipulated for quality declared seed production. However, TOSCA still allows this seed to be sold as common grade seed.

Similar questions arise about the enforcement of seed quality standards. According to TOSCA all seed being sold should still be subject to physical inspection. This requires that sample seed lots be submitted to one of three TOSCA laboratories for analysis. The closest laboratory to Dodoma is the TOSCA headquarters in Morogoro. This regulation places a substantial burden on the seed producer, but is currently not being enforced. Most of the seed being sold by at least two of the three programs is not subject to post-harvest inspection.

Registration of growers

TOSCA indicates that seed growers must be registered to allow the possibility of field and harvest inspections. Seed cooperatives or grower's associations may register as a group, but the names of individual members have to be listed. The list must be given to the nearest extension worker trained in seed production and inspection. This extension worker is expected to file reports on isolation distances and field purity for each seed plot. Currently this requirement is not being enforced.

Source seed

Only varieties that have been formally released by the government of Tanzania are allowed to be multiplied for sale in the country. These varieties must be identified on the national variety registration list. Correspondingly, producers of certified seed are expected to purchase fresh foundation seed every year. Quality declared seed can be multiplied from either foundation seed or certified seed. If foundation seed is used, seed growers can replant a second generation to produce a new seed crop. Certified seed must be renewed every year.

Currently, the three seed programs are promoting the use of fresh foundation seed or second generation 'foundation seed' that has been graded as quality declared seed. However, the DCT and ICRISAT schools programs have stated their interest in promoting the use of cheaper, certified seed in the future. As noted above, this will require stricter advance planning of foundation and certified seed requirements.

Packaging

The original Seed Act requires that all seed sold in the country (even sales between neighboring farmers) be packaged and labeled. Debate continues about whether this is necessary for community-based seed programs. Some observers believe that this is necessary to protect the consumer, or assure the consumer of the quality of the seed being purchased. Others argue that this unnecessarily increases the cost of seed.

The limited evidence of the survey suggests that packaging is not necessary for seed sold within the community. Farmers are well aware of the seed production programs and of the likelihood that they can obtain better seed from certain farmers. However, information about the origins of a seed lot may be more important for seed leaving the community.

Costs of regulation

The seed producer is expected to pay the full costs of any field inspections as well as the subsequent inspection of a sample seed lot. In order to reduce the costs of field inspections, TOSCA has encouraged training of district, ward, and village level extension staff in seed quality control. The trained staff are then informally authorized to stand in for TOSCA inspectors. The expectation is that TOSCA will continue to perform random field checks, but it is unclear who will pay for these services. Under the MAFS program, the services are fully paid by the donor-funded project. Correspondingly, TOSCA representatives have been visiting most of the MAFS seed plots. Many of these plots were visited 2 or 3 times. No systematic inspection visits have been made in the DCT and ICRISAT programs.

Summary of issues

The government of Tanzania needs to decide what regulatory boundaries to set for community seed production programs. The establishment of QDS standards is an important step toward supporting community seed production. However, the government, and TOSCA in particular, still does not have the resources to undertake the inspections necessary to achieve the newly published standards. In consequence, most of the seed being produced by community programs, and all the seed being produced under the DCT and ICRISAT programs, must be identified as common grade seed.

Insofar as the primary objective of the three programs is to promote the adoption of new varieties, rather than establish a formal seed market, there is good justification for encouraging the multiplication of cheaper, common grade seed. Minimum standards could be established to protect farmers from gross negligence (eg the sale of diseased or dead seed), but emphasis may best be placed on promoting the multiplication and distribution of larger quantities of seed of acceptable quality. This is the de facto strategy currently being employed in two of the three seed schemes. In this context, efforts to enhance knowledge of seed standards may have a higher payoff than efforts to enforce strict regulatory standards.

The regulations still require seed to be packaged before sale. This is not being enforced and there appear strong grounds for continuing this lenient strategy, particularly for seed sold within the village community. Packaging is not necessarily linked to seed quality. Packaging and labeling is only one means to advertise quality standards which may ultimately not be enforceable. Currently, it is probably better to offer cheaper access to new varieties, than risk reducing the availability of seed by enforcing this standard. Alternatively, TOSCA could agree to selectively enforce the standard, for example, enforcing packaging and labeling only for seed sold in licensed retail shops.

Costs and Returns

Each of the three community seed programs assumes that farmers can make money from producing and selling seed. Farmers were asked in the survey whether they believed they were making any profits. Most of them complained about production costs and marketing difficulties. Nonetheless,

Table 27. Proportion of participants who believe they have earned a profit and are willing to continue the program, 2001 (% of respondents).

	MAFS program (n = 15)	ICRISAT program (n = 23)	DCT program (n = 33)
Believe they earned a profit from seed production	30.8	63.6	90.9
Willing to continue producing seed	93.3	90.9	72.7

Source: Comparative seed study surveys, 2001

most DCT farmers believed they were making money through sales facilitated by the Diocese (Table 27). Almost two-thirds of the school teachers believed they were earning a profit. In contrast, the MAFS farmers generally believed they were not making any money.

Paradoxically, despite their concerns about profitability, the school teachers were enthusiastic about continuing their seed production efforts. The DCT farmers, who likely made the most profits from seed sales because of the high prices and larger market offered by outside buyers, were less interested in continuing. Almost 30% of DCT farmers claimed they would drop out of the program during the next season. While the MAFS farmers were most discouraged by the lack of a market, almost all of them said they would continue producing seed.

The problem with this sort of question is that farmer perceptions of profitability are notoriously inaccurate. Few farmers keep records or account for their non-cash costs. Profits are commonly confused with cash returns.

In order to test these perceptions, it is possible to construct a simple enterprise budget of seed production costs. The major changes in crop management practices being made for seed production are outlined in Table 28. Most of these changes were encouraged by seed program advisors. However, adoption rates were variable. Many farmers shifted to line planting and more accurate spacing, most

Table 28. Common changes in seed crop management claimed by seed producers interviewed, 2001.

	Changes for seed production (compared with grain production)	
Management practice	More common changes (cited by at least 25% of producers)	Less common changes
Choice of field	Isolated field	More fertile field with better drainage
Land preparation		Ox plow
Type of seed used	Foundation seed	2nd generation foundation seed
Planting	Line planting, spacing	
Weeding	Extra weeding	
Fertility management	Manure	Chemical fertilizer
Harvesting		Remove diseased panicles
Drying		Dry on elevated structure
Threshing		Thresh on clean floor
Seed treatment	Insecticide	Fungicide

Source: Comparative seed study surveys, 2001

claimed to select more isolated fields, and many added an extra weeding. But manure application was less common and relatively few farmers used chemical fertilizer.

The management changes being adopted by approximately 25% or more of the sampled households were used to construct an enterprise budget of seed production costs. The calculation outlined in Table 28 takes account of both labor and input costs. This summarizes budget data obtained from DCT, and applied by them when determining what seed prices to offer. This budget considers both cash and non-cash costs, but not the costs of external monitoring and supervision of the seed plots.

The enterprise budget allows the calculation of an approximate breakeven price for seed sales. Various sensitivity analyses can then be conducted to account for changes in the costs of source seed, labor, or insecticide. The initial analysis suggests profits can be made if all seed is sold and prices are more than Tsh 252 kg^{-1} (Table 29). The Tsh 350 price being offered by DCT more than meets this requirement. DCT farmers sold sorghum seed to their neighbors at a median price of Tsh 500 kg^{-1}. However, very little seed was sold through this channel. MAFS farmers and the schools obtained a median local price of Tsh 300 and Tsh 200 kg^{-1} respectively.

Seed that cannot be sold can be valued at the prevailing price of sorghum grain. This was about Tsh 100 kg^{-1} following the 1999/00 drought and as low as Tsh 50 for larger transactions in villages less affected by drought.

If only two-thirds of the seed was sold to external buyers, with the remainder valued at Tsh 100 kg^{-1}, the breakeven price would have to increase to Tsh 328. If half the seed was sold to external buyers, the breakeven price would increase to Tsh 404 kg^{-1}.

Table 29. Estimated costs (Tsh/acre) of sorghum seed production, 2001.

Management practice	Item	Units of cost	Estimated additional cost (Tsh)
Choice of field	Isolated field (travel time)	1 person-day × Tsh 700	700
Land preparation	Ox plow	Plow services	7,000
Type of seed used	Foundation seed	3 kg × Tsh 5000	15,000
	Transport	3 kg × Tsh 300	900
Planting	Line planting, spacing		5,000
Weeding	Two weedings	Tsh 7000 each	14,000
Crop purity	Rogueing	½ person-day × Tsh 700	350
Fertility management	Manure	Transporting and spreading	17,000
Bird control	Hire bird scarers	21 days	15,000
Harvesting	Harvest and transport		4,000
Threshing	Threshing and winnowing		5,000
Certification	Post-harvest check	Tsh 2 per kg	800
Seed treatment	Actelic insecticide	1 kg	5,000
	Agrosan fungicide	100 g	9,000
Bagging	90 kg grain bags	4 bags × Tsh 500	2,000
Total			**100,750**
Expected yield	400 kg/acre (1 t ha^{-1})		
Cost of seed produced	Tsh 251.88 kg^{-1}		
Breakeven price for seed	Tsh 252 kg^{-1}		

Source: DCT

This analysis suggests that most seed producers were not making a profit. However, few used all the inputs suggested by the DCT enterprise budget for sorghum. The actual costs of hiring plowing, weeding, and bird scaring services may be less than the proposed opportunity costs of household labor. Nonetheless, this budget highlights the significance of the costs of source seed and seed chemicals in the overall analysis. These constitute the main additional costs associated with seed production, as opposed to grain production. If these can be minimized, seed production is likely to be profitable.

Summary of issues

The sustainability of the three projects depends on identifying breakeven seed prices acceptable to both buyer and seller. During the early period of seed production for a new variety, buyers may have little choice but to pay a premium price in order to gain access to the variety. However, once such access is gained, buyers are substantially less likely to pay a premium price. Consumers then face a choice – to purchase high quality grain for use as seed, or to purchase pure seed from a designated seed producer. If the seed is too expensive, grain will be purchased.

Correspondingly, each seed project needs to find ways to lower seed costs, especially for seed destined for sale in the local community. Farmers may be encouraged to use foundation seed when first producing a new variety for their own community. Thereafter, they may be encouraged simply to maintain higher standards of seed production and selection from their own fields.

Higher, and more expensive, standards may be sought for seed to be 'exported' to more distant communities. This may include the use of foundation or certified seed. The larger distance between buyer and seller may also justify the quality assurance inherent in seed inspections, treatment, and specialized packaging.

Relative Advantages of the Pilot Programs

Various criteria are available for assessing the relative success of these three seed programs. Several indicators are reviewed below. However, the reader should account for the fact that two of the three programs were in the middle of their second year at the time of the survey, and are still refining their approaches.

Levels of seed production and sales

One main criterion for success is the program's capacity to produce and sell seed. All three programs successfully supported seed production activities (Table 30). The DCT program produced the largest quantities. However, the relative strength of the three programs cannot be judged solely on this basis. The MAFS program was at an early stage, and did not attempt to produce large quantities. The schools program was only in its second year.

Table 30. Quantity of seed (tons) produced in 2000.

	MAFS program (n = 15)	ICRISAT program (n = 23)	DCT program (n = 33)
Sorghum	5.9	22.9	0.0
Pearl millet	1.2	17.8	0.0
Maize	2.2	0.0	0.0

The DCT program was also the most successful in selling its seed, largely because another external agency was willing to purchase this seed. In both 1999 and 2000, FAO purchased most of the seed produced by DCT farmers. This has encouraged the DCT farmers to continue to participate. However, when FAO stops purchasing this seed, the program appears likely to collapse. Thus, this sales strategy also appears to be the least sustainable.

The schools program was relatively more successful in selling seed within the village community, probably because parents of the school children were encouraged to buy. Seed purchases can be promoted and justified as a means to support the primary school. This success may also have resulted from the fact that most farmers in the areas around the schools, particularly in Singida, had not previously had access to improved sorghum or pearl millet seed. These purchases also may not prove sustainable, unless the varieties change.

The sales results of the MAFS program were most disappointing. This appears to have resulted, in part, from confusion about seed pricing strategies. Some of the participating farmers also questioned the choice of crops to be multiplied.

Profitability and continuity

Farmer perceptions of the profitability of seed production are notoriously inaccurate. Few farmers keep records or account for their non-cash costs. Profits are commonly confused with cash returns. However, most farmers in the three programs believed they were making a profit (Table 27). The analysis in the previous section of this paper confirms that profits are likely if sorghum seed can be sold at least double the farmgate price of grain. However, the actual breakeven level depends on the proportion of seed sold.

A closer look at price and sales levels indicates that DCT farmers likely made the best profits. However, they depended on external buyers purchasing seed for drought relief programs, so the DCT program may also be the least sustainable.

Variety adoption

The programs all seek primarily to promote the adoption of new varieties, but no program directly incorporates a means to measure variety adoption rates. Each program seems to assume that once variety adoption rates increase to a self-sustaining level, seed growers will request a change in variety. The MAFS program explicitly allows for this decision. The mechanism for this change in the ICRISAT and DCT programs is less clear.

ICRISAT did, however, run a national adoption survey in collaboration with the Ministry of Agriculture and Food Security in 2001. This evaluated national adoption rates for sorghum and pearl millet varieties. Since the survey was broadly targeted, the sample was too small to allow any inferences to be drawn on the success of the schools program. But the results do allow inferences about the impacts of the broader national seed delivery made possible through the DCT program.

Early results suggest that distribution of seed purchased from DCT farmers has sharply increased adoption rates for new sorghum and pearl millet varieties in many parts of the country. This is because large quantities of seed were produced and widely distributed. By inference, larger scale production and distribution offers a quick and relatively efficient way to accelerate variety adoption. This may be the largest single impact of the seed programs to date.

Sustainability

Since two of the three programs are at early stages of implementation, it is too early to draw conclusions about their relative sustainability. However, a few inferences can be drawn from the observations to date.

The DCT program has probably had the largest impact to date, but may be the least sustainable in the medium term due to its heavy dependence on external support for both foundation seed delivery and seed purchase. In effect, the program promotes the production of a cash crop. As long as DCT continues to support the market, the program will persist. When DCT truly withdraws, or outside buyers are no longer available, this program appears the most likely to collapse.

If sustainability is measured in terms of improved farmer awareness about how to produce and market a seed crop, the advantages of the DCT program are inherent in the multiple years of experience. These farmers recognize the value of foundation seed, and have some understanding of seed markets. This may serve them well when trying to grow alternative cash crops in the future.

The sustainability of the ICRISAT schools program is most difficult to judge. Seed production will have to compete with alternative food production and income generation activities of the school farms. Almost 40% of the schools complained they were not making a profit. Many were particularly concerned about the high costs of foundation seed. Nonetheless, the marketing of seed through school children was relatively successful.

The sustainability of the MAFS program is also difficult to judge. This program is the least dependent on the development of marketing systems for large quantities of seed. It builds on the known capacity of a few better-than-average farmers to serve as seed sources within any given community. These farmers are expected to serve as a conduit for the introduction and dissemination of new varieties. The program primarily aims simply to expand the capacity of these farmers, who would normally serve as sources of community seed security.

However, the impact of this program may be jeopardized by the degree of external interference in the strategies used for multiplying and distributing new varieties. To start with, seed producers may select different crops or varieties for multiplication, compared with outside agencies or village governments. Higher investments in seed production conflict with the traditional practice of pricing seed only marginally higher than grain. Questions remain about the willingness of neighboring farmers to pay extra for seed treatment and packaging. Concerns also remain about external interference in the seed market. The prohibition on seed sales outside the community may help promote new varieties within the community, but discourages seed producers. In some cases, external pressure to set higher seed prices in order to meet production costs increased the cost of seed above what neighboring farmers were willing to pay.

The MAFS program carries the heaviest investment in the training and supervision of seed producers. Correspondingly, this program may have the most significant longer term impact on seed supply in these communities. However, the impact of these investments could be greater if the village seed market is allowed to reach its own level of equilibrium – if seed producers can decide on their own what levels of quality are appropriate, and how best to competitively sell their seed.

Lessons for Community Seed Production Projects

A major objective of this study was to identify how the three seed projects can be further improved, and to draw lessons for the planning of future community seed projects. Each of the three projects offers distinct advantages. Yet they also face similar problems. Diagnosing these problems at an early

stage of implementation can increase the payoffs from investments, and improve the likelihood that such community seed projects will be sustainable.

Seed marketing

The most serious issue in all three programs, and in similar programs elsewhere in southern Africa, is seed marketing. Each program assumes there will always be strong demand for quality seed in the village market. Each expects participating farmers to sell most of their seed to nearby farmers. Unfortunately, many of the participants in each program have remained with significant stocks of unsold seed.

Tanzania's farmers are undoubtedly interested in obtaining new varieties. However, once this access is gained, the market quickly diminishes. Small numbers of farmers may be forced to look for seed each year because of drought or poverty. But these poorer households are likely to be the least inclined to purchase high quality seed at premium prices. Given the choice, they are more likely to obtain grain from neighbors for use as seed.

Two marketing options are apparent. The DCT option has been to promote the production of seed as a cash crop for sale outside the community. This works well so long as there is an outside buyer. During the past few years, FAO has supported large purchases for redistribution to drought-affected parts of the country. But such programs are unlikely to continue. The 2000/01 rainy season was relatively favorable, increasing the likelihood that there will be no market for most of the DCT seed. This could seriously undermine the interest of participating farmers in continuing to produce a seed crop, and threaten the reputation of the DCT itself.

Promotion of seed production as a cash crop requires a deliberate marketing plan. Production for the relief seed market is a risky proposition. This market can be highly lucrative if droughts continue, but will disappear if there is no drought (or related emergency). One way to ensure greater consistency in this market is to maintain seed security stocks. Though grain security stocks are common, governments and donors have been reluctant to pursue similar investments in seed security.

Another alternative is to produce a commercial seed crop on contract for seed companies. This is being attempted in Zimbabwe, though the financial viability of this strategy has yet to be proven. One problem is that most commercial companies have no interest in marketing seed for crops such as sorghum and pearl millet.

A third alternative is to invest in developing commercial retail seed trade. This would require the establishment of links with retailers already selling agricultural inputs. But given the uncertainty about retail seed demand, pilot programs would need to be developed to test this market.

The second generic strategy is to produce small quantities of seed of a shifting array of new varieties – the essence of the MAFS effort. But the program still seems to be gaining experience on how best to evaluate local interest in alternative varieties. Clearly this needs to be monitored closely. In addition, the program should assume that these varieties will need to be changed at fairly frequent intervals, perhaps every 2 years.

In order to be successful, seed costs must be kept as low as possible. Farmers may pay a premium for specialty seed, but will generally purchase the cheapest available seed if choices are available. If farmers are accustomed to obtaining seed free from their neighbors, or at prices approximating the grain price, it is unlikely they will start paying two to three times the grain price for a neighbor's 'quality' seed. It may be more practical to enhance the local market for cheaper common grade seed, than to develop a new market for certified or quality declared seed. At a minimum, the price elasticity of demand for seed of varying quality needs to be investigated.

Questions remain about the willingness of farmers to pay extra for seed that has been specially treated and packaged. There is good justification for encouraging seed treatment if there is high risk of losses from insects or diseases. But treatments may be unnecessary if the objective is to provide low-cost seed to farmers. Packaging has been promoted as a means to assure buyers of the quality of the seed being sold. However, there is no evidence that this is an issue on the local village market. Seed is more likely to be judged by sight, and by the reputation of the grower, than by the packaging. Again, neighbors may prefer not to pay the additional costs of packaging.

Quality control

A second main objective of these three programs was to improve the quality of seed being produced and distributed in smallholder farming areas. All three programs have partially succeeded in this objective. Participating farmers generally understand the difference between grain and seed, and recognize that seed quality can improve with better management. Yet seed quality is still primarily viewed in terms of the physical size and purity of the grain, rather than the genetic purity.

Despite extensive training, most of the seed producers interviewed still fail to understand isolation distances. This is particularly surprising since field isolations were discussed in detail in training sessions. One is left with the lingering impression that the seed producers simply do not believe in the necessity of isolation. They may perceive that they have adequately maintained their own seed stocks without this, so the advice need not be followed.

Changes in crop management practices are often made with the expectation of achieving a premium price for seed. Without such a premium, the justification for purchasing higher quality source seed, or farming isolated fields, or applying manure, or drying the seed crop off the ground, is lost. In effect, the strength of the seed market will determine the optimal level of investment in improved management practices and in seed treatment.

Questions remain about the willingness of most neighboring farmers to pay a premium price for this seed. At best, it seems, local farmers may pay a premium for new varieties. It is much less likely that any significant number will pay a premium price for 'higher quality' seed. Farmers are more likely to pay a little extra for common grade seed, than a premium price for quality declared or certified seed, especially if this seed comes from their neighbors.

While these results merit further testing in the village market, the implication is that different markets need different quality standards. If seed is destined for the formal market, stricter standards may be justified. If it is destined for the village market, most buyers would prefer to purchase cheaper common grade seed.

Common grade seed can be sold in Tanzania at the discretion of TOSCA. This flexibility has served the country well. It has allowed DCT to provide substantial quantities of good quality seed for drought relief programs. Given this strategy, it may be useful to identify a minimum standard for this type of seed to clarify the distinction between seed and grain. This standard should aim to facilitate the production and distribution of cheaper seed. Implementation should correspondingly require a minimum level of inspection. Emphasis may be placed on training farmers and extension workers about the difference between seed and grain, as opposed to the enforcement of strict standards.

This implies that training in seed quality control would entail something more than a single course during the first year of a program. Investments may be needed in a series of training modules that can be used by a wider range of personnel. Initial courses might target the training of trainers. Thereafter, refresher modules could be implemented. Such training would need to be an ongoing program, integrated into the normal activities of extension staff. And the impacts of the training may need to be monitored.

Partnerships

The issue of partnerships is complicated simply because there are so many different organizations involved with program implementation. This has created some confusion among regional and district staff based in areas where more than one project operates. This can be most readily seen in the case of the ICRISAT schools project, which has worked substantially better in Singida (where there are no competing seed projects) than in Dodoma. Nonetheless, it is useful to test multiple strategies for community seed production. Evaluating these programs in the same environment provides more information about the advantages and disadvantages of alternative strategies.

Two main lessons seem to arise. First, where multiple programs are operating, it may be helpful to promote greater transparency in planning. The projects could benefit from sharing their annual workplans. In an annual pre-planting meeting, each program could summarize its plans and the expectations of field staff. The roles and responsibilities of these staff can then be explicitly reviewed.

Second, in order for these projects to be sustainable, each needs to clarify what inter-institutional linkages need to be maintained (or developed) for longer term implementation. The MAFS project appears to have the most considered strategy for sustainability through district and village extension staff. In effect, the program expects that supervision of seed production will remain the responsibility of these staff. In comparison, the ICRISAT and DCT projects are simply pilot projects. DCT has no plans for longer term support for its community seed production initiatives. The ICRISAT program has yet to formulate a longer term implementation plan.

One complicating factor is that national financial constraints have encouraged government personnel to respond to each new source of operational payments. If per diems and fuel are provided, the staff will support the program. If not, the program cannot be implemented. Government staff may shift their focus to alternative, specially funded programs. Project planners will need to consider what implementation strategies are most sustainable by field staff with extremely limited resources.

Source seed

There seems to be a common view that the foundation seed being purchased from Msimba Seed Farm is too expensive for these programs. It may be more practical to promote the use of cheaper certified seed – but little of this available. The availability of certified seed needs to be improved.

This study did not examine the operations of the Msimba Seed Farm. On the basis of the limited information available from key informant interviews, it appears likely that Msimba's profitability depends heavily on foundation seed purchases by the three projects. As long as the projects plan their seed requirements ahead of time, inform Msimba of their needs, and promote purchases from the farm, all should work smoothly. But when the projects no longer support foundation seed purchases, viability of the farm may be threatened. One solution is for Msimba to play a more active role in evaluating demand for alternative seed crops and advertising variety options. This would be normal practice if Msimba were a commercial company. If Msimba is to become sustainable, such commercial strategies may need to be adopted.

There may also be good justification for maintaining a partial subsidy on the production and distribution of foundation or certified seed. If the value of the productivity gain derived from adopting new varieties is higher than the cost of the subsidy, the investment will pay off favorably. Similarly, if productivity gains are available, substantial economic gains will accrue from achieving the gains earlier – higher average yields this year, rather than 5 years from now. This sort of investment analysis argues for a subsidy to accelerate the distribution of new varieties. The costs of this investment can be

limited, if the subsidy is initially targeted to support the distribution of starter certified or foundation seed to community seed programs.

Finally, channels for the sustainable distribution of 'starter seed' need to be clarified. The three projects currently use their own resources to distribute this seed. When the projects end, these resources will disappear. Will the regional and district authorities continue to play a role in advertising and selling foundation seed? If so, this strategy needs to be clarified and tested.

Policy

A number of policy issues have been highlighted by this study. First, there is a need to clarify what seed quality standards are practical in the context of community seed production. Most projects are unlikely to meet the requirements of quality declared seed. Tanzania does not have the inspection capability to enforce such standards, even if extension workers are trained to backstop TOSCA's efforts. Further, it is unlikely that most small-scale farmers will pay extra for the QDS standard.

The three projects are all helping to increase access to and adoption of new varieties. However, seed production and distribution are higher in the two schemes where quality control is more lax. Some degree of regulatory control is necessary, but the appropriate level of control must be judged in relation to the objective of increasing adoption rates quickly.

The study notes an ambiguity in the role of MAFS's Seed Unit in supervising these sorts of programs. Currently, the Seed Unit is the primary implementing authority for the MAFS program. The ICRISAT project is run with the knowledge and support of the government, but the Seed Unit is not involved in monitoring or supervision. The DCT program can best be characterized as an independent NGO initiative. The Seed Unit is aware of this program, but again plays no role in supervision or management. This implies that the only officially sanctioned community seed program in the country is the Danida-supported MAFS On-Farm Seed Production Program.

Each of the three community seed programs has lessons to offer for the development of the national seed sector. One possible role for the Seed Unit would be to monitor such initiatives and more continuously seek to draw lessons about which seed strategies work, and which do not. These lessons can then be used by public and private investors interested in further developing the national seed sector. For example, all three projects offer information about the acceptability of new varieties and strength of seed demand. This information should be of interest to the private sector. It can also be used in planning drought relief programs which include a component of seed distribution. Information about what components of these programs seem to work can help guide investments by government and NGOs in similar initiatives elsewhere in the country.

Another policy issue raised by this study is the relationship between public and private sector initiatives. Public subsidies on community level seed multiplication and distribution threaten the viability of related private investments. Yet Tanzania has a policy of promoting development of the private seed sector. The two objectives of public subsidy and private investment can be complementary, but only with clear, explicit strategies. For example, community seed projects can be encouraged to produce seed on contract for private seed companies; or publicly supported seed projects might focus on areas where the private sector is not selling seed on the retail market. Similarly, community seed projects might aim to test the demand for new varieties, with the information about market opportunities then passed to the private sector. Such efforts will require larger investments in collaboration and information sharing.

Finally, policy makers need to consider that none of the three programs is likely to continue on its own without external technical support and funding. These sorts of programs will not be self-

sustaining. Ongoing public investment, either government or donor funded, will be required to ensure access to foundation seed, support training and monitoring programs, and even to facilitate distribution of the seed being produced. Nonetheless, there may be huge payoffs to continuing such public investments. An increase of as little as 10-15% in the adoption rates for new, more productive varieties, can increase aggregate national income by millions of dollars. Investments targeting more rapid seed distribution are likely to be well justified. They simply need to be well planned, and made as efficient as possible.

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About ICRISAT

The semi-arid tropics (SAT) encompasses parts of 48 developing countries including most of India, parts of southeast Asia, a swathe across sub-Saharan Africa, much of southern and eastern Africa, and parts of Latin America. Many of these countries are among the poorest in the world. Approximately one-sixth of the world's population lives in the SAT, which is typified by unpredictable weather, limited and erratic rainfall, and nutrient-poor soils.

ICRISAT's mandate crops are sorghum, pearl millet, finger millet, chickpea, pigeonpea, and groundnut; these six crops are vital to life for the ever-increasing populations of the semi-arid tropics. ICRISAT's mission is to conduct research which can lead to enhanced sustainable production of these crops and to improved management of the limited natural resources of the SAT. ICRISAT communicates information on technologies as they are developed through workshops, networks, training, library services, and publishing.

ICRISAT was established in 1972. It is one of 16 nonprofit, research and training centers funded through the Consultative Group on International Agricultural Research (CGIAR). The CGIAR is an informal association of approximately 50 public and private sector donors; it is co-sponsored by the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), and the World Bank.