Canadian Foodgrains Bank
A Christian Response to Hunger

SUSTAINABLE SEED SYSTEMS

Best Practices in Seed Distribution, Seed Production and Seed Saving in Food Security Programs

AGRICULTURE & LIVELIHOODS TECHNICAL NOTE

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Background

Production and distribution of high-quality seed can increase yields, incomes, nutrition, and resilience of smallholder farmers. Non-governmental organizations (NGOs) often work to improve the availability of, and access to, good quality seed by farmers. Most seed aid or relief interventions address seed availability through direct seed distribution, cash, or vouchers to procure seed. Longer-term, community-based seed initiatives commonly take the form of community seed production schemes or community-based seed banks. Despite large investments in seed programs, the outcomes of these interventions have often been mixed, and their greatest challenge has been a lack of sustainability. The goal of this technical note is to help partners improve their design and implementation of seed system interventions.

KEY TERMS USED IN SEED SYSTEMS

Self-pollinated/cross-pollinated crops: Self-pollinated crop species; including beans, rice, wheat, and tomatoes; can produce seed without receiving pollen from another plant, and therefore reproduce "true to type" through many generations. Cross-pollinated crops, like maize and sunflowers, mostly reproduce using pollen from other plants, transported by wind or insects. Unless they are grown in isolation (either physically or by planting at a different time) they will not breed true from generation to generation. Other crops; like melons, pumpkins, cotton and pigeon peas; reproduce through both self- and cross-pollination. How a crop is pollinated determines how much it needs to be isolated to produce pure seed.

Open pollinated varieties (OPVs) are varieties which produce seed that is genetically similar to the parent. If the crop is cross-pollinated, the OPV will need to be isolated to produce pure seed.

Hybrid seed is created by cross-pollinating different lines for seed production. Hybrids generally produce plants with greater vigour and uniformity. When grain from hybrid seed is replanted for a second generation, the offspring are not true copies of the original hybrid, so farmers must buy new seed each season. Maize is the most widely utilized hybrid seed.

Certified Seed is inspected and tested by a government agency for genetic purity, germination, and freedom from disease and weed seed. Only varieties registered by a government agency can be certified.

Quality declared seed (QDS) is produced and sold by farmers or community-based organizations who are not registered seed dealers. Both modern varieties and landraces (traditional varieties) can be included. Government authorities identify which varieties are eligible and must inspect at least 10% of QDS fields.

Seed systems

Smallholder farmers utilize multiple sources to produce and obtain the seed they need, including both *formal* and *informal* seed systems. Understanding how these systems work is important in improving seed availability and accessibility by small-scale farmers.

Formal seed systems: The formal seed system is managed by public agencies and private companies. Seed regulations guide the production of certified seed. Public seed farms typically produce a broader range of certified seed. In contrast, because the private sector is profit-oriented, it focuses mainly on hybrid seed, which needs to be replenished each season, and which are more profitable than open-pollinated crops. The formal system distinguishes between grain (used for food) and seed (used for planting). The high price of certified seed, its limited availability, and lack of a diverse range of preferred crops and varieties contribute to its limited use by smallholder farmers. In sub Saharan Africa, the World Bank estimates only 5-10% of farmers purchase seed from the formal sector.

Informal seed systems: The informal seed system is also known as the traditional/local seed system and is managed by farmers and traders. This system is the main source of seed for most crops in developing countries. The seed is obtained through farmer production, seed exchange, barter, and normal grain markets. Seed produced includes local varieties, and modern varieties. Farmer seed is generally selected at harvest or from grain stocks. The seed supplied is cheaper and is useful in maintaining diversity in crops. There is often no clear difference between food grain stocks and seed used for planting. The seed is often of variable quality and shortages can be experienced as a result of disasters or low productivity.

Seed system security assessments

The need for seed-related interventions should be guided by a seed assessment to enable appropriate responses that address the specific constraints affecting specific crops. Seed System Security Assessments (SSSAs) examine how seed systems function, uncover which systems farmers use, and identify the main challenges and opportunities related to seed. An SSSA should guide the initiatives which projects take to improve seed systems. Assessments can be done within one to two weeks and look at;

Availability - is there sufficient quantity of seed of appropriate crops within reasonable proximity and in time for planting?

Access - do people have adequate income or other resources to acquire seed through purchase or barter?

Quality - are available seeds able to establish a good crop under normal growing conditions?

Varietal suitability - to what extent are available varieties adapted to local farming conditions and practices as well as consumer acceptability?

For further information on seed system security assessments go to seedsystem.org.

Best practices for seed distribution in emergency/ early recovery situations

An SSSA will identify the main seed systems challenges and opportunities in time of crisis. If seed is available, but farmers can't *access* it, due to their lack of cash, market-based approaches should be used. Cash or vouchers resolve the lack of access by enabling farmers to buy seed locally. This supports local merchants and gives farmers greater choice over what seed they obtain, including selecting varieties they know are well-adapted. More details into how voucher systems work and best practices are available in: Guidelines for Input Trade Fairs and Voucher Schemes and the Agricultural Fair and Voucher Manual.

If the main challenge identified by the SSSA is a lack of seed *availability*, direct seed distribution can be pursued and the following should be considered:

Timing - Right timing of seed inputs is important. In many developing countries, where farmers rely primarily on rainfed agriculture, once the rainy season is over it is no longer possible to grow another crop. Since there are many stages in seed procurement and delivery, projects need to plan ahead. A seed package is only useful if it arrives in time for planting.

Targeting - Not all project participants will benefit from seed. Remember that the most vulnerable might not have access to sufficient land or labour. The targeting criteria for seed should be discussed and communicated in the communities in order to avoid misinformation and potential jealousy amongst participants.

Crops and seed types - Seeds distributed should be appropriate to the agroecology and preference of farmers. A seed crisis is not the time to introduce new crops or varieties. Late-maturing crops, and those which require additional inputs, will also hamper an early recovery process.

Seed quantity - In most relief projects, the seed provided is meant to plant only a small area (e.g. 1000 m^2 for maize, sorghum, or millet which will require two to five kg of seed). For sweet potato or cassava cuttings, one or two bundles are usually provided which is enough to plant 100 – 200 m^2. The amount of seed provided for vegetables depends on the type and the available package size for the particular vegetable.

Best practices in seed distribution during longer-term programming

Seed provision is often a component of long-term food security programming. However, unlike in emergency situations, the main objectives of seed distribution in food security programming *should* be to introduce new crops or to improve the genetics of existing crops. Seed distribution in food security programming should also be guided by an SSSA. This assessment will help identify which crop species and/or varieties have the most potential for benefit in the community. It will also guide the distribution strategy used by the project. As with emergency programming, if the SSSA determines that seed is available, but farmers have difficulty accessing it, voucher systems, working with local merchants, are preferable to direct distribution by the project.

Cover crops, like this jack bean planted under maize, have spread widely over the past 7 years, due in part to seed distribution by Foodgrains Bank-funded projects

Selection of variety/crops to be distributed - A good fit to environmental conditions, farmer needs, and consumer preference is critical to successful seed distribution. Do not assume that a "modern" variety recommended by a research or extension program is better than what farmers are already growing until it is proven in the local context. When new varieties or crops are being introduced, farmers should receive sufficient information about them and only enough seed to test in small plots alongside a control plot with the farmer's regular variety. Results of these comparisons should be compiled and analysed before promoting a new variety more widely. Whenever possible, farmers should have a choice in which varieties or crops to experiment with.

Quality control - It is important for projects to ensure good seed quality, as poor-quality seed can lead to a crop failure, and cause more harm than good. When certified seed is distributed, it must be from reputable suppliers, clearly labelled and properly handled until it reaches the farmer. It is always important to test the seed for germination before distribution. A simple, but accurate germination test and standards for germination are described in Appendices A and B.

Seed distribution can be used to successfully distribute new crops or varieties. For example, Foodgrains Bank started promoting the use of green manure cover crops in 2014, and these crops are now used by over 20,000 farmers in Foodgrains Bank-supported programming in sub-Saharan Africa.

Pass-on seed schemes – In these schemes, where a farmer is required to return seed to the project after growing it for a season, the hassles often outweigh the benefits. Monitoring the genetic purity and quality of the seed returned by farmers is difficult, and the logistics of collecting, processing, storing, and redistributing seed create a huge burden for the NGO involved. Projects should instead encourage farmers to share seeds with neighbours not involved in the project without the NGO being involved in the logistics.

The use of seed as an incentive for participating in programs - The practice of incentivizing project participation with seed distribution can confuse farmers and create a false impression that they are interested in training and other activities when their real motivation is free seed. This practice is not recommended in food security programming, and projects which choose to use it should only do so in the initial year of a farmer's participation. They should also make it abundantly clear that farmers will be expected to save their own seed for subsequent seasons. Repetitive seed distribution should always be avoided.

Community seed production

Community seed production involves organization of farmers to produce or supply seed at the local level. These schemes can improve the quality of local seed, introduce new varieties, and generate income. Farmers may produce seed for their own use or for sale to other farmers. The nature and form of the seed production scheme may vary, but building the capacity of farmers in seed production and quality maintenance is a key to their success.

Many community-based seed production projects succeed in improving local seed availability or in helping diffuse new crop varieties, however their greatest challenge has been sustainability. Starting with a business orientation will go a long way towards improving their viability and sustainability.

One example of an effective seed production strategy was implemented by the *Office de Development des Eglises Evangéliques* (ODE), an MCC/Foodgrains Bank partner in Burkina Faso. ODE trained 20 individual farmers in seed production, provided start-up inputs, and connected them to the national seed service for inspection and certification. In 2017, these farmers produced 34.7 tons of quality declared (QDS) maize, sorghum, cowpea, and rice seed.

They should be run as profit-making businesses, beginning with a thorough market assessment. Furthermore, in order to minimize the potential for crop failure, production sites should be located on irrigated land or in areas with consistent rainfall. More details and case studies on challenges and success of community-based seed production can be found in the publication Community Seed Production.

Some key strategies for viable and sustainable community-based seed production are:

Assessing seed needs and demand - Understanding the local context can help ensure that production will align with farmers' needs and demands and provides the basis on which production operations should be planned. If farmers primarily source seed from their own stocks and from each other, this should be taken into consideration in determining seed production targets. Initiating seed production without enough information creates a risk of producing seed that does not meet the demand criteria of farmers.

Profitability and economics of production - For sustainability, seed production should be profitable for the producers, but the seed prices should not deter communities from buying it. Subsidies may be appropriate for initial investments in production facilities, but these should be targeted and of short duration. Community seed production schemes that diversify and have other sources of income can usually afford to keep seed prices low until farmers fully appreciate the benefits of purchased seed.

Quality control - Seed production should follow all procedures and standards for the type of seed produced. Since it is very difficult to monitor the purity of bulked seed grown by a large number of farmers, it is advisable to work with small groups of farmers who can be more easily monitored for production quality. Clustering fields for seed production in consultation with communities can help assure adequate isolation distances and seed purity. Facilitating access to finance for appropriate storage facilities may be important in maintaining seed quality.

Marketing support - Strengthening the marketing and business skills of farmers involved in seed production is as important as agronomic training. Many seed production schemes succeed in producing seed but fail to sell the seed because they have no clear marketing strategy. Market promotion can be achieved through demonstrations, participation in fairs, and agricultural shows. Linkages with the private sector are also helpful in marketing of seed as they may provide a consistent market as well as inputs and equipment which can further enhance incomes of seed producers.

Community seed banks

Community seed banks store and supply seed to local farmers. They help ensure timely supply of seed since they are usually located within the communities where the seed will be used. They can also help maintain crop diversity by making both local and modern varieties available to farmers. Seed banks can store seed of individual farmers separately or bulk seed for collective storage. Despite these advantages, community seed banks often collapse once project resources are discontinued due to a number of challenges:

Financial viability - Economic sustainability should be embedded in community seed banks from the design stage. Community seed banks must be able to cover their operational costs including the labour of members involved in receiving, documenting, handling, and distributing seed. In addition to storing farmer-produced seed, many community seed banks that have been successful also produce and sell seeds to non-members to generate income for the organization. Some have revolving funds to meet financial obligations, as well as other income-generating activities to diversify their income.

Quality issues - Seed banks face many of the same quality issues as community seed production, particularly the tendency of farmers to keep the best seed for themselves, and to give seed of lesser quality to the seed bank. Training farmers in improved storage methods can help, but maintaining quality with bulked farmers' seed is inherently problematic.

To address the quality control issue, farmer groups supported by the Evangelical Fellowship of Sierra Leone, a Tearfund Canada/Foodgrains Bank partner, store seed in a common storage, but keep seed from each farmer in a separate container. Seed quality for individual households is easier to maintain with this approach.

An alternative to bulking is to store individual farmer's seed separately within a community storage facility.

Because of these challenges, many NGOs have concluded that improving seed storage in individual homes is more effective than community seed banks.

More information and guidelines on how communities can establish and run community seed banks can be found in Community seed banks: Concept and practice.

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Appendix A: Simple Germination Tests

RAGDOLL TEST

International standards require that, for each seed lot, 4 samples of 100 seeds each should be tested. If the number of vendors and seed types are relatively small, this guideline should be followed. If the voucher scheme has many vendors, or many different species of seed which are being distributed, this standard may need to be reduced.

1. Prepare pieces of clean cotton cloth 30 cm x 60 cm in size.
2. Moisten cloth, then squeeze out excess water.
3. Place 100 seeds in a 10 by 10 pattern on half of the cloth.
4. Roll up the cloth and place in a plastic bag marked with a waterproof marker. If multiple samples are tested of the same seed lot, they may be placed in the same plastic bag.
5. Store in a warm (20-25°C) location.
6. Check every 2 days for germination and moisture content. Cloth should remain moist, but any excess water should be drained off.
7. When germination is complete (4-6 days for maize and beans depending on temperature, longer for some vegetable species) count the number of germinated seeds.

Appendix B: Seed Quality Standards

SEED QUALITY STANDARDS FOR EMERGENCY ACTIVITIES

Based on FAO Quality Declared Seed (QDS)

Cereals	Varietal purity[1] (min. %)	Analytical purity[2] (min. %)	Germination[3] (min. %)	Moisture content[4] (max. %)
Maize	98	98	80	13
Pearl millet	98	98	70	13
Rice	98	98	75	13
Sorghum	98	98	70	13
Wheat	98	98	80	13
Food legumes				
Beans	98	98	70	10
Broad beans	98	98	70	10
Chickpeas	98	98	75	10
Cowpeas	98	98	75	10
Dry peas	98	98	75	10
Groundnuts	98	98	70	10
Lentils	98	98	70	10
Mung beans	98	98	75	10
Soybeans	98	98	70	10
Oil crops				
Sesame	98	98	70	10
Sunflower	98	98	70	10
Industrial crops				
Cotton	98	98	70	10
Castor bean	98	98	70	10

In determining seed quality, the working seed sample is separated into three fractions - pure seed, seed of other crops (includes weed seed) and inert matter. In the QDS specifications, seed of other crops, weed seed and inert matter should be at an acceptable maximum level.

[1] **Varietal purity**: the percentage of the pure seed that will produce plants that exhibit the characteristics of that specific crop variety. This can only be determined through DNA fingerprinting and/or field inspection of seed crop plots.

[2] **Analytical purity**: the percentage of the seed that is of the same crop species but not necessarily the same crop variety. The balance can include inert matter, weed seed, damaged seed. While regular seed testing procedures may not in all cases distinguish between different varieties of the same species, the seeds of different crop (species) can be identified in the seed laboratory by close examination of the seed.

[3] **Germination**: the percentage of the seed with the ability to germinate and that can develop into plants under appropriate field conditions of optimum moisture, aeration and temperature.

[4] **Maximum moisture content**: recommended for safe storage and good germination. Values may vary to crop types (starchy vs. oil/high protein content seeds) and according to local conditions, in particular with environmental relative humidity and temperature. Local standards should be applied.

Source: Seeds in Emergencies

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