

Sustainable Seed Supply

Seeds are one of the most crucial elements in agriculture as they contribute substantially to crop productivity and food security. A sustainable seed system ensures that high quality seeds of a wide range of crops and varieties are produced, available and affordable for farmers (FAO, 2014).

In Afghanistan severe challenges exist with regard to seed supply, and farmers face difficulties to have “timely access to quality seeds” for the most commonly cultivated crops. For instance, the primary problem in wheat production is seed quality and the lack of improved varieties. Various organisations such as the FAO, MAIL¹ and CIMMYT² are working on access to quality wheat seed. The challenges for potato are the same, although establishing a virus-free potato seed supply is one of the primary strategies. Poor seed quality and the genetic purity of varieties for vegetable seeds (e.g. tomatoes), and rootstock selection in horticulture remain major concerns (USDA&UC Davis, 2013). “Technical”, “institutional” and “knowledge” interventions designed to overcome these challenges are discussed from a farmer's viewpoint in the following section.

Sources of seeds

There are various sources of seed supply (see Figure 1). The FAO distinguishes between *commercially-oriented seed supply*, which includes the private sector and often a national seed service too. Seed companies are usually the main actor in the commercially-oriented supply. *Agricultural research* is another source of seed supply, but this sector is rather weak in Afghanistan. Nevertheless, international research centres such as the CGIAR group, which includes ICARDA, CIMMYT for wheat and CIP for potato, are important sources of seed supply. The final FAO category is *community-based seed supply*, whose main stakeholders are farmers. For various crops, e.g. wheat, farmers keep some seeds every year to resow them the next season, something that is referred to in what follows as **on-farm seed production**. These seeds are not only replanted by the farmer, but often shared within and among farming communities. Local seed supply includes various forms of “organisation”, e.g. seed cooperatives, seed banks, community nurseries, etc. which enable farmers to exchange and sell their seeds with other farmers or on the local market. There are therefore many sources of seed supply and this renders the system very complex. Regardless of the supplier, though, seed quality is central to crop productivity and remains a major challenge in Afghanistan.

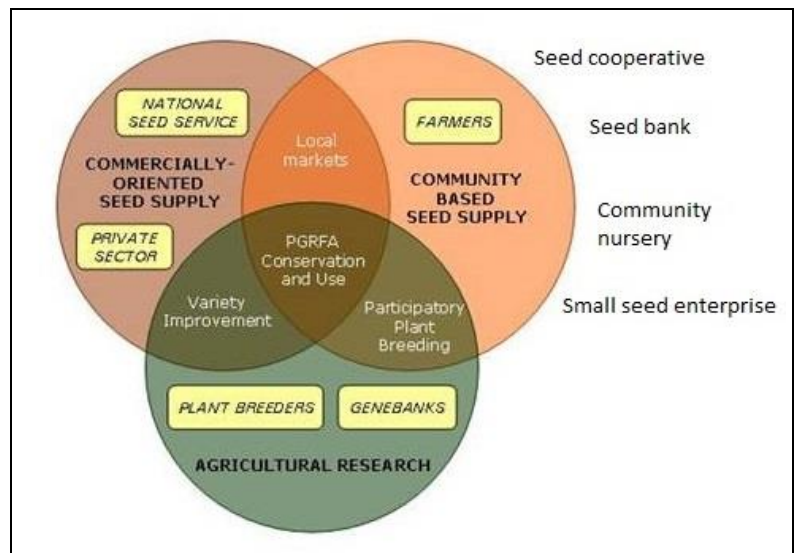


Figure 1: The various sources of seed supply (FAO, 2014)

Seed quality

Seed quality refers to the physical purity, the physiological vigour, the genetic potential and the health of the seeds (FAO, 2010).

- **Physical purity:** Good quality seed is free of damaged seeds, of weed seeds, dirt, stones and other crop seeds. Good quality seed is also uniform in seed size.
- **Physiological vigour:** Good quality seed shows high germination and growth vigour.
- **Genetic potential:** Good quality seed shows high genetic potential for desired criteria (resistance, quality etc.) and is optimally adapted to the local conditions and genetically pure.
- **Seed health:** Good quality seed is healthy, meaning that they are free of pests and diseases.

¹ Afghanistan's Ministry of Agriculture Irrigation and Livestock

² International Maize and Wheat Improvement Centre

It should be remembered that seed quality not only refers to certified seeds, but can also apply to local seeds produced by farmers on-farm.

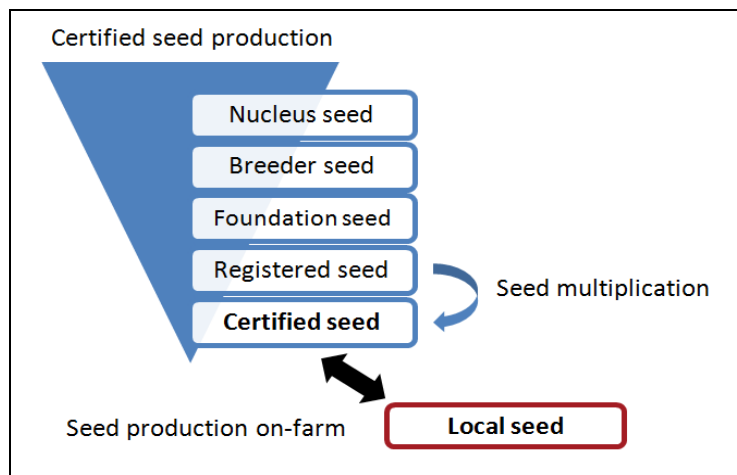


Figure 2: Seed production and quality control scheme (HELVETAS Swiss Intercooperation, 2014)

Certified seeds

Certified seeds have been through a production and quality control scheme, which is subject to full legal and regulatory requirements and which allows these seeds to be traded across international boundaries. Apart from a few farmers involved in seed multiplication or plant breeding, farmers are not generally part of the seed certification process. The main stakeholders are private seed companies or national organisations. We can distinguish several seed classes, as presented in Figure 2, yet from the farmer's point of view only the certified seeds - the end product - matter. The government of Afghanistan is currently preparing seed legislation that will include seed production and quality control regulations.

Box 1: Hybrid seed

Hybrid seed is seed of the first generation (F1) from a controlled cross-pollination between two different inbred lines (selfed for many generations). A hybrid shows high yield potential and outperforms both parent lines, which is known as the *heterosis* effect. Hybrid seed is very common for maize and many vegetable species.

Advantages:

- **High-yielding**
- **Homogeneous and uniform**
- **Other positive attributes** (e.g. resistance, quality, etc.)

Disadvantages:

- **Decreased performance if recultivated**
- **High seed costs**
- **Depend on input package**
- **Not necessarily adapted to local conditions**

The OECD has established seed quality assurance processes, and standards for the international seed trade. The FAO has also developed a quality control system called Quality Declared Seeds (QDS), mainly for countries that do not yet have their own seed legislation (FAO, 2010).

Local seeds

Local seeds include all seeds from the informal sector, such as seeds produced on-farm by farmers. Local seed are not necessarily of poorer quality than certified seeds, but they do not hold a quality certificate.

Selection criteria

There are often a number of varieties that are available to farmers; they must therefore decide which variety to cultivate. There can be various reasons for this decision, and farmers often take a wide range of selection criteria into account when making their



Figure 3: Some criteria of variety selection of farmers (HELVETAS Swiss Intercooperation, 2014)

choice. Figure 3 shows some of the criteria for varietal selection, though there are many more.

On-farm seed production

For many crops farmers grow/recultivate their seeds on-farm. They set some seeds from their harvest aside to resow them the next season. On-farm seed production is closely linked to seed supply, as farmers might buy certified seeds and recultivate them for some years, as well as exchanging and selling their seeds to other farmers or on the local market. On-farm seed production usually involves the following steps: production, selection, cleaning, storage, treatment and sowing. Figure 4 gives an overview of on-farm seed production and its links to seed supply.

Production

An important starting point of on-farm seed production is the use of quality seed. Yet seed production itself depends very much on the mode of reproduction and pollination (self-, crosspollination, vegetative, etc.) and time (annual, perennial, etc.). Hence, seed production is crop-specific and involves different practices such as isolation and winter storage among others.

Selection

When a farmer decides to keep a part of the harvest for seed, he or she must consider a few aspects prior to harvesting. First of all, he or she has to decide which part of the harvest he or she wants to keep. Either a whole field or a part of the field should be selected for seed production, and the following points have to be carefully considered:

- **Selection of healthy plants:** Only plants that are not infested by pests and diseases;
- **Selection of uniform plants:** Only plants that are uniform, meaning that they display the same phenotypic properties such as colour, height, maturity, etc.;
- **Selection criteria:** Only plants that show the desired characteristics, e.g. high yield.

Cleaning

After harvesting, most seeds still have to undergo a cleaning process. The cleaning steps depend very much on the crop species, although the objective is always the same:

- **To remove damaged seeds, weed seeds, dirt, stones and seeds of other crops, as well as diseased and non-uniform seeds.**

For wheat this may involve a sieving stage, which also removes the main weed in wheat: wild oats.

Storage

Seed storage is crucial for maintaining seed quality until such time as they are resown. Proper seed storage depends very much on the crop, but in general the following aspects are important:

- **Sanitation:** Storage facilities are, and remain, free of insects and other pests;
- **Moisture and temperature:** The seeds are dried to ensure low moisture content prior to storage and the storage unit is kept dry and at an appropriate temperature;
- **Treatment:** Seed treatment is appropriate.

Treatment

Seed treatment is essential for some crops because of seed-borne diseases, and can be divided into physical (hot water treatment) and chemical (fumigation) treatment.

Hot water treatment: <http://www.infonet-biovision.org/print/ct/233/recipesForOrganicPesticides>

Fumigation: Natural (e.g. ashes, smoke) or by local available chemical fumigation

Sowing

Before resowing the seeds, a brief process of seed testing is recommended, in particular to test seed germination. **Germination test:** http://afghanag.ucdavis.edu/other-topic/seed/fact-sheets/FS_Seed_Ragdoll.pdf

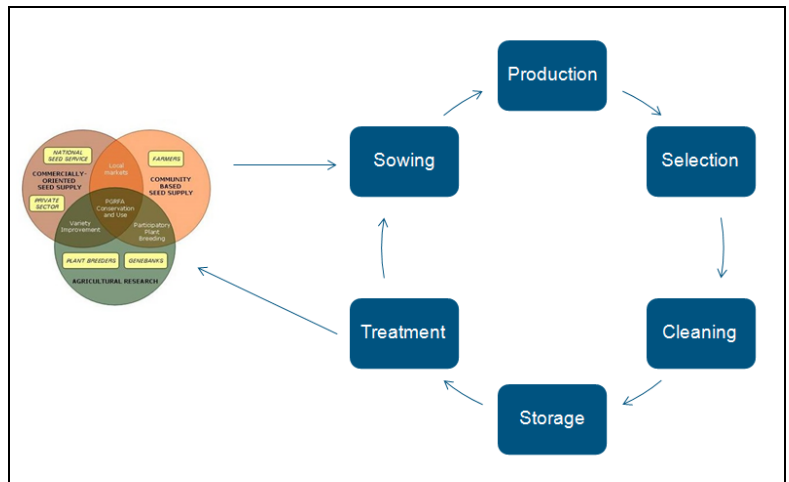


Figure 4: On-farm seed production includes six steps and is closely linked with the seed supply

Not all seeds are directly sown; there is an additional nursery step to consider for most vegetables and especially for fruit and nut trees.

Nursery: http://teca.fao.org/sites/default/files/technology_files/Good%20Nursery%20Practices.pdf and specific information on USDA&UC Davis, 2013: http://afghanag.ucdavis.edu/a_horticulture

Organisation of seed supply

Seed supply is not a purely technical discipline, for it involves social aspects too. If there a seed system is to be sustainable, it is important to promote both sustainable technical interventions and sustainable **institutional and knowledge interventions** to increase seed supply to farmers.

Input procurement

Farmers usually buy certified seed on the market or directly from a seed company. There are major challenges in the availability of, and accessibility to, those seeds. The supply of certified seeds may be too remote, and certified seeds can be too costly for farmers. Better seed availability and enhanced seed accessibility can be promoted in Afghanistan by means of a dealer system or input supply chain for input procurement.

Seed banks

In addition, seed banks - such as HELVETAS Swiss Intercooperation seed banks - also play an important role in promoting the supply of seeds to farmers. Seed banks' borrowing schemes can substantially improve the availability and accessibility of certified and local seeds. A seed bank may also include saving and finance schemes. Access to seed banks remains a critical element, as they are often established in provincial capitals that are still a long journey for some famers.

Cooperatives and farmer's groups

If farmers produce their own seeds on-farm, they need on the one hand to be trained in on-farm seed production, especially in matters of seed quality improvement and assurance. Capacity-building in "technical" seed production aspects such as selection, cleaning, storage, treatment and sowing is best promoted by Farmer Field Schools (FFS) on seed production. The establishment of farmers' cooperatives or seed production groups involving horticulture and vegetable nurseries, can be a sustainable practice. A cooperative or group can bulk-buy necessary inputs (e.g. vegetable tunnels) as well as marketing their seeds together, which contributes to local seed production and availability.

Small seed enterprise

A small seed enterprise produces and sells quality seeds and can be set up by a single farmer or by a group of farmers. A seed enterprise is always a private undertaking based on seed demand on the local market. For more information refer to the small-scale seed enterprise manual for Afghanistan, available at: <ftp://ftp.fao.org/docrep/fao/010/a1516e/a1516e00.pdf>

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Further reading and references

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Annexes

Crop groups	Planting rates (kg/ha)
Wheat (irrigated)	161
Wheat (rainfed)	79
Rice	132
Pulses	50
Oil crops	22
Cotton	61
Potato	1 712
Melon	7
Tomato	2
Other vegetables	9

Annex 1: Planting or sowing rates (kg/ha) for a selection of crops (FAO, 2007)