Quality Seed Production

Seeds are one of the most crucial elements in agriculture as they substantially contribute 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.

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 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[2], CIMMYT[3] for wheat and CIP[4] for potato, are important sources of seed supply. These two sectors dominate the supply of **certified seeds**. Certified seeds have been through a production and quality control scheme, which is subject to full legal and regulatory requirements, and 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. Moreover, today many certified seeds are hybrid seed (see Box 1).

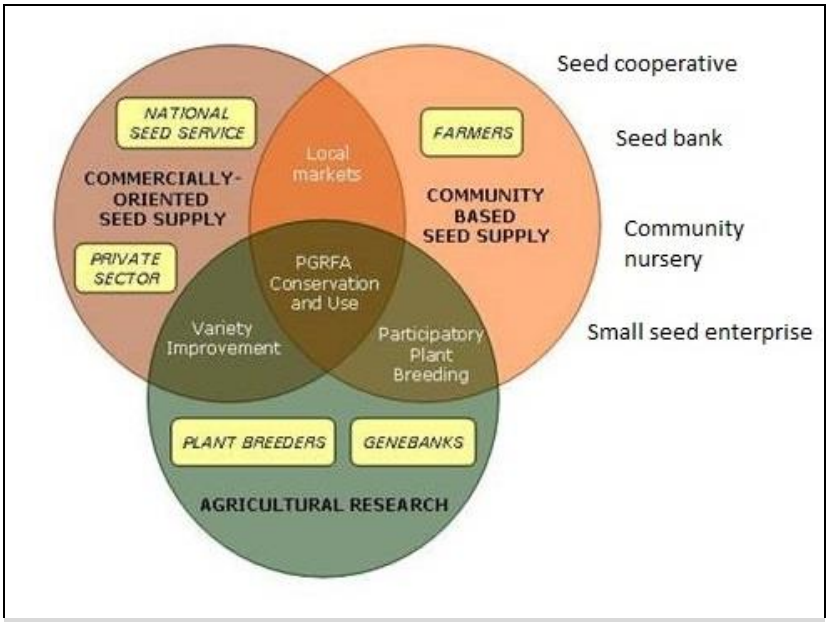

Figure 1: The various sources of PGRFA[1] seed supply (FAO, 2014)

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**

[1] Plant Genetic Resources for Food and Agriculture
[2] International Centre for Agricultural Research in the Dry Areas
[3] International Maize and Wheat Improvement Centre
[4] International Potato Centre

The third FAO category is *community-based seed supply,* whose main stakeholders are farmers (women and men). 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. **Local seeds** include all seeds from this informal sector. Local seeds are not necessarily of lesser quality than certified seeds. But certified seeds hold a certificate that guarantees seed quality (see Box 2).

From a farmer's viewpoint, she or he has the following options to obtain seeds:

- Buy certified seeds (from seed companies, national seed centres, international research centres, etc.);
- Buy local seeds (from farmers, local seed producers such as community nurseries, etc.);
- Exchange seeds (certified and/or local seeds) with other farmers and farming communities.

No matter which option a farmer choses, she or he must pay special attention to obtaining quality seed. The quality of the seed is of crucial importance and determines later crop performance.

Box 2: Seed quality

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

- **Physical purity**: Good quality seed is free of damaged seeds, 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 it is free of pests and diseases.

Selection of seeds

A farmer may have various different reasons for growing a particular crop, and also for selecting a particular variety for production. Generally, a few varieties of one crop at least are available to farmers for cultivation. Thus a farmer must decide which variety she or he wants to grow. The selection for a variety (e.g. wheat variety), may differ among farmers, farming communities and regions. A farmer may grow a variety because it is early maturing, shows high yields or because this particular variety is drought tolerant, or resistant to a particular pest. Figure 2 shows some criteria for selecting a variety for cultivation. There are many other criteria and they also differ among crops; for instance, in wheat production plant height is of particular interest as it determines the amount of straw produced.

The selection of a variety implies, however, that farmers know about the available varieties' characteristics. With certified seeds, these are usually promoted on the packages. Knowing the characteristics of local seed varieties is much more difficult. But a farmer may decide to grow a variety she or he saw on a neighbour's field, for instance.

Figure 2: Some criteria for selecting a crop variety (Helvetas Swiss Intercooperation, 2014)

Seed production on-farm

For many crops, especially the main crops wheat and potato farmers keep a part of their harvest aside to re-sow it the next season. For instance, farmers might buy certified seeds and re-cultivate them for some years, as well as exchange and sell these 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 3 gives an overview of the steps in on-farm seed production.

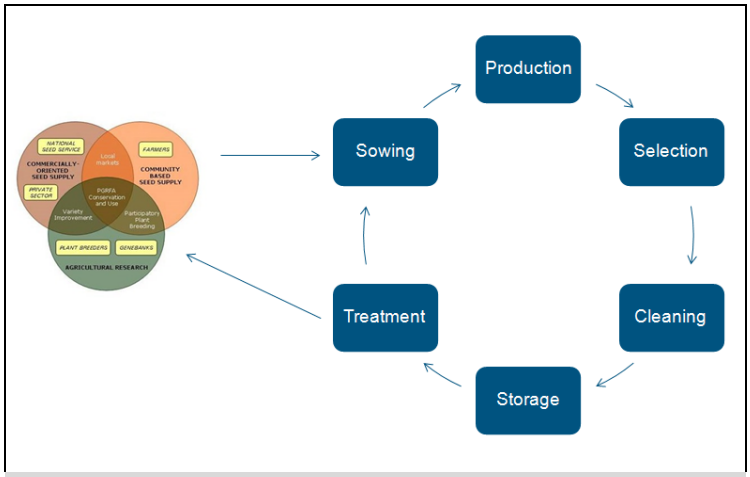

Figure 3: Steps in on-farm seed production (Helvetas Swiss Intercooperation, 2014)

Wheat seed production

It is common practice in Afghanistan to buy certified wheat seeds and re-cultivate them for some years. This practice should be promoted, and if a few aspects are given good consideration, on-farm wheat seed production can substantially increase, especially with regard to maintaining seed quality over the years. Wheat is a self-pollinated crop, this means that if properly managed and selected, wheat seed can be re-cultivated for several years without degrading its characteristics.

Production: The starting seed needs to be of good quality; a farmer either starts with certified seeds bought at market or good, clean, healthy seeds from his or her own farm or from another farmer. Wheat seed production should be managed carefully, to harvest good quality seed at the end, see: System of Wheat Intensification

Selection: Either a whole field or a part of the field should be selected for seed production. The following points have to be carefully considered before seeds are harvested:

- **Selection of healthy plants:** only plants that are not infested by pests and diseases;
- **Selection of uniform plants:** only plants that are uniform, i.e. displaying 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 and threshing, seeds still have to undergo a cleaning process with the main objective **of removing damaged seeds, weed seeds, dirt, stones and seeds from other crops, as well as diseased and non-uniform seeds.** For wheat this involves a sieving or winnowing 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 re-sown. The following aspects are important:

- **Sanitation:** storage facilities are, and remain, free of insects, rodents 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.

It is best to store wheat in an airtight container, e.g. the IRRI Super Bag

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; (natural (e.g. ashes, smoke) or by local available chemical fumigation.

Potato seed production

Potato is usually re-cultivated by storing tubers until the next season. This means one using the vegetative reproduction of potatoes in potato seed production. The steps are the same as for wheat seed production, however selection takes place on tubers. Instead of cleaning there is a step of manual sorting of potatoes. Sanitation and storage (e.g. improved potato storage) play a crucial role in potato seed production and need special attention.

Vegetable seed production

The manual Saving Your Own Vegetable Seeds shows vegetable seed production for most of the vegetables produced in Afghanistan.

Horticulture seed production

Fruit and nut trees are usually reproduced in a tree nursery producing seedlings for planting. Specific information for some fruit and nut trees is also available on USDA & UC Davis, 2013: http://afghanag.ucdavis.edu/a_horticulture

If farmers produce their own seeds on-farm, they need to be trained in on-farm seed production, especially in matters of seed quality improvement and assurance. Capacity-building for "technical" seed production aspects such as selection, cleaning, storage, treatment and sowing is best promoted by Farmer Field Schools (FFS) on seed production.

Organisation of seed supply

Seed supply is not a purely technical discipline, for it involves social aspects too. If a seed system is to be sustainable, it is important to promote along technical interventions also 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 by means of farmer groups/cooperatives, 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 farmers' groups

The establishment of farmers' cooperatives or seed production groups, including horticulture and vegetable nurseries, can be a sustainable practice. A cooperative or group can bulk-buy the 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.

Further reading and references

- FAO, 2007: Analysis of the Seed Market in Afghanistan. Available at: ftp://ftp.fao.org/docrep/fao/010/a1225e/a1225e.pdf
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