INTEGRATED SEED SECTOR DEVELOPMENT
PROJECT ETHIOPIA

Training manual on **Seed Producer Cooperatives (SPCs)**

MODULE | Post-harvest value addition for SPCs working with quality seed

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Please cite as | WCDI (©2020) *Local seed business management, Module*: *Post-harvest value addition for SPCs working with quality seed*; December 2020. Commissioned by the programme on Integrated Seed Sector Development in Ethiopia (ISSD Ethiopia). Wageningen Centre for Development Innovation, Wageningen University & Research.

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This report can be downloaded for free at https://doi.org/10.18174/536876 or at www.wur.eu/cdi (under publications).

This work was commissioned by Integrated Seed Sector Development in Ethiopia (ISSD Ethiopia), a programme of the Bilateral Ethiopia Netherlands Effort for Food, Income and Trade (BENEFIT) partnership funded by the Netherlands Ministry of Foreign Affairs through the Embassy of the Kingdom of the Netherlands in Addis Ababa, Ethiopia. ISSD Ethiopia is implemented by the consortium of Bahir Dar University, Haramaya University, Hawassa University, Mekelle University, Oromia Seed Enterprise, and Wageningen Centre for Development Innovation, which is a part of Wageningen University & Research, in collaboration with the Government of Ethiopia and many others across research, industry and civil society in Ethiopia.

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Post-harvest value addition for SPCs working with quality seed

This training module aims to support the capacity building processes of professionals involved in the strengthening of SPCs in Ethiopia. By zooming in on elements related to value addition, it builds on the previous module's focus on seed quality control.

Trainers can make use the information and facts from this manual as input to tailor design their own training sessions. The assignments and reflection questions in this manual can be used as inspiration to engage participants through interactive training sessions that build on their personal experience and insights.

This module brings together experience and learning from the Integrated Seed Sector Development Programme in Ethiopia (ISSD Ethiopia) that operates within the BENEFIT-Partnership programme in six regions.

This module has two sections and could be tackled in a single training session. It explains how value can be added to quality seed after harvest.

General learning objectives

By the end of module seven, participants will have learned about and be able to discuss the following questions.

- What is value addition, and what is its main principles?
- What are the key features of value addition for quality seed?

SECTION 1 Adding value to quality seed

Learning objectives

- To know and understand the definition of value addition
- To understand how value addition fits into the objectives of seed business.

In an ideal situation, every farmer should be able to access healthy seeds which are genetically pure, with high seed vigour and good germination percentage, as timely availability of good quality seeds at reasonable prices increases the likelihood of good yields and profits. But at present in Ethiopia the demand for good quality certified seeds far exceeds market availability. SPCs are in a key position to improve local accessibility and availability of quality seeds whilst creating employment opportunities for members. There are a number of activities through which a SPC can generate income and employment opportunities. Seed production is an obvious income-generating activity, but post-harvest value addition to quality should also be considered as a key ingredient of a SPC's successful business model.

In general, *adding value* is the process of changing or transforming a product from its original state to a more valuable state. A broad definition of the term *value added* is to economically add value to a product by changing its current place, time and characteristics to another set of characteristics that are preferred and in high demand in the marketplace. Value-added agriculture entails changing (processing) a raw agricultural product into something new, through cleaning, grading, treating, packaging, or any other type of process that differentiates the product from the original raw commodity. This training manual provides insights into the different options and practices that seed producers and SPC can implement to add value to their raw product.

Reflection questions

In groups of three, share some examples and experiences that you know of where value was added to a 'raw' product. Use these examples as references to reflect on the following questions.

- What was the result of the value addition?
- Who benefitted from this value addition and in what ways did they benefit?
- How does value addition fit into the objectives of an SPC?

SECTION 2 Key features of value addition to quality seed

Learning objectives

- To know and understand different options in value addition to quality seed
- To be able to discuss which options would be best for a SPC and why.

Value addition activities can generate employment opportunities for SPC members and community members. Value adding activities should be tailored to the specific context and possibilities of a particular SPC, a specific location, and a precise seed crop.

The business case and business model for investing in post-harvest value addition needs to be studied and designed carefully in order to generate positive impact and returns on investment.

Some examples below are provided of ways in which SPC and seed producers can effectively add value to quality seed after having harvested the raw seed product.

2.1 Seed cleaning

Cleaning is the removal of inert matter, other crop seeds (including weeds), and damaged seed from harvested, threshed and dried seed material. This will increase marketable value. Seed cleaning ensures good seed quality, reduces the bulk to be handled and stored, and removes moist and green plant material that may cause heating during storage. If done with the right equipment and appropriate methods, it can increase purity and germination percentage. It can also decrease the number of diseased seeds and improve visual, commercial and planting quality.

Seed cleaning can take place by hand or can be done mechanically.

Traditional cleaning methods

- **Hand picking** is used for small quantities of high value seed. One can pick the desired seeds from a seed lot or one can pick out undesired material for a seed lot.
- **Winnowing** blows seed over a clean floor by subjecting the seed to a breeze. When the seed is thrown into the air, the best and biggest seed falls closest, and the lighter seed, trash and chaff blows furthest.
- **Sieving** involves placing the seed on a sieve/screen and shaking it. Some of the materials pass through while others are retained on the sieve. The extent by which seed is separated from inert matter largely depends on seed size, the size and shape of the perforations in the sieve/screen, the speed and distance travelled with each shake, and how long the seed is subjected to sieving.

Mechanical ways of seed cleaning

Modern ways of seed cleaning are costly when compared with traditional cleaning methods. But they are safe, clean a large amount of seed within a short period of time, and require less manual labour. In some situations it is advisable for seed producers to use modern ways of seed cleaning. The cost can be affordable to SPCs. For example, the seed cleaners in figure 3 altogether cost 80 - 90 thousand ETB, which most SPCs could manage. Before investing in mechanical seed cleaning equipment SPC should evaluate the business feasibility and consider complementary income generating opportunities, for instance from providing services to other farmers and SPC's or renting out equipment.

The principals by which mechanical seed cleaning operates is by distinguishing and classifying different types of seeds and other materials. Physical characteristics such as size, shape, weight, surface area, colour, texture, stickiness, specific gravity and electrical properties can be sensed and measured by mechanical devices called separators. The separators cull unwanted impurities from the seeds on the basis of one or more of these physical characteristics.

The most frequently used modern cleaning machines are the following:

- **Air screen cleaner**, which separates the seed from other inert materials based on seed size, shape and density
- **Indented disc and cylinder cleaner**, which separates seed based on seed length
- **Gravity table**, which cleans the seed based on the specific density of the seed.

2.2 Seed grading

Seeds can be graded or separated depending on their quality. Seeds are living organisms which give birth to new plants; unless they are looked after in the proper way, their quality will unavoidably deteriorate. In addition to that, the cost of cultivation, fertilization and control of weeds are high. Using and growing best quality seeds reduces the chance of crop and sales failure.

The core objective of seed grading is to produce sound, even-sized and uniformly shaped seed in order to ensure vigour of the future plant and to make mechanical planting easier. Seed grading can also improve the appearance of processed seed, which increases sales appeal. Most seed cleaning machines simultaneously grade the seed into first grade, second grade, third grade and so on, based on uniform size and shape.

2.3 Seed treatment

After cleaning and grading, seed must be treated for several different purposes. Seed treatment commonly refers to the application of pesticides (fungicides, insecticides, or a combination of both) in order to **disinfect** and **disinfest** seeds from various seedborne and soil-borne pathogenic organisms and storage insect pests.

- **Disinfection** refers to the eradication of fungal spores established within the seed coat or the inner tissues.
- **Disinfestation** refers to destruction of surface organisms (fungi, bacteria, insects) that have contaminated but not infected the seed surface.

Seed treatments are used to prevent or reduce losses from diseases caused by organisms associated with seed or present in the soil. The pathogens may be present in or on seeds. There are two seed treatment methods.

Mechanical methods are designed to remove infected materials mixed with seeds. Seeds can be mechanically cleaned before seedling to remove most pathogenic organisms from the seed surface. However, mechanically treated seed is not completely free from pathogens and requires further treatment.

Chemical methods are designed to protect stored seed through the distribution chain and during the early stages of crop growth. Seed dressing is a more generally used term, and includes insecticide/fungicide treatment and pelleting, Insecticidal and fungicidal seed dressings should act against seed-borne diseases; storage pests and fungi; and soil-borne pests and diseases that attack the seeding and the plant in the later growth stages. The stored seed must be inspected regularly and fumigated when necessary to control insect pests such as weevils.

Ideally, the chemical used as fungicide/ insecticide should have the following characteristics:

- effective against all the major pathogenic organisms;
- non-toxic to the plant and people, if misused
- environmentally safe
- stable during the storage period
- systematic in the plant to increase its effective life
- economically competitive.

2.4 Seed packing

At the end of processing, the seed is packed and sealed into containers of uniform size. The transfer of the cleaned seed from the processing plant to the field where it is to be sown is neither a simple nor a speedy operation. The seed may have to be transported long distances by various transportation means. The journey may include periods of storage. On arrival at the farm, the seed is kept for a time in a storage place, in the farmers' home or even out of doors.

Seeds are packaged in different materials and containers. In determining the kind of packaging material or container best suited, the following points need to be taken into consideration:

- the quantity of seed in each package
- the quality of the seed and protection desired
- the cost of the package
- the value of the seed
- the average amount of seeds that buyers are interested to buy
- the conditions under which the container will be kept.

A seed package accomplishes several essential functions:

- serves as a convenient unit for handling, transport, and storage
- protects seed against contamination and mechanical damage
- provides a suitable environment for storage
- provides a barrier against seed loss and the escape of pesticides
- serves as a sales promoter.

If seed packing is inappropriate, the seed can lose quality with, for example:

- physical cracking
- damage by disease and pests
- loss of viability
- reduced ability to germinate
- increased exposure to rainfall, light and heat.

Ultimately, if seed packing is inappropriate, the potential customer can lose interest in purchasing the product.

Seed labelling

Information about the contents of a package must be displayed on the seed packaging. The information that must be displayed includes:

- name of the species (crop name)
- name of variety/cultivar
- grade and lot reference number
- date of packing and sealing
- production year and season
- minimum germination %
- physical purity %
- moisture %
- net seed weight.

All information must be written in Ethiopia's major languages.

There must be **two labels** for each bag: one on the **outside** the bag for identification and information and a **copy inside** the bag for confirmation (and as a back-up should the outer label be lost). Each label has an individual tracking number so that the history of every individual seed packet can be traced. If a seed pack is not labelled with these pieces of information, that seed is not considered quality seed. Farmers should always use certified seed which has all the information on the label.

SPCs experience from the field

A SPC in West Harerghe purchased certified seed without checking the label, and bought basic seed. Before the seed was distributed and planted, the SPC was advised by ISSD experts to avoid its use. The ISSD team explained the importance of reading the seed labels when buying and before sowing to avoid any issues that might affect the quality of your seed and the reputation of your SPC.

Small size packs

Increasing the availability and quality of seeds can increase the yield of crops significantly. In many cases seed is offered and sold in large volumes and large seed packs. This requires a substantial investment and complicates transport from the market to the farm. For smallholder farmers who do not always have the intention to invest heavily in quality seed the size and price of large seed packs might be discouraging. Seed availability and accessibility to smallholder farmers can be improved through offering smaller package sizes. The approach has the following advantages.

- Smallholders need seeds in small packs because they have only small landholdings which may be shared between two or more crops in the same season.
- Average land holding of Ethiopian farmers for most cops is below 0.25 ha.
- Farmers can sow different varieties, and get to know their characteristics, desirable traits and sources. They then have a better idea of which varieties work best for them.
- Seed producer cooperatives are then better able to understand farmers' needs and get an opportunity to create market linkages that will help promote their local seed business.
- The behaviour and attitude of farmers towards the use of quality seeds is improved.
- Linkages among government extension workers, service providers and SPCs are strengthened.

Government agencies have appreciated this approach of offering small seed packages and are committed to its support. Currently, some cooperative unions (for instance, Chercher Oda Bultum Farmers' cooperative union), and SPCs are in the process of scaling up the approach, and the cooperative promotion agency has also confirmed its support to the promotion of small seed packs.

SPCs experience from the field

Abdi Gudina SPC successfully uses small seed packages for value added marketing to local farmers

BENEFIT-ISSD worked with Abdi Gudina SPC to source transparent plastic jars with 2kg seed capacity and automatic-lock. A total of 500 plastic jars were filled and sealed with the seed of three different crop varieties including tef (Kuncho, Boset); common bean (Awash-1, Nasir, Red-woliyta and Mexican-142); and chickpea (Ararti). These 2kg seed packs were designed for selling at a local mini-market. On the day, more than 60 diverse crop varieties were packed in small packs of 0.5-1 kg and displayed on tables. The display tables were arranged and checked to accommodate the different crop portfolios and plastic jars.

Small seed pack Oromia East Unit, Haramaya University (Abdi Gudina SPC)

The market was extremely successful. Farmers confirmed that the small seed packs have the following advantages:

- *better opportunities to find the right seed crops with the right amounts that consider their purchasing power*
- *increased convenience for investment*
- *increased seed use*
- *avoidance of seed quality deterioration and wastage*
- *ease of transportation and handling*
- *increased trust in the seed producer.*

Hermetic seed storage technologies

Hermetic storage is a technology that enables farmers to store their own seed for long periods of time without affecting seed quality and without incurring loss due to insects. The technology consists of enclosing seed in air-tight containers that prevent or minimize gas exchange. As insect aerobic respiration depletes O_2 and increases CO_2, their feeding ceases, and then they die. There is no need for insecticides. Additionally, hermetic storage can impede the growth of fungi, as these organisms also need oxygen to proliferate.

Appropriate seed storage technologies must be tailored to each specific seed product and contextual situation. Technologies that are cost effective, accessible to farmers, take into consideration local circumstances and locally available products have higher probability to be taken up and adopted.

Three types of hermetic seed storage containers are promoted for use by smallholder farmers these include;

Locally available containers. The most common include simple water bottles and recycled vegetable oil containers. 5 and 20-litre vegetable oil containers are quite popular in villages throughout Africa, and are typically used to store water and local beverages. These locally available containers can provide an effective hermetic seal for seed storage.

Purdue improved crop storage (PICS) triple-layer sacks and **GrainPro Super Bags** come in 50 and 100 kg sizes (see figures 4 and 5). This is typically more seed than a farm household requires for storage, though the flexible material allows for compression to store smaller quantities such as 20–25 kg. However, the bags can be used to store seed from more than one household or more than one crop, with the different seed lots in separate, non-hermetic sacks, placed inside the larger PICS or GrainPro sacks. These sacks can also be used for effective long-term grain storage. **PICS sacks** are composed of two high-density polyethylene plastic liners and a printed woven polypropylene bag for reinforcement.

SPCs experience from the field

About 2,400 of Purdue Improved Crop Storage (PICS) sacks were trialled by ISSD Oromia South West. Farmers' feedback was positive. They stated that the sacks were cost effective, moisture resistant, suitable for long term storage, and re-useable two or three times. Moreover, they were effective at preventing pests, and particularly useful for weevil-sensitive seed. The only downside was the maintenance of the integrity of the bags, as they tended to rupture if not handled properly. Overall, farmers concluded that PICS bags are a cost effective method for maintenance of quality seed.

GrainPro Super Bags are sold as a single polyethylene liner with a proprietary formula, for which farmers must generally purchase the necessary woven sack for reinforcement. Unlike local woven bags which simply 'organize' grain without providing protection against insects, hermetic bags provide full protection against insects without the need for any additional treatment.

The steps in using Super Bags

1. Make sure that the seed are properly dried (for instance, 12% moisture content for maize).
2. Place the super bag inside another bag such as a jute or polypropylene bag for mechanical protection.
3. Fill the super bag with dried seed.
4. Remove air from the bag completely. To remove air, press from one side of the bags to take out air from the bag. Then twist the free plastic to fold it into two.
5. Tie off the twist with a strong rubber band or adhesive tape.
6. Close the outer bag by tying. Make sure not to puncture the super bag.

Reflection questions

- What is value addition?
- What steps do you have to follow to add value to your seed?
- Discuss the major differences between traditional and modern seed cleaning.
- What should you consider when you treat seed with chemicals (fungicide/insecticide)?
- What do you need to consider when packaging seed?
- What are the essential functions of packaging?
- What information should be on the label of a seed packet?
- Why might some farmers not use the hermetic packaging?
- Why are small seed packets interesting for farmers?
- which value addition options do you think would be useful for your SPC? Why?

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