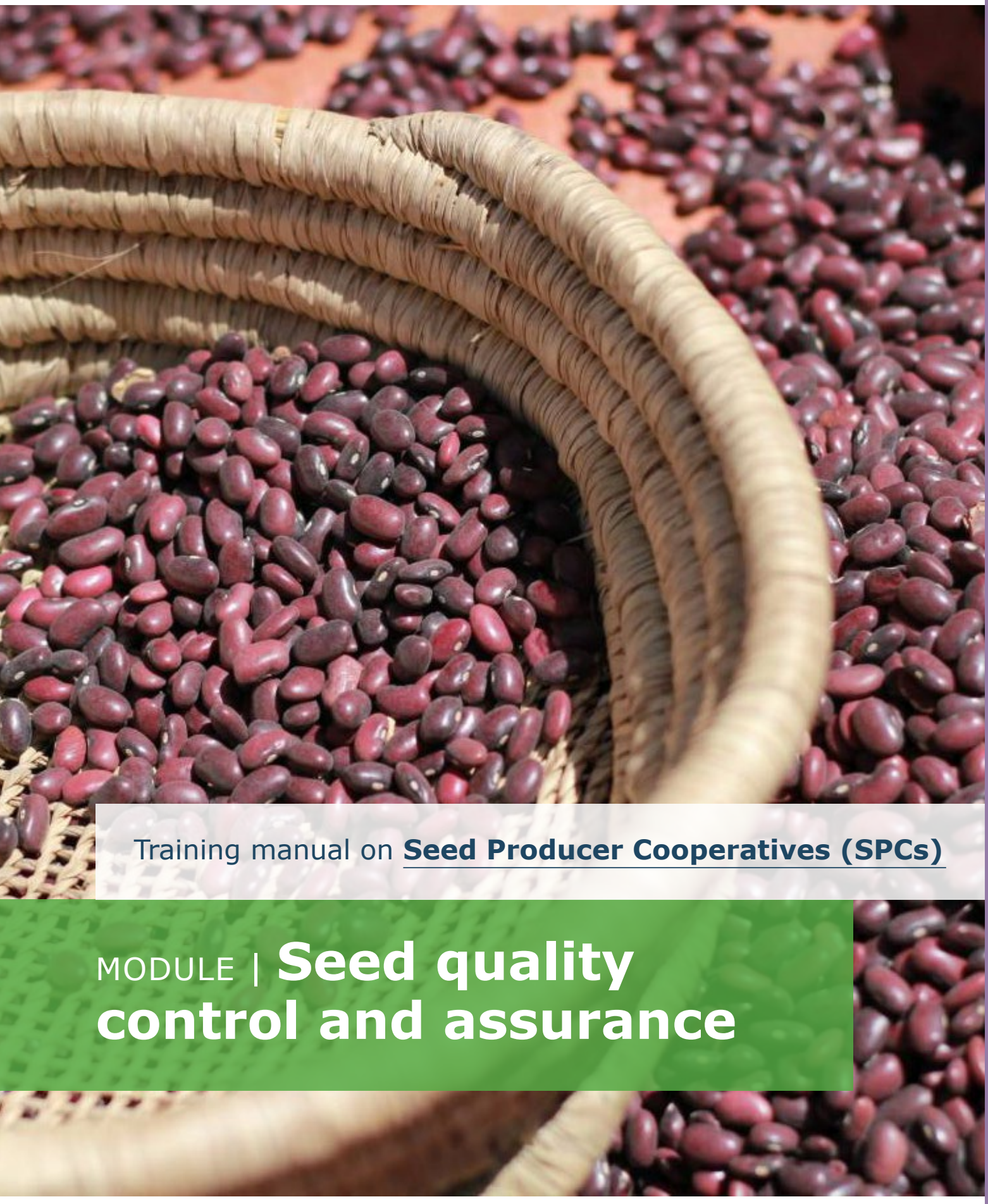
INTEGRATED SEED SECTOR DEVELOPMENT
PROJECT ETHIOPIA



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

MODULE | Seed quality control and assurance

WAGENINGEN
UNIVERSITY & RESEARCH

Colophon

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Contents

Seed quality control and assurance for SPCs

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 seed quality control and assurance, it builds on the previous module's focus on quality seed production. It is particularly aimed at executive members of SPCs, seed quality control committees, woreda experts, implementing partners, SPC farmers and SPC/PSP store workers.

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 consists of three sections. Each one could be tackled in a separate training session:

- definition and principles of seed quality control and assurance
- internal controls
- external controls.

General learning objectives

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

- What is seed quality control and assurance, and what are its main principles?
- What are the key features of internal seed quality control?
- What are the key features of external quality control?

SECTION 1 What is seed quality control and assurance?

Learning objectives

After competing this section, participants will be able to:

- describe what seed quality control and assurance is
- analyse why seed quality control and assurance is important for SPCs
- provide advice to an SPC on how to set up internal and external mechanisms to monitor and implement seed quality control and assurance measures.

Reflection questions

In small groups of up to 3 people, reflect on the following questions.

- What is seed quality?
- What is seed quality control?
- Why is seed quality control important?
- Do you know of, or put in practice, any quality control mechanism?

These questions can be asked again at the end of the session, allowing participants to assess their learning.

1.1 An introduction to seed quality control and assurance

Seed quality control and assurance is the combined efforts and activities undertaken to ensure that the seeds that are being produced for the end users (farmers) conform to minimum quality standards.

- **Quality assurance** refers to an overall management plan to guarantee the reliability of data that is needed to comply with the minimum standards.
- **Quality control** refers to a series of analytical measurements used to assess the quality of seed.

Good seed quality control and assurance will avoid unbiased field inspection and laboratory testing for quality control. The main goal of quality control and assurance is to ensure that clients have access to seeds which are:

- genetically pure
- free from seed borne diseases
- free from weed seeds and pests
- produced in conformance of minimum requirements in terms of physical purity, germination and moisture content.

1.2 Principles of seed quality management systems

Effective seed quality management systems rely on the following:

- competence inspector or other professional personnel
- responsible and professional members (clear-cut roles and responsibilities regarding the quality control committee and individual members)
- application of rigorous scientific methods (technical fundaments of seed inspection and tests)
- objective results
- impartial conduct (should be done by an independent body to avoid conflict of interest)
- traceable measurements and repeatable tests
- transparent processes (open to internal and external inspections).

1.3 Internal and external seed quality control

Generally speaking there are two main types or categories of seed quality control; internal seed quality control and external seed quality control.

- **Internal control** is mainly carried out by the internal seed quality control committee of SPCs and professional experts of private seed producers (PSPs). They should have decision-making protocols as set out by the Ethiopian seed proclamation of 2013.

- **External control** is done by an autonomous and accredited body that should inspect every stage of production, including preparation of the seed field, the pre and post-harvest period, processing, storage and transportation.

Section 2 provides detailed insights into the main activities of internal quality controls and section 3 goes into detail into the activities of external controls.

SPCs experience from the field

Strengthening Tuka Katar SPC in Arsi Zone

The livelihoods of the members of the Tuka katar SPC, located in Arsi zone have improved thanks to the income and activities from seed production. Since the SPC started producing quality seed for different crop varieties, the problem of not having access to locally available quality seed, in the locality, has been solved. In the period between 2016 and 2018 the SPC had been able to increase the total area of land that was being cultivated with seed crops by 58% and increased the total volume of their seed production by almost 95%. The SPCs capital had increased from 41,558 ETB to 439,133 ETB in this same two year period. According to members of the SPC this progressive achievement has been attained through ISSD's support in strengthening the skills and knowledge of cooperative members about how to produce, control and assure quality seed.

Reflection questions

In small groups of 3 people reflect on the following questions.

- How does seed quality control and assurance affect a SPC? Think of at least 2 positive elements and 2 negative considerations.
- Who is responsible or seed quality control and assurance in a SPC?
- Is it worth the effort for an SPC to invest in seed quality control and assurance?

SECTION 2 Main activities of internal quality controls

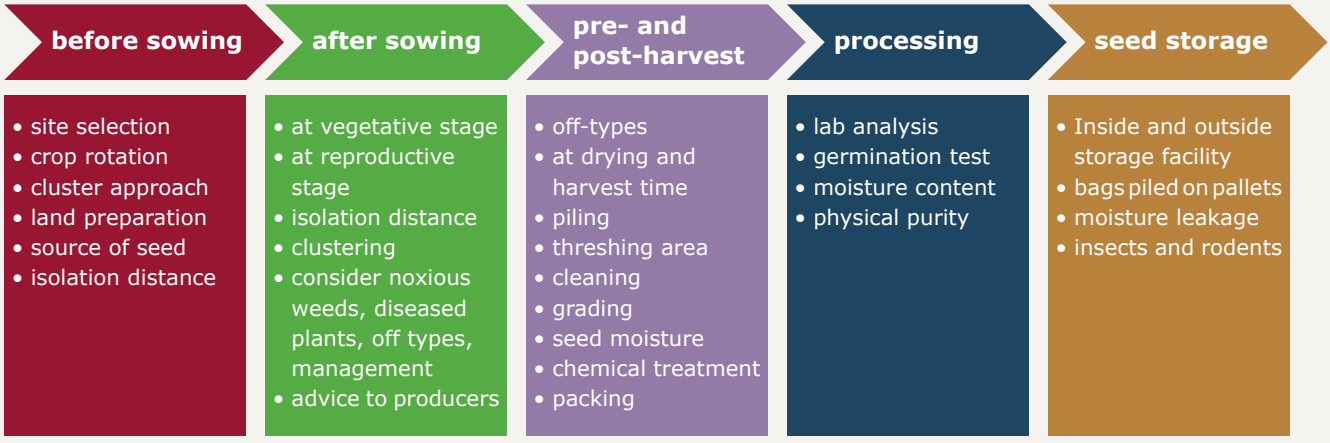
Learning objectives

Participants will have a good understanding of, and be able to discuss, the following:

- the main activities of internal quality control bodies
- how these improve seed quality
- how these reduce the risks of seed rejection by external inspectors.

Internal quality control bodies intervene at different points in the production cycle where they assess and inspect the production methods against the minimum standards set for different varieties of crops. The steps and points to be considered during inspection for internal quality control are summarized in the following diagram.

Figure 1: Stages and activities for internal seed quality control



2.1 Field inspection before sowing

Field inspection is a fundamental requirement both for internal and external seed quality control. In field inspection, a seed field is assessed in relation to a number of variables to check and validate its compliance with the official field standards as set by the Ethiopian standards authority.

Field inspections are done to achieve the following objectives:

- verify the seed source and variety
- gather information on the cropping history of the seed field, that is, to verify whether the seed field meets the prescribed land requirements
- monitor crop and cultivation conditions and isolation distance
- monitor freedom from impurities (other crop plants and weeds), other cultivars and off-types, and seed-borne diseases.

These field observations are compared with a set of prescribed standards which are specific to each crop.

Site selection: checking whether the selected plots comply with the minimum requirements for quality seed production, taking into consideration the following points:

- suitability of land for cultivation
- fertility status of soil
- previous land use and history in terms of cultivation
- adequate drainage
- minimum risk and susceptibility in terms of drought and flood problems.

Based on the above criteria, the inspectors confirm and validate that the selected land effectively fulfils the minimum standards for site selection, in order to ensure quality seed production and reduce risks.

Crop rotation: the Ethiopian seed regulation 375/2016 (article 23) dictates the minimum standards for crop rotation that should be taken into consideration for quality seed production. According to the seed proclamation:

- minimum standards for crop rotation vary in relation to specific crop types and types of seed classes to be produced. For example, the minimum attainable years for crop rotation to produce certified seed of food barley and bread wheat are two and one, respectively.
- these minimum standards provide the basis for avoiding seed contamination from volunteer crops of different varieties, reducing seed-borne diseases, and avoiding weeds and pests.

The internal quality control bodies should check whether individual seed producers fulfil the minimum standards through early field visits and inspection.

Seed quality control and assurance in clustered fields

When members of an SPC have decided to cluster their fields for seed production, it is important that the internal regulatory bodies pay specific attention to ensure that the correct clustering approach has been implemented, safeguarding the quality of the seeds that are being produced.

Definition

Clustering: growing the same variety/varieties of a given crop by grouping (clustering) adjacent plots of land from different farmers.

- Clustering should be done based on the interests of members of the SPCs. In other words, individual members should want to cluster their fields on a voluntary basis. It is not advised that SPC make it mandatory for farmers to cluster.
- The clustering approach reduces the probability of genetic and physical contamination from adjacent fields.
- The clustering approach facilitates supervision and field inspection and facilitates providing advice and coaching to seed producers.
- From this understanding it is important that the internal quality control committees train the members on the importance and advantages of clustering, and provide advice and coaching to seed producers who want to cluster or have already clustered their fields.

Inspect source of seeds: One of the main duties of an internal seed inspector is to check the sources and quality of the basic seeds that will be used to produce and multiply certified seed. The internal control committee should confirm that:

- seed has been obtained from legally licenced seed producer organizations
- official seed tags or labels are available and traceable.

The internal quality control committee can perform simple germination tests before distributing the seed and initiating planting, in order to avoid risks of crop failure.

Isolation distance: the minimum required distance between two varieties of the same crop or species in order to prevent genetic or physical contamination.

Seed producers may follow different mechanisms to comply with these requirements. Some common examples of this are:

- **Distance isolation:** ensuring a minimum distance between two adjacent plots sown with different varieties of the same crop, or with different crops
- **Spatial isolation:** planting a completely different crop variety between two adjacent plots creating a spatial/physical barrier to prevent cross contamination.
- **Temporal isolation:** planting different varieties of the same crop at different times ensuring that the flowering and pollination stages do not coincide.

Annex 1 contains a summary of referential isolation distance criteria established in Ethiopia for different crop types. The criteria established by the Ethiopian standard authority refers to distance isolation between crop types and classes of seeds to be produced. For example, the minimum isolation distance for malt barley, tef and bread wheat is 3-5m, while for faba bean it is 100-200m.

Based on these predefined criteria, the internal quality control inspectors should verify and confirm that the minimum distance utilized by the seed producers is in compliance with the minimum standards set for each crop.

SPCs experience from the field

Innovative practices in safeguarding isolation distances

One of the main challenges that tend to cause disagreements among SPC members and other farmers are isolation distances between adjacent plots that produce different varieties of the same crop. Sometimes adjacent plots may not belong to SPC member farmers. In this case the farmers are not necessarily interested in planting the same improved varieties of quality seed as adjacent farmers who are SPC members. An SPC, in Arsi, Oromia, solved this challenge, after discussions between the executive committee, seed quality control committee, and SPC members. Firstly, the executive committee offered the same variety of quality seed of the targeted crop to nearby farmers who were not members of the SPC, convincing them of the importance of using quality seed and mechanisms/requirements for quality control. The nearby farmers now sow quality seed of the same variety and comply with the minimum isolation distance and other requirements. The second innovation that was introduced was to sow different crops between two varieties of the same crop. For instance, the SPC grew faba bean seed between two different varieties of malt barley planted adjacent to each other; the faba beans thus served as an isolation barrier (spatial isolation), and were harvested at a premature stage, as green pods, before the time of barley harvesting. Such types of innovative practices have been practiced and proven viable by SPCs. They have prevented the emergence of conflict between farmers and have facilitated effective conflict resolution.

2.2 Field inspection at crop growth stage

The internal seed quality control committee should also inspect production fields throughout their growth stage. During this stage the key objective is to estimate the maximum tolerable off-types of different varieties of the same species, other crops, noxious weeds and disease plants and to relate those estimates against the defined standards. Field inspection should ideally take place at least at three moments during the growth and reproductive stages, for example:

- at the vegetative stage (before flowering)
- at the reproductive stage (after flowering to grain filling stage)
- at a stage near to the maturity period.

For the field inspection, the inspectors should follow the internationally agreed sampling procedures (e.g. minimum number of sampling points and amount). If field inspection is conducted according to the defined standards, the internal quality control committee can provide a clear assessment, rejecting or approving a particular field of seed crops, even before the seeds are harvested. Based on the field inspection, the internal quality control committee provides recommendations to the farmer; for example, instructing her or him to rogue of off-types and other undesirable plants at the growth and reproductive stages. Once an individual seed producer has complied with the recommendations, the inspectors should re-check the field to ensure uniformity of the field and the nonexistence of any off-types.

SPCs experience from the field

The importance of internal quality control for hybrid seed production

The lack of hybrid maize seed in the Amhara region needed to be addressed, so an SPC in that region planned to multiply hybrid maize seed in collaboration with the Ethiopian Seed Enterprise (ESE). The SPC planned to produce hybrid maize seed of the variety BH 540 on 80 ha of land by accessing quality inbreed lines from ESE. Even though the internal quality control committee of the SPC performed field inspections, the external quality regulatory body rejected the entire field of 80 ha because the specific moment that the internal quality control committee had inspected the fields (ahead of the tasselling period) was inappropriate. Furthermore, the internal quality control committees were not well equipped and trained on specific inspection procedures and minimum standard requirements. They had not evaluated all fields and had not decided to reject fields that did not follow the required standards and that would possibly affect other fields that did follow all the elements of the standards. As the result, all fields were rejected and the producing farmers were extremely discouraged because of their lost time and energy and the financial losses they had incurred.

2.3 Inspection at harvest and post-harvest processing stages

Internal quality control committees are required to perform inspections during harvest and post-harvest stages of the entire seed production and processing process. The section below summarizes what specific inspection activities take place at different stages

Harvesting

It is important to make sure that seed moisture content is checked ahead of harvesting. The inspector should check whether time of harvesting is ideal and seed moisture content is below the maximum standard limit. For instance, the inspector should inspect moisture content of maize against the maximum standard (14% at harvest time) and advise the farmers accordingly.

Threshing

Before initiating the threshing activity, the inspector should check the quality of the cemented or plastered threshing floor to ensure that:

- during threshing seeds are not mixed with soil or other inert matter
- the purity of the seed is maintained and it is not mixed with other varieties of the same crop.

The internal quality control inspector should provide effective advice to individual seed producers allowing them to critically consider mechanisms and strategies to avoid physical mixture during threshing and cleaning of plant material and seeds (for instance, not to thresh seed of different varieties on the same floor; and to use other threshing materials, like canvas or a threshing machine, to avoid mechanical mixture).

Cleaning and grading

At this stage, the internal inspectors should advise the seed producers on cleaning and grading during seed processing so that they attain the minimum quality standards set by the Ethiopian seed proclamation 375/2016. These quality standards refer to:

- the maximum percentage of other varieties or crops present in seed material
- the maximum percentage of weed seeds and other inert matter present in seed material.

Chemical treatment of seed

Seed quality control at this stage focuses primarily on the possibility of seed-borne disease and insect attack; the internal inspector should ensure that the SPC carries out seed dressing using appropriate and certified chemicals.

Packing

The final processing stage at which internal quality control takes place is at the packing stage. Inspectors should check the quality of the bags used for packing. Ideally, the seed bag should be waterproof as to avoid moisture to infiltrate and affect the seed (most seed producers use seed bags that have internally sealed plastics). Internal quality control bodies should also provide advice to the SPC and individual seed producers about appropriate packing materials with affordable bag sizes and brand names.

SPCs experience from the field

Employment generation through cleaning seed

An SPC located in East Shoa, Oromia, has been producing chickpea, lentil and tef seed varieties since 2014. It multiplied its seed on the farms of individual members so that the production area steadily increased from 193 ha in 2016 to 422 ha in 2018. However, it was forced to sell raw seed at low prices as it had no seed cleaning machine or electric power.

The seed quality control committee thought of mobilizing community members to manually clean the seed by paying for the labour involved. The executive committee agreed on the labour costs that would be covered (25 ETB per quintal for chickpea and 20 ETB per quintal for lentil). Additionally, SPC members who cleaned by themselves could obtain a dividend based on their contribution to seed cleaning and the amount of cleaned seed delivered to the SPC. Activities were initiated to encourage individuals to clean the seed, and large numbers of people were mobilized.

This activity allowed SPC members and adjacent community members to access an additional source of income. It also meant that the external quality control authority was able to provide a certificate of quality certified seed. The SPC is now a competent supplier of quality seed and is able to sell the cleaned seed at a premium price. It has shared this innovative idea with other SPCs during experience exchange visits.

2.4 Seed storage inspection

The main purpose of storing seeds of various crops, particularly field crops, is to store and preserve the quality of the seeds from the time of packing until the next planting season. However, management of seed in the storage is crucial as seed can easily deteriorate in inappropriate storage environments.

The longevity, viability and quality of seed kept in storage predominantly depends on:

- the moisture content of the seed upon packing
- the temperature control and relative humidity (RH) in the storage facility.

For instance, during the two months of a rainy season, high relative humidity can reduce seed viability from 90% to 70%. If the moisture content of seed is 5-14%, its storage shelf life can double by reducing its moisture content to 1%. Therefore, seed storage management by a seed producer is crucial to maintain seed viability until the next planting season.

Inspection of storage management by internal quality control bodies is also vital to evaluate the viability and healthiness of the seed and to control insects and rodents in the storage facility. the inspectors should regularly carry out the following and advise the seed producers/storage personnel accordingly:

- check the outside of the storage facility for drainage or erosion problems, signs of rodent paths and holes, and the presence of trash or weeds
- check inside the storage facility for moisture such as leaks in the roof, dampness on the floor, or water stains on the wall
- check that seed bags are kept on pallets or on tree branches placed in a wood frame on the floor, to avoid contact with a cemented floor.
- inspect the seed inside the bags or storage container for insects or moisture detection
- check the status of seed in storage areas; whether it is appropriately handled in terms of optimum temperature, relative humidity, and air moisture.
- ensure that storage personnel and visitors check in and out of storage areas, to avoid damage and seed losses in the store.

Reflection questions

In groups of 3 people reflect on the following questions.

- What are the main activities of internal quality control bodies. List their key activities during production, harvest and post-harvest stages?
- What options do SPC and seed producers have to improve seed quality without investing in expensive machines and equipment?
- What risks do SPC run if they do not invest in seed quality control and assurance?
- What benefits can SPC obtain from investing in seed quality control and assurance and post-harvest value addition?

SECTION 3 External quality controls

Learning objectives

- Upon completing section 3 of this module participants will have clear understanding of the main functions and activities of external inspection, seed quality control and assurance.

The main activities of external inspectors for quality assurances are testing seed with a laboratory analysis, inspection of seed labelling, and seed certification. Details are provided of the specific inspection activities that take place in each mentioned step.

Laboratory analysis

The Ethiopian seed regulation 375/2016 (article 29) states that any officially recognized seed producer should analyse their seed produce through legally recognized seed laboratory services. Once analysed, these service providers can accredit quality assurance certificates.

The main purposes of laboratory analysis of seed are:

- to determine the quality of the seed based on a number of seed quality attributes
- to provide a basis for price and consumer discrimination among seed lots and seed sources
- to determine the source of seed problems, thereby facilitating any corrective measure(s).

The seed producers, usually their internal quality control committees, should contact the nearest official seed laboratory for quality analysis, which checks that a seed conforms to the applicable Ethiopian seed standards. It involves:

- physical and analytical purity percentage
- germination capacity
- seed moisture content.

Having obtained a positive laboratory analysis report, testifying the good quality of seed, the seed producers and respective SPC have the right to obtain a quality assurance certificate.

Inspecting seed labelling

The Ethiopian seed regulation 375/2016 (article 15) states that any registered seed seller who sells prescribed and certified seed which has been tested has the obligation to label the seed product by printing or stamping with indelible ink on the seed bag or upon a specified label attached. The labels should contain the following information:

- the name of the producer and its emblem or symbol/logo
- year of production
- the date (day, month and year) on which the prescribed seeds were tested
- type of crop and name of the variety
- seed class (pre-basic seed, basic seed or certified seed)
- other particulars specifying seed quality, for example, physical/analytical purity, moisture content and germination capacity.

The external seed regulatory body will also inspect the seed labelling, particularly during transportation and distribution, making sure that any unknown seed sources are not distributed.

Seed certification

The main purpose of seed certification is to ensure the genuineness and quality of the seed for the purchaser. It is performed in seven steps:

1. receipt and scrutiny of application
2. verification of the seed source/class used for raising the seed crop
3. field inspection to verify conformity to the prescribed field standards
4. supervision at post-harvest stages including processing and packaging
5. supervision of seed storage to verify conformity to the prescribed standards
6. seed sampling and laboratory analysis
7. grant of certificate and certification tags, tagging, sealing.

Reflection questions

In groups of three people reflect on the following questions.

- What is the value of having internal seed quality control committees?
- What are the risks that SPCs take if there is not good internal quality control?
- Does your SPC perform internal quality control? If so, do farmers consider this as an added value and service of the SPC, or do they consider it an inconvenience?
- In your experience, what are the main areas of conflict over seed quality control?
- How can one guarantee the independence and objectivity of internal seed quality control?
- What is the complementarity of internal seed quality control performed by internal quality control committees and individual farmers?
- Is there a template to register and document the quality control of the individual producer and the quality control of the internal quality control committee?

SPC internal quality control: report template for inspection, monitoring and evaluation

Region: _____ Zone: _____ Woreda: _____

Kebele: _____ Name of SPCs/union: _____

Production year: _____ Type of crop: _____ Type of variety: _____

Source of seed: _____ Seed class sown: _____

Class of seed to be produced: _____

Name of farmer multiplying the seed: _____

Main inspection points that the internal quality control committee should take into consideration

1 Site selection and land preparation (land cropping history, landscape, fertility status, and land preparation):

_____

_____

2 Isolation distance against the minimum standards for each crop, variety and class of seed:

_____

_____

_____

3 First cycle field inspection points during vegetative growth stage (appropriate management, seed born disease occurrence, off types of different varieties of the same crops, volunteer crops):

_____

_____

_____

4 Second cycle field inspection points during flowering to grain filling stage (appropriate management, presence of off-types against minimum tolerable percentage, seed-borne disease):

_____

_____

_____

5 Third cycle inspection points at the end of maturity period. This is the final decision point for acceptance or rejection at the field. It is also the final moment of verification regarding the minimum tolerable off types and other important traits:

6 Fourth inspection points during pre-harvest time (drying, harvesting, threshing, cleaning, grading and packing) to verify the mechanical mixture of the seed:

7 General comments and decision of the internal quality control committee on acceptance or rejection of farmer's seed:

Final decision (for acceptance or rejection):

_____ type of seed class of _____ variety of the crop multiplied by _____ *(name of farmer)* was _____ *(accepted or rejected)* since they have _____ *(followed/not followed)* the minimum criteria for quality seed production. Our SPCs _____ *(shall officially collect/shall not officially collect)* the seed from the farmers after the final verification of the external seed inspectors.

Name and signature of internal seed quality control committee

1 Chairman _____ signature _____ date _____

2 Secretary _____ signature _____ date _____

3 Member _____ signature _____ date _____

Annex 1: **Minimum field & laboratory standards for certification of seeds – major crops**

Crop	Field standard									Laboratory standard								
	Minimum rotation (years)			Minimum isolation (m)			Off- type (max%)			Pure seed (min%)			Germination (min%)			Moisture content (max %)		
	Breeder/pre basic	Basic	Certified	Breeder/pre basic	Basic	Certified	Breeder/pre basic	Basic	Certified	Breeder/pre basic	Basic	Certified	Breeder/pre basic	Basic	Certified	Breeder/pre basic	Basic	Certified
Sorghum	3	2	2	400	400	200	0.01	0.02	0.02	99	99	98	90	85	80	12	12	12
Maize	2	1	1	400	400	300	0.1	0.1	0.1	99	99	98	90	85	85	13	13	13
Wheat	2	1	1	5	3	3	0.03	0.05	0.1	98	98	97	90	90	85	13	13	13
Barley	2	1	1	5	3	3	0.03	0.05	0.2	98	98	97	90	90	85	12.5	12.5	12.5
Faba bean	2	1	1	200	150	100	0.2	0.2	0.5	99	98	97	85	80	75	12	12	12
Tef	2	1	1	10	5	5	0.01	0.02	0.1	98	98	97	90	85	80	11	11	11
Field Pea	2	2	1	10	5	3	0.2	0.2	0.5	99	98	97	85	80	75	12	12	12
Chickpea	2	2	1	10	5	3	0.2	0.2	0.5	99	98	97	85	80	75	12	12	12
Haricot bean	2	2	1	10	5	3	0.1	0.1	0.2	99	98	97	80	75	70	12	12	12
Soya bean	2	1	1	10	5	3	0.1	0.1	0.2	99	98	97	80	75	70	12	12	12
Tomato	2	2	2	100	100	50	0.1	0.1	0.2	98	98	97	85	85	75	10	10	10
Onion	3	3	3	1000	700	500	N.S	0.01	0.02	98	97	97	75	75	75	9	9	9
Linseed	3	2	1	400	300	200	0.2	0.2	0.5	99	98	97	90	87	85	8	8	8
Sesame	3	2	1	100	50	50	0.1	0.2	0.3	99	98	97	90	87	85	8	8	8

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