

Vegetable Seed Production Good Practice Guide

JANUARY 2017

PREPARED BY

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PURPOSE AND DISCLAIMER

This guide is designed to assist stakeholders; seed companies and seed producers, who are engaged in vegetable seed production and sales, to ensure the integrity of the production chain from stock seed to commercial seeds. These commercial seeds are sold by seed companies to distributors and growers all over the world. An additional aim of this guide is to safeguard Intellectual Property Rights (IP) and other rights of the parental lines in general. For this, best practice includes: selecting a reliable Seed Producer, negotiating a verifiable seed production quota, sending stock seed, following the production of commercial seeds, shipping it to the Seed Company and receipt of the seed at their end.

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This Guide is not meant to be a substitute for the ISF Rules and Usages for the Trade in Seeds for Sowing Purposes, but rather to complement this with some practical examples. You are strongly advised to refer to the ISF Rules and Usages for the Trade in Seeds for Sowing Purposes in the production contract signed by the contracting parties.

This Guide is flexible and its application will differ according to the size, nature and complexity of the organization and the vegetables involved. The Guide is not exhaustive. It is the responsibility of any user of this Guide to consider the user's specific circumstances when developing a process specific to its organization, and in meeting any applicable legal requirements.

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INTRODUCTION

Plant and seed multiplication for crops is a continuous process in which products are grown according to defined standards and requirements to ensure genetic identity, maintain varietal purity, and meet certain quality standards before distribution to growers and consumers. In many countries, seed multiplication is part of a legally sanctioned system for quality control of this seed production.

The entire breeding process, from new entries to a vegetable breeding program and their cross with existing material until the development of parental lines, is managed as a controlled process. The parental line seeds are normally insufficient to produce sufficient seed for commercial sales and the parental line seeds are multiplied to sufficient quantities to be able to start commercial seed production. Seeds used for commercial seed production are commonly called stock seed.

In those countries where seed registration and/or certification are required by law, there are generally four recognized stages of seed multiplication: breeder seed, foundation seed, registered seed, and certified seed. These are also recognized by the OECD Seed Scheme as Pre-Basic (breeder seed), Basic (Foundation/Registered seed), and Certified seed. Even in countries that do not require formal registration and certification, the following definitions are generally recognized as the different stages of seed multiplication (steps and terminology can be different in vegetable seed companies). Breeder seed (related to the process of creating new fixed lines) is directly controlled by the originating or sponsoring plant-breeding organization. The first increase of seed breeder's parental lines (fixed lines) is usually referred to as foundation seed; it is handled to maintain specific genetic identity and purity. Foundation seed is used in most

organizations to create stock seeds that are used as the base for commercial seed, produced by the breeder originator company, or outsourced to seed producers.

The guidance in this document is intended to be flexible and its application will differ according to the size, nature, and complexity of the organization involved, as well as the products being produced. Common throughout the entire process, there is an emphasis on the importance of product identification and traceability as well as documentation and governance.

The ISF and APSA represents the interests of the seed industry at a global level and regional level by engaging with public and private institutions to facilitate international seed trade. Their working group Vegetable Seed Production and the special interest group Vegetable and Ornamentals were established in recognition of the need to produce seeds according to defined industry standards. These groups also have the aim of establishing industry-wide guidelines in order to assure quality seeds for all seed companies and creating the proper communication tools for all stakeholders.

QUALITY MANAGEMENT SYSTEMS (QMS)

In order to support good production practices it is highly recommended that seed companies and seed producers implement a Quality Management System (QMS). A properly maintained process-based and continuously improved Quality Management System is an important contributor to mitigation of risk around seed production and commercialization. A QMS is a collection of documented processes, procedures and work instructions reflecting the business of a company. The context of the QMS can be expanded to suppliers if they perform a specific service for the company. These documents, hence, inform employees and other stakeholders how certain processes and tasks and duties should be executed. Key elements of a QMS include processes to: 1) manage and control documentation, 2) address non-conformities; 3) trace and identify products; 4) train and measure competency of employees; 5) continuously improve systems and performance; and 6) audit and measure conformance to the system. Any mitigation measure involving changes of the set-up of processes or tasks should be included in the related documents.

The International Organization for Standardization (ISO) family of standards collectively provides a framework that an organization may use to develop, implement, and maintain a management system that incorporates a process for continual performance improvement while addressing the needs of interested parties. The ISO maintains the generally accepted standards for developing and implementing a QMS (ISO 9001:2015 and ISO 9000:2015). It requires a documentation system that contains the processes, procedures and standard operating procedures (SOPs) of the company controlled by a workflow allowing continuous improvement and accountability.

The QMS should include a record of employees' training which should be checked regularly by an audit process. The non-conformities and corrective action that are the result of this process should lead to improved documentation and re-training of staff.

What are the specific elements that have to be taken into account building a QMS with the purpose of managing vegetable seed production?

The integrity of the seed production chain

- Secure the identity of the stock seeds
- Prevent mislabelling
- Prevent errors in tracking
- Give clear directions of crop biology (e.g. strict cross-pollinator, strict self-pollinator)
- Prevent unwanted pollen transfer (e.g. clothing, equipment)
- Seed production structure definitions (e.g. open field, containment facility)
- Prevention of seed admixtures
- Status of QMS implementation

Determine critical control points

- Transport of stock seeds to the Seed Producer

- Unbroken chain of labelling, movement and storage of seeds
- Proper young plant production and planting
- Confirmation of reproductive isolation
- Right male /female pollination
- Extraction, cleaning, disinfection and drying of seeds
- False safe combining of seed lots
- Transfer of seeds for conditioning, packaging storage and transport

Child labour

Child labour is a violation of fundamental human rights. It has been shown to hinder children's development, potentially leading to lifelong physical or psychological damage. International labour standard sets the general minimum age for admission to employment or work at 15 years. ISF/APSA and its members stipulate that all contracts include a specific clause stating that no child labour is allowed in the production of seeds.

SEED PRODUCTION GOOD PRACTICE

Good practice from the Seed Company's perspective

1. Selecting a reliable producer in a good production area

It is important for the Seed Company and the Seed Producer to achieve reliable crop production. For this it is of paramount importance that proper documentation exists on the interaction of the behaviour of the parental lines and the environment. This information should be enriched during the follow-up of subsequent seed production to continuously improve the information, allowing even more reliable (future) seed production. For the requisite interaction between the Seed Company and the Seed Producer it is important that:

- the Seed Company checks that the Seed Producer has a good reputation of professionalism and honesty.
- the Seed Producer preferably has a QMS system that shows that the growers are properly trained and provided with the right documentation to produce the commercial seeds.

2. Negotiating seed production quotas/contracts

The collaboration between the Seed Company and the Seed Producer needs to be formalized by a contract that stipulates the responsibilities and autonomy of each party in the production of the seeds. The roles of the Seed Company and Production Company are as follows.

- The Seed Company guarantees that it is the IP owner of the variety or authorized to produce the seeds of the variety.
- The Seed Company has ideally performed (a) trial production(s) before undertaking large scale production with a Seed Producer to be able to provide concrete information for commercial seed production.
- The Seed Company provides documentation explaining the growing characteristics of the parental lines to produce the commercial seeds including but not limited to:
 - a description of the parental lines allowing the Seed Producer to verify the right planting and possible off types. It includes the susceptibility to specific diseases
 - a description of the designated climate of optimal growing performance of the parental lines for the production of flowers allowing fruit set
 - the potential seed yield on the female plants under the given climate condition.
- The Seed Company does not mention the commercial name of the variety to produce, but refers to a production code. The production code is designed for the purpose of not leading to errors of interpretation.
- The production should always be sanctioned by a production contract to be signed by both parties. The contract includes as a minimum the specification of the final product to be shipped to the Seed Company in quantity and quality (germination, physical purity, genetic identity and purity), the price per seed quantity, the time of delivery and the conditions of shipment should be declared.
- The Seed Producer should agree that after completion of the production activities any remaining seeds (including stock seeds) will be returned to the Seed Company.

3. Sending shipments of stock seeds to the producer

The stock seeds being shipped to a Seed Producer will normally pass through numerous hands including but not exclusively the shipper, custom officers and plant quarantine employees in both countries. Each of the steps can lead to actions affecting the product integrity. It is, therefore, important that the following are adhered to.

- The Seed Company uses a concise coding system.
- On the seed package the crop species, the code of the variety, the lot number, the quantity of seeds in the packet (number of seeds, or weight and TSW) and quality information (batch/lot number, a germination percentage and date, genetic purity percentage) are clearly indicated. This should also be sent by separate document or email, as some producers repack and information could be lost. Secret coded indication on whether this is to be used as female or male can be considered.
- It should never be mentioned on the seed packet or in the shipping documentation whether it contains female or male seeds. This information should be sent separately (e.g. by email) to the Seed Producer.
- It is preferable to send more than one set of seeds in the same shipment (otherwise the quantity could indicate which one is to be used as female or male).

- Always ensure that the stock seed sent is free of diseases where seed is a pathway or any other diseases that could create phytosanitary problems, or problems in seed production.
- If the contract stipulates that the seed being produced should be free from certain seed borne diseases, it should be based on an agreed list of diseases and tests.
- The documentation mentions a reference person who can be contacted by the Seed Producer in case of information or content that can be interpreted differently.

4. Following production with the Seed Producer

It is good practice of the Seed Company to visit and/or follow up regularly the production with the Seed Producer. The frequency is determined by the Seed Company and the Seed Producer. However, critical control points specifically relate to the following.

- Verifying the information on the seed bags and the received documentation before sowing are identical
- Have two persons observing the combination of stock seed lots if performed before sowing
- Planting of the seeds (in nursery)
- Verifying tray identification
- Verifying tray identification and documentation delivered at growers
- Planting and plant stand of young plants
- Performing identity and purity check of lines (based on provided documentation by the Seed Company)
- Disease monitoring of fields
- Ensuring good isolation from neighbouring fields
- Pollen collection and pollination
- Fruit set and estimation of seed yield
- Harvesting
- Transport to extracting, cleaning, (disinfection), drying site
- Mixing of fruits before extraction
- The extraction, disinfection and drying process
- The mixing of seed lots to create a mother lot
- It is good practice to receive regular crop reports from the Seed Producer with pictures. It is important to study these reports and comment immediately if something is out of ordinary.

5. Receiving seed from the third party producer

It is important that the quality of the seed produced is assessed before shipping the lots. This is to prevent the transportation of lots that cannot be used by the Seed Company. It is hence important to:

- send a representative sample from the Seed Producer to the Seed Company before sending the entire seed shipment
- for the Seed Company to send instructions to the Seed Producer on how she/he would like to receive samples (individual lot, or blended lots), how many and which packaging
- for the Seed Company to test the seed for germination, genetic purity and seed health and confirm the results to the Seed Producer who then arranges the shipment of remaining seed.

Good practice from the Seed Producer's perspective

1. Acceptance of the Seed Company

- Seed Producer should check that the Seed Company has a good reputation of professionalism and honesty, and should ask for a statement of good reputation from the Seed Company in case of doubt.

2. Negotiation of seed production quota/contract

- Seed Producer's contract should stipulate that by signing the contract the Seed Company declares that he/she is the legal owner of the IP rights or authorised to produce seeds of the particular variety. If any doubt exists about this, the Seed Producer may indicate that the material could be subject to PCR testing.

- It is the responsibility of the Seed Company to ensure that all relevant technical information on a variety is made available to the Seed Producer to ensure optimal seed production results (parental descriptors, special agronomic practices required etc.).
- Ideally the Seed Producer together with the assistance and support of a representative of the Seed Company should propose a small-scale trial production for those varieties that have never been grown in the proposed production area.
- The production contract is signed by the parties agreeing all conditions and quality requirements agreed upon for production.

3. Selection of reliable growers in good and sustainable production areas

- After accepting a production contract from the Seed Company, the Seed Producer has to ensure he selects reliable experienced growers in an adequate production area.
- Care should be taken that the seed is sown according the client's protocol with the necessary splits between male/female lines.
- It is imperative that the growers get the proper instructions and training from the Seed Producer based on the protocols delivered by the Seed Company in order to produce a reliable seed crop.
- Optimal sowing times with the right windows for each line should be applied diligently for each variety.

4. Receiving of parental lines from the Seed Company

- The Seed Producer will receive the parental lines from the Seed Company.
- It is good practice to take a picture of the packets containing parental seed to make sure that the writing on the packet corresponds to documentation, and to that packets have not been tampered with. On any doubt take contact with the Seed Company representative indicated in the documents.
- Check the received weight and compare with the weight on the packing list.
- Always keep a sample of each parent line (if quantity permits) in case a problem of genetic purity or seed borne diseases arises later on.
- It is good practice to retest the germination of the parent lines as soon as received and report the result in case it is inconsistent with information received.
- Keep the information of the Seed Company confidential (limit the number of people who have access to this information), avoid any internal reference or communication about the seed companies or their varieties.

5. Follow-up of production with the Seed Producer

- It is good practice to provide regular feedback to the Seed Company about the ongoing production. Ideally once a month or on an ad hoc basis according to the Seed Company or as stipulated in the production contract.
 - Send to the Seed Company a report indicating sowing and transplanting dates, size of each field or number of transplanted plants, area where the field is located, and a name or code identifying each field.
 - Follow up the different agricultural activities.
 - Make sure isolation distance is kept as agreed in the production contract. It is considered good practice to indicate the GPS coordinates of the fields in the report, if available.
 - Immediately report deviating types/off-types from the variety description and be available to remove them upon request of the Seed Company. Administrate and report the number of removed plants in total.
 - Contact the representative of the Seed Company additional checks by specialist might assist the quality of the seed production
 - Follow up on the yield development.

It is good practice to request that the fields should be visited by Seed Company staff at critical phases during the seed production: sowing, planting, rouging of aberrant plants, harvesting and cleaning/disinfection/drying stage. Because these stages vary according to climate conditions during production, it is important to indicate in advance the best time for a planned visit.

6. Sending of produced seed to the Seed Company

- It is good practice to receive seed separately from each individual farmer producing the same variety.
- Representative samples have to be taken.
 - These samples should be tested for germination (in house or outsourced) and if vigour specifications have been agreed in the production contract.
 - Depending on the agreement with the Seed Company, the representative samples should be sent to the Seed Company either individually or grouped into composite sample and in size/weight/number of seeds as requested by the Seed Company after having tested the individual lots.
 - Depending on the agreement with Seed Company of breeder originator the other tests (genetic purity/seed health) are performed by either the Seed Company the breeder originator, by a third party, or by the Seed Producer.
- The produced seed should be packed in freight-worthy packages, with labels indicating clearly the crop species, the production code given by the Seed Company, the batch/lot number (from the Seed Producer's record), the quantity, and the quality results (from Seed Producer side). There should always be two labels (inside and outside the bag).

APPENDIX I –ALTERNATIVE MEASURES FOR IP PROTECTION

Measure	Advantage	Disadvantage
Separated male and female productions (male sites provides pollen to female sites). Male site managed by either Seed Company or Seed Producer (not individual growers).	<ul style="list-style-type: none"> Physically separated production locations. Both parents can't be acquired at once. 	<ul style="list-style-type: none"> Can cause organizational, planning and logistic at risks. Dispute on the root cause in case of impurity.
Pollen supply from seed company to production company instead of male seeds.	No access to male source for the Seed Producer/grower.	<ul style="list-style-type: none"> Phytosanitary constraints shipping pollen, quality risks in storage and transport. Dispute on the root cause in case of impurity, pollen shortage or low vitality of the pollen. Feasible for limited number of crops.
Use of concentrated homefarms instead of scattered growers.	Easier control and oversight.	<ul style="list-style-type: none"> Cost impact. More expertise required from Seed Producer. Risk reduction can be questioned Mostly the risk is from people understanding the business and value, which might be an increased risk here.
Fencing and guarded entry to protect unwanted people entering.	Advanced physical control and oversight.	<ul style="list-style-type: none"> Feasible for i.e. GSPP sites. Cost impact. Not for all crops. Could be "false sense of security" and even draw more attention.
No sign of the origin of seed company at the site. No logo or name on the package and on the carton box or documents. Don't wear seed company clothing (shirts, caps, pens etc) when visiting production sites.	More difficult to link production location with particular seed company	None
Risk analysis on the genetics. Don't place high value genetics with valuable new traits in risk areas. Don't produce varieties and sell in the same country.	Less attractive for local people as local varieties cannot be obtained in the production country	Less flexible in production option, more complex supply chain.