Seeds – saving & storage

Introduction

There are many reasons gardeners, growers and farmers tend to produce and their own seeds. Some of them include:

- to preserve local varieties
- to select for new types and lines that are better adapted to their environments (breeding)
- to reduce cost
- to exchange material (seeds) with others
- to maintain independence
- to learn and gain experience

The increased availability of commercial seed has resulted in a loss of practice and knowledge of what were once more common skills of growing plants out for seed production and saving the seeds. The lack of understanding of the new F_1 hybrids and their biology is particularly harmful, as farmers attempt to reproduce seeds from these F_1 hybrids that may be infertile or produce different traits from the original parents that are less favorable to the ones for which the hybrids were initially developed.

Learning Objectives

- Develop a basic understanding of seed production, when it is appropriate and what aspects to consider when saving seeds.
- Understand the basic distinction between open pollinated (OP) lines and F_1 hybrids
- Learn the correct terminology to use when talking about seeds.

Learning Outcome

Extension workers will learn how to properly collect, clean and store seeds. They will come to appreciate the complexities of seed production.

Materials

- flipchart or blackboard
- chalk or markers
- some packages of seeds (improved varieties, F_1 hybrids)
- examples of different plant products with seeds, either dry (legumes, lettuce, arugula etc.) or soft (tomatoes)
- sifters with different mesh sizes
- large sheet of paper
- knife
- clean water
- several glass jars
- mixing rods
- suitable surface for drying the seeds
- paper envelopes
- plastic bags
- air tight containers (either plastic or glass jars with lids)
During the class the students will practice collecting seeds from tomatoes and starting the fermentation. Another batch of seeds prepared in advance can provide material for the final parts (rinsing and drying).

**Lecture Notes and Lesson Plan**

Review the basic distinction between open pollinated (OP) lines and F₁ hybrids. Hybrid plants result from a genetic cross. While the process occurs abundantly in nature, “hybrids,” “F₁ lines,” or “F₁ hybrids” are terms used specifically for seeds and plants that are the result of first generation cross-breeding between specific parental lines raised for commercial purposes. Because of their genetic background and the way they are produced, plants grown using seed from an F₁ plant will not be just like the hybrid parents; instead, they will be a completely new combination of the good and bad traits of the plants that were initially crossed. Open pollinated lines/varieties will maintain the same characteristics over generations if they are handled properly. This is called maintaining the line “true to type.”

We can keep the seed from open pollinated plant varieties. We cannot keep the seed from hybrids. Tomatoes, peppers, beans and peas are good choices for seed saving. These plants have flowers that are self-pollinating, and seeds that require little or no special treatment before storage. Some species tend to self-pollinate more than others, such as lettuces, legumes, and those from the Solanaceae family (tomato, pepper, eggplant). Plants in these groups can still be cross-pollinated either by wind or insects, but less frequently. Seeds from biennial crops such as carrots or beets are harder to save, since the plants need two growing seasons to set seed.

Plants with separate male and female flowers, like corn and vine crops, may cross-pollinate, so it is difficult to keep the seed strain pure. Cucumbers, melons, squash, and pumpkins can all be cross-pollinated by insects. Although the quality of the current crop will not be affected, seeds from such a cross will grow into vines with fruit unlike that of the parent plant—often inferior in flavor and other characteristics. On the other hand, we eat corn seeds (the kernels), so the cross pollination between types or varieties of corn will directly affect the crop in the same growing season.

If we are planning to keep seeds from OP varieties, it is important to keep the different varieties separate in the garden. This is also helpful when growing species that can cross-pollinate. This can be done through:

- space isolation (distance)
- time isolation (flowering time is different)
- physical or mechanical isolation (bags, net cages, row covers)

Different species require different growing distances. For mainly self-pollinating species, distances are shorter (7-10 m). Cross-pollinating species need more distance. Peppers require about 170 m and squash plants even more. For this reason, in a garden the use of physical barriers to pollination...
is more practical. Independently from the natural pollination of the species (insects or wind), it is possible to manually pollinate plants.

For seed collection always choose the best quality plants, flowers, fruits and vegetables. Consider productivity, flavor, vigor, adaptability to local conditions, disease or stress resistance traits. Weak or diseased plants should be avoided for the purpose of seed production and collection.

After growing healthy plants that produce quality seeds, you must harvest and store the seeds properly to keep them viable until you are ready to plant them. For best results your seeds should be harvested at the right time, properly cleaned and dried and then stored under conditions favorable to their long-term health. Some seeds also need to be ‘fermented’ before cleaning and drying.

**Part I - Seed separating cleaning methods**

*Seed harvesting and cleaning techniques fall into two main categories according to whether the fruits and seeds are dry or wet when mature. Cleaning wet seeds requires washing to clean the seeds and to separate them from the surrounding pulp.*

**Wet processing**

1. remove the seeds from the fruit
2. wash to clean the seeds
3. dry

For seeds that do not need to be fermented, scoop the seeds from the fruit, pulp and all. Pour the seeds and pulp into a large, sloping bowl and add water. Healthy seeds will sink to the bottom of the bowl, while dead seeds and most of the pulp will float. Use your fingers to gently separate all the seeds from the pulp.

Then, to remove the pulp and dead seeds, carefully pour the extra water with the floating pulp and dead seeds from the bowl. Pour quickly enough for dead seeds and pulp to pour off the top, and slowly enough so that the heavier, good seeds remain safely on the bottom. By repeating this rinsing and pouring process several times, the seeds can be made very clean, which prevents them from sticking to whatever surface you dry them on.

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**Quick Tips**

**Tomato seeds:** Allow the fruits to fully ripen on the plant and scoop out the seeds and pulp. Place in a jar of water and leave for a few days, swirling them in the water daily. After a few days, the seeds should have come free from the pulp and sunk to the bottom. Pour the liquid away and rinse the seeds. Leave them to dry on a paper towel and, when fully dry, store in an envelope in a cool, dry place.

**Pepper seeds:** Harvest seeds from peppers after the fruit has fully ripened on the plant and started to wrinkle. Remove the seeds from the peppers and spread them out on paper towels to dry. When fully dry, store in an envelope in a cool, dry place.

**Peas and Beans:** Allow the pods to ripen on the plant until they are dry and start to turn brown. Remove the pods from the plant and spread them out on a tray indoors, to dry. Leave them for at least two weeks before shelling the pods or wait until you are ready to sow the seeds the following spring.
**Wet fermenting** method is used with soft fruits and generally those fruits that will naturally drop on the ground and ferment. Fermentation helps to prevent possible seed-borne diseases and removes chemicals inhibiting germination. It also makes them more permeable to water. Fermentation is needed for tomato seeds and can also benefit squash family and eggplant seeds, though more care must be taken with these to avoid premature sprouting. Ferment squash seeds for only a day-and-a-half or so, eggplants a little longer:

1. Recover the seeds with part of the pulp of the fruit.
   - Cut large fruits open and scrape out seeds.
   - Small fruits can be crushed or smashed to remove the seeds.
2. Put the seeds with pulp in a plastic container or glass jar.
3. Add water - no more than a third of the volume, so as not to dilute the mixture too much, which can slow fermentation.
4. Put in an undisturbed spot and allow fermentation to proceed for 2-3 days, stirring occasionally. If they are left too long they will begin to germinate and will not be able to be stored.
5. When you notice bubbles and a mold covers the surface, add two volumes of water and stir well. The good seeds will settle to the bottom.
6. Separate the mold and the debris by straining.
7. Wash the seed with abundant clean water.
8. Dry the seeds on plastic, glass, screens, stone or similar. Cloth is not recommended because it will be difficult to remove the seeds. This will also happen with paper, but to a lesser degree.
9. Spread the seeds and turn them gently during the day. Make sure temperature is about 32°C, never over 38°C, avoiding direct sun.

**Dry processing and winnowing**

Seeds produced in pods or husks are usually left to dry on the plant and harvested dry. Some species will naturally disperse their seeds once they are dry by shattering the structures that contain them. Seeds do not mature all at once, so you may need to pick the dry pods on a daily basis to avoid losing the seeds. Or you can bag the seed heads by putting a paper bag tied at the base over the plants to capture the seeds. Old row-cover materials or small mesh also work well for bagging.

- **Threshing** is the process that breaks the seeds free from their coverings.
- **Winnowing** separates the chaff and debris from the clean seeds.

*Show the samples and have the students collect the seeds and clean them.* Wooden sticks can be used as rolling pins to help crush pods and free the seeds. Depending on the types of seed, a sifter of different mesh size can be used to clean the seeds. Beans and pea seed are ready to harvest if they crack when hit with a hammer.

**Part II - Seed disinfection and treatment**

Review Benefits of Seed Treatment:
1) Prevents spread of plant diseases
2) Protects seed from seed rot and seedling blights
3) Improves germination
4) Provides protection from storage insects
5) Controls soil insects.

**Chemical treatments**

Chemical treatment refers to the application of chemicals to seeds so as to disinfect and disinfect them from seed-borne or soil-borne pathogenic organisms and storage insects.

*Review some specific treatments:*
• **Chlorine treatment** - is effective to remove bacterial and fungal pathogens from the seed surface. Unlike hot water treatment, it does not eliminate pathogens within the seed. (Protocol for chlorine treatment is given in the unit on seed quality and germination test.)

• **Tomato bacterial canker** – soak seed in 1% sodium hypochlorite solution for 20-40 min or 10% hydrochloric acid for 1-2 hours, rinse well and dry immediately.

• **Bacterial spot** for both tomato and pepper seeds – soak in 1.3% sodium hypochlorite solution for 5 min, rinse well and dry immediately.

**Hot water treatment**

Hot water treatment is a valuable technique for seed savers and organic seed producers. It will disinfect seeds effectively, controlling several seed-borne diseases and eliminating most pathogen bacteria on or within the seed. It is not recommended for cucurbit seeds (squash, gourds, watermelon, zucchini, pumpkins, etc.) that are easily damaged by hot water.

Hot water treatment is probably out of reach for most home gardeners and farmers, as it is expensive and requires a lab quality water bath with a thermostat and careful adherence to prescribed temperature and length of treatment.

1. Place seeds loosely in a cotton or nylon bag.
2. Pre-warm for 10 minutes at 37°C in water.
3. Move to the water bath at the recommended temperature for the prescribed time.
4. Once treated, place immediately in running water for a few minutes to cool down fast.

**Part III – Storage**

*Review Storage guidelines*

• Store only thoroughly dried seeds, to avoid mold in storage.

• Don’t allow seed to become humid after initial drying.

• Keep the storage temperature as low and as uniform as possible.

• Keep the storage area as dry as possible.

• Store seeds in paper envelopes inside air tight containers.

• Label all containers with variety, date and any other important information.

• Stored seed is best used the following year.

• When removing seeds from cold storage, leave containers closed while the seeds reach room temperature, to avoid condensation.

**Table 1 – Hot Water Treatment for Selected Seed Types**

<table>
<thead>
<tr>
<th>Seed</th>
<th>Temp (°C)</th>
<th>Time (min)</th>
<th>Diseases controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broccoli, cauliflower, collard, kale, kohlrabi, turnip</td>
<td>50</td>
<td>20</td>
<td>Alternaria, blackleg, black rot</td>
</tr>
<tr>
<td>Brussel sprout, cabbage</td>
<td>50</td>
<td>25</td>
<td>Alternaria, blackleg, black rot</td>
</tr>
<tr>
<td>Celery</td>
<td>48</td>
<td>30</td>
<td>Early blight, late blight</td>
</tr>
<tr>
<td>Eggplant</td>
<td>50</td>
<td>30</td>
<td>Phomopsis, anthracnose</td>
</tr>
<tr>
<td>Pepper</td>
<td>50</td>
<td>25</td>
<td>Bacterial spot, rhizoctonia</td>
</tr>
<tr>
<td>Tomato</td>
<td>50</td>
<td>25</td>
<td>Bacterial canker, bacterial spot, bacterial speck</td>
</tr>
<tr>
<td>Tomato</td>
<td>55.5</td>
<td>30</td>
<td>Anthracnose</td>
</tr>
</tbody>
</table>
Concluding Activities

- Practice water bath treatment and chemical treatment of seeds.
- Have seeds ready to store. Have students pack and label them for storage. If possible, allow students to take a jar with them.

Assessment questions

1) What are open pollinated varieties?
2) Can we keep seeds from open pollinated varieties for planting next season?
3) When should we avoid producing our own seed?
4) What plants should we use to collect seeds for the next season?
5) How should we store seeds?

Glossary

Open-pollinated seed is seed produced as a result of natural pollination by insect, bird, wind, humans, or other natural mechanisms. As long as pollen is not shared between different varieties within the same species, then the seed produced will remain true-to-type year after year.

F₁ hybrid (or Filial 1 hybrid) - the first filial generation of offspring of distinctly different parental types. F₁ hybrids are used in genetics and selective breeding. The offspring of distinctly different parental types produce a new, uniform phenotype with a combination of characteristics from the parents.

Other Resources

Saving Seeds
http://www.extension.umn.edu/garden/yard-garden/vegetables/saving-vegetable-seeds/

Vegetable Seed Treatment to prevent plant disease (1992)
https://ipm.illinois.edu/diseases/rpds/915.pdf

Definitions
http://ag.montana.edu/msga/text/General%20Information/definition%20of%20terms.pdf

Parts of this factsheet are adapted from University of Maryland Extension, Home and Garden Information Center
http://extension.umd.edu/hgie

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