

Multiplying Seed of Pepper Lines

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Introduction

These procedures will produce pure, high-quality seeds of any chili or sweet pepper (*Capsicum* spp.) line. "Pure" means the absence of seeds from other lines, cross-pollinations and off-types (plants that differ in appearance from the line being produced). "High-quality" means that the seeds will have a shiny tan seed coat, plump endosperm, high germination rate (at least 70%), and be free of debris and disease (Figure 1).



Figure 1. Differing qualities of pepper seed.

The requirements for producing pure, high-quality seeds include favorable climatic conditions, a suitable field, the proper equipment and good management practices.

Note: These procedures cannot be used to produce seeds from hybrid plants. Seeds saved from F₁ hybrids will produce plants that are inferior and not uniform. Special techniques, not described in this guide, must be used to produce F₁ hybrid seed.

Climate

Peppers grow best in the dry season with temperatures in the range 18–27°C for sweet peppers, 21–33°C for chili peppers.

The night temperature is especially critical in seed production. Generally, peppers will not set fruits if night temperatures remain above 24°C (for sweet peppers) or above 30°C (for chili peppers).

Field requirements

Ideally, select a field where the previous crop was a legume or a cereal. Avoid fields where the previous crop was pepper. This prevents the new seed crop from being contaminated with pollen or seeds from volunteer pepper plants.

Avoid fields where the previous crop was sweet potato or a Solanaceous crop (tomato, pepper, eggplant, and white potato). This prevents the build-up of diseases and insects.

Growing to maturity

Healthy plants produce healthy seeds. Guidelines on growing peppers are presented in two AVRDC International Cooperators' Guides: *Suggested Cultural Practices for Chili Pepper* and *Suggested Cultural Practices for Field Cultivation of Sweet Peppers*.

Isolation

Although pepper is classified as a self-pollinated crop, its out-crossing rate may sometimes exceed 90%. Cross-pollination is primarily caused by bees; therefore isolating the crop from bees is very important. Cross-pollination is less often caused by other insects (thrips and ants), and rarely by wind.

Optimum isolation can be achieved by growing the crop at least 200 meters away from other pepper lines, by covering the pepper plants with 16-mesh nylon nets to keep out bees (Figure 2), or by growing plants inside an enclosed greenhouse or screenhouse. Sweet and chili peppers will cross with one another.



Figure 2. Pepper grown under nylon net.

If optimum isolation is not possible, plant the crop on a large plot (at least one hectare). Plant tall barrier crops such as sugarcane, maize or sorghum around the pepper plot to restrict the movement of bees into and out of the plot. Collect fruits only from the central part of the plot. Even so, some contamination is likely.

To produce small amounts of seed, individual flower buds can be protected against insect pollination by wrapping them in cotton or gluing them shut before they open. Self-pollinated flowers can be marked by hanging a metal ring, paper clip or cardboard tag on the fruit stem.

Inspect each seed production plot twice—once before flowering and again just before harvest. Remove any off-type plants (this is called *roguing*). These off-types may arise from volunteer plants from previous crops, cross-pollination in the previous seed crop, seed mixtures, mutations (rare), or damage to the plant.

Harvesting

Harvest pepper fruits when their color indicates that they are ripe (usually red, but may be orange, yellow, green, brown or white, depending on the variety). Keep harvested fruits in a cool, dry place (25°C and 50% relative humidity [RH] is ideal) for a week to allow any slightly immature fruits to ripen fully. If you have more than one variety, keep fruits of each variety separated to avoid mixing the seeds during the seed extraction process.

Seed extraction

Chili pepper seeds may be extracted from fresh or dried (seven days at 40°C) fruits. Sweet peppers do not dry well, and seeds should be extracted only from fresh fruits. Seeds may be removed by hand (Figure 3) or by grinding the fruits (with dull blades to minimize seed damage) and separating seeds from fruits with a series of water washes (Figure 4).

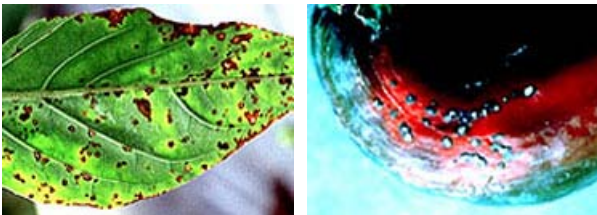


Figures 3 and 4. Seed extraction and washing.

The good seeds will sink. Fruit debris and any bad seeds will float and can be skimmed off. Repeat the washing until almost all of the debris has gone and only good seeds remain on the bottom of the container. Unless the seeds are to be sown immediately, they should be dried before storage.

Disease control

Several diseases can be transmitted in or on pepper seeds. The most important are bacterial spot (BS, caused by *Xanthomonas axonopodis* [previously *X. campestris*] pv. *vesicatoria*) (Figures 5 and 6) and diseases caused by tobamoviruses such as pepper mild mottle virus (PMMV)(Figure 7), tobacco mosaic virus (TMV)(Figure 8), and tomato mosaic virus (ToMV).



Figures 5 and 6. Symptoms of bacterial spot.



Figures 7 and 8. Symptoms of tobamoviruses.

Trained pathologists should inspect production fields twice — once before flowering and again just before harvest — and any suspicious-looking plants should be tested for the presence of these pathogens.

Seeds may also be treated for these pathogens after harvest. If BS is detected, treat freshly harvested seeds with acetic acid and Clorox. Soak seeds in 13 ml of acetic acid

per 1000 ml of water. Shake the seeds in the solution for four hours and rinse with water three times. Then soak seeds in 12.5 ml Clorox bleach per 1000 ml of water for 5 minutes and finally rinse under running water for 15 minutes. This treatment may decrease the germination rate of some varieties.

If tobamoviruses are detected, treat the seeds with trisodium phosphate (TSP, $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$). Half fill a cloth or 32-mesh nylon bag with freshly harvested seeds and hang it in a 10% (w/v) solution of TSP for 30 minutes, making sure the seeds are always covered by TSP. Transfer the sack to a fresh solution of TSP for two hours, again making sure the seeds are always covered. Rinse the sack in running water for 45 minutes, shaking the bag occasionally.

Several fungal pathogens such as *Colletotrichum*, *Rhizoctonia*, *Fusarium* and *Phytophthora* can also be transmitted on or in the seeds. The fungicides Captan or Benlate are typically used for treating seed surfaces. Follow instructions on the container label.

The TSP treatment described above is a good protective seed treatment if no information about seed pathogens is available. Seeds produced under optimum management, in an optimum environment, and which test negative for BS and TMV don't need any seed treatment.

Drying

After the seeds have been harvested and treated (if necessary), they should be dried quickly for the best germination and seedling vigor.

Spread the seeds on a screen for drying at 25°C for 24 hours, preferably in an air dryer (Figure 9). Then dry the seeds to about 7% moisture in a dryer at 20°C and 40% RH for one week before putting them into storage.

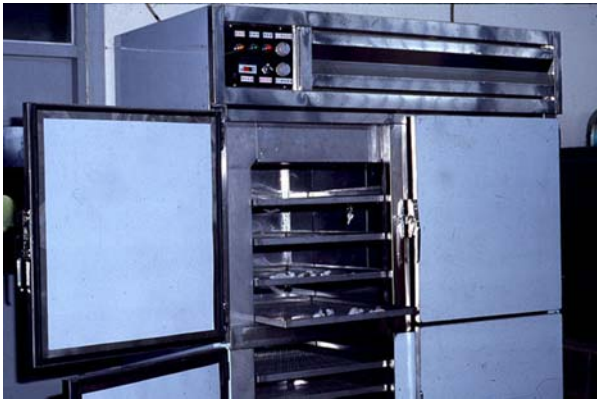


Figure 9. Air dryer.

Moisture content of fresh seeds can be measured as follows:

- weigh 100 seeds to be tested for moisture (original weight: w_o);
- dry them to 0% moisture (80°C for two days);
- weigh them again (final weight: w_f);
- calculate moisture content from $(w_o - w_f)/w_o \times 100$].

Storage

Store pepper seeds in manila envelopes (for small quantities), cloth or mesh bags, plastic containers, metal containers, foil envelopes or any other suitable container. The optimal container will be airtight, such as a sealed glass jar, metal can or foil envelope.

Label each container to show the variety name or code number, year, location of the seed production field, quantity of seeds in the container, measured germination rate, and percentage (by weight) of any impurities such as debris or weed seeds.

Store seeds under controlled conditions in order to maintain good germination. Small quantities can be kept in a refrigerator.

For larger quantities a special room with controlled humidity and temperature should

be used (Figure 10). For optimum pepper seed storage, the temperature should not exceed 25°C, and the sum of Celsius temperature + RH in the storage area should be less than or equal to 60 (for example, 18°C + 40% RH = 58).



Figure 10. Seed storage room.

Seeds stored under these conditions should still have germination rates of about 60% after five years. At AVRDC, some pepper seeds have been stored for more than 10 years under these conditions, and germination rates are still close to the original levels.

Testing

Conduct grow-outs to determine the purity of the multiplied seed. A standard grow-out is 100 plants of a given variety. Use 10 plants of the same variety from the previous seed source as a check. Score each plant for morphological traits, such as cotyledon length and width; presence/absence of anthocyanin in the hypocotyl; days to anthesis; and fruit length, width, weight, and color. Plants that differ from the checks are noted as off-types, and should number 2% or less.

Test seed germination using standard International Seed Trade Association procedures (either the Petri dish or the rolled paper towel method) with four replicates of 100 seeds each. A germination rate of at least 70% is desirable for pepper seeds.