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THE OHIO STATE UNIVERSITY EXTENSION

Extension FactSheet

Plant Pathology, 2021 Coffey Road, Columbus, Ohio 43210

Hot Water Treatment of Vegetable Seeds to Eradicate Bacterial Plant Pathogens in Organic Production Systems

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One way plant pathogens are introduced into a crop is on infested seeds. Bacterial pathogens are particularly notorious for this method of spread. In general, the earlier a pathogen comes in contact with the crop, the greater the potential for a serious disease problem to develop. This is why it is very important to start with "clean" seeds (i.e. those that are free of pathogens). Bacterial pathogens on or within the seeds can be killed by treating the seeds with hot water.

When hot water-treating vegetable seeds it is critical to follow the instructions exactly, as seeds may be damaged by the treatment and/or the pathogen may not be completely eliminated. A few seed companies hot water-treat their seed prior to sale. Check all seed packages before applying the treatment to be certain that they have not hot water-treated the seeds. Seeds may be damaged if they are hot water-treated twice. In addition, old or poor quality seed can be injured by seed treatments. **Therefore, it is recommended that a small sample be treated and tested for germination prior to treating the entire seed lot (see method below).** The treatment should only be applied to raw seeds (without pelleting or films). Since seeds used in organic production systems are not treated with a synthetic fungicide to control fungal pathogens that cause damping-off, good cultural, biological and sanitation procedures are critical to prevent the introduction of these fungi. Such practices include:

1. Keeping the greenhouse CLEAN and not allowing seedlings, planting mix, or plants to come in contact with outside soil.
2. Only using well or city water to water seedlings and plants.
3. Using a pathogen-free planting mix. Mixes containing a high quality compost can be suppressive to *Pythium* and some other damping-off organisms.
4. Using an Organic Materials Review Institute (OMRI)-approved biopesticide if damping-off continues to be a problem.
5. Maintaining greenhouse environmental conditions that are optimal for seed germination but not for pathogen development. **Do not over-water seedlings, allow soil temperatures to become too cool, or overheat the greenhouse.**
6. If available, select disease-resistant varieties.

Hot Water Treatment

Properly used, hot water treatment kills most bacterial disease-causing organisms on or within seeds. This treatment is suggested for seeds of eggplant, pepper, tomato, carrot, spinach, lettuce, celery, cabbage, turnip, radish, and other crucifers. **Seeds of cucurbits (squash, gourds, pumpkins, watermelons, etc.) can be severely damaged by hot water and thus should NOT be treated.**

Instructions

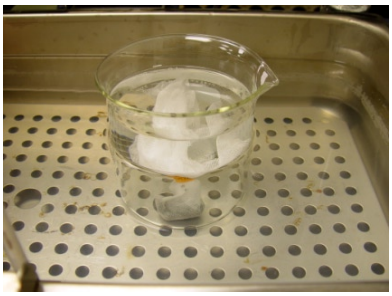
A. The following equipment and supplies are needed to hot water treat organic vegetable seeds:

- Water bath (preferably two: one for pre-warming and one for treatment; Sources: Fisher Scientific Co., Thomas Scientific, VWR Scientific)
- Thermometer
- Cotton cloth, cotton bags, or nylon bags
- Screen for seed drying

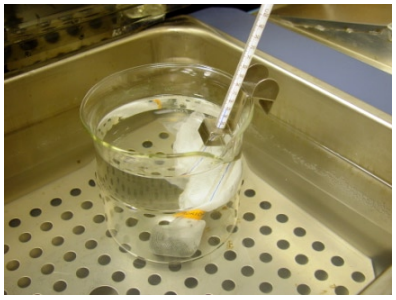
B. How to Hot Water-Treat Seeds

Step 1: Wrap seeds loosely in a woven cotton (such as cheesecloth) or nylon bag.

Step 2: Pre-warm seeds for 10 minutes in 100°F (37°C) water.



Step 3: Place pre-warmed seeds in a water bath that will constantly hold the water at the recommended temperature (see table that follows). **Length of treatment and temperature of water must be exactly as prescribed.** If water is too hot or treatment is too long, seeds may be damaged.



Type of seeds	Water temperature		Minutes
	°F	°C	
Brussels sprouts, eggplant, spinach, cabbage, tomato	122	50	25
Broccoli, cauliflower, carrot, collard, kale, kohlrabi, rutabaga, turnip	122	50	20
Mustard, cress, radish	122	50	15
Pepper	125	51	30
Lettuce, celery, celeriac	118	47	30

Step 4: After treatment, place bags in cold tap water for 5 minutes to stop heating action.

Step 5: Spread seeds in a single, uniform layer on screen to dry.

How to Test for Seed Germination After Hot Water Treatment

1. Mix seeds thoroughly in each seed lot and count out 100 seeds per seed lot.*
2. Treat 50 of the seeds exactly as described in the fact sheet.
3. After treated seeds have dried, plant the two groups of seeds separately in flats or pots containing planting mix according to standard practice. Label each group as "treated" or "untreated".
4. Allow the seeds to germinate and grow until the first true leaf appears (to allow for differences in germination rates to be observed).
5. Count seedlings in each group separately.
6. Determine the percent germination in each group:

$$\text{percent germination} = \frac{\text{number of seedlings emerged}}{\text{number of seeds planted}} \text{ (X 100)}$$

7. Compare percent germination in each group: they should be within 5% of each other.

* If seed supply is limited, use a smaller number (at least 30) of seeds to test germination.

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