Heat treatment of Seeds: A Component of Bacterial Disease Management
Integrated Management Plan for Bacterial Pathogens of Tomato, Pepper, and Brassica Crops

1. Field rotation – 4 years without host crop.  
   *Ensure complete decomposition of host material.*

2. Clean seed - prevents re-introduction of disease.  
   *Clean seed yourself (heat-treat) or purchase plants from a source that does.*

   *All surfaces should be sterilized prior to transplant production.*

4. In-field practices – limit spread, if disease is present.  
   *Sanitize re-used stakes, avoid fields when wet, work from youngest to oldest plantings.*
Common Bacterial Infections of Tomato

Bacterial Speck (*Pseudomonas*) – dark lesions on leaves, dark blisters on fruit.

Bacterial Spot (*Xanthomonas*) – dark lesions on leaves, dark, scabby lesions on fruit. Can start on or spread to peppers.

Bacterial Canker (*Clavibacter*) – dark lesions on leaves starting at the edge, light blisters on fruit, cankering of branches. Can kill plants.
What makes bacterial canker different?

• Bacterial canker can become systemic in tomato plants.

• The organism may be present within the seed coat, not just on the outside.

• Chemical (calcium or sodium hypochlorite) treatment of seed is not always reliable.
How do we get these infections?

The first canker infection on the farm is typically introduced through infected seed or plants.

Once the disease has been introduced on the farm, it can recur when rotation or sanitation practices are not adequate OR through new infections on seed or plants.

The canker organism is very difficult to detect on seed at low levels and can still result in a field epidemic.

Plants have no symptoms for 6-8 weeks or longer!
Other seed-borne bacterial infections that may be managed with hot water treatment include:

- Black rot
- Peppery leaf spot

These diseases are becoming more prevalent in New Jersey with increased culture of “exotic” brassica varieties.
Start with clean seed that is free of disease organisms!

Seed that is purchased commercially is generally free of pathogens. Seed companies test for these, but in some instances, bacterial organisms can be present at levels below our ability to detect. Therefore, heat treatment is advisable. Heat treatment can eliminate bacterial canker from within the seed coat as well as organisms on the seed surface. Heat treatment is acceptable in organic production systems.
Using fiberglass screen for heat treating seed.

1. Cut screen piece large enough so that the seed lot fits loosely inside.

2. Fold once, fold and staple two sides, leaving the third open so that seed may be inserted.

3. Add seed, fold and staple final side. Add a marker with seed name or code (plant tag with permanent marker shown here).
Using #4 cone-style coffee filters for heat treating seed

1. One cone-style filter and a weight (quarter shown here) to prevent floating.

2. Place seed inside, no more than half full. Include weight.

3. Fold and staple top. Add a marker with seed name or code (plant tag with permanent marker shown here).
Various types of tea infusers may be used for small amounts of seed.

When using these, seed must be rinsed back out onto screen in order to prepare for drying.

The seed may be tapped out of the screen onto paper towels for transport, if necessary.
Ozone generator and air pump

The ozone generator (top, left) is used to purify water in the baths between batches of seed. The tube is an air dryer attached to the intake side of the generator.

The aquarium pump (above) is used to circulate water in the hot bath during treatment. The bubble stone may be switched between units. Note the check valve in the hose, preventing moisture from entering pumps.

Full setup (below, left).
Heat Treatment of Seed

Place all seed to be treated into containers. LABEL EACH CONTAINER!

Only heat treat seed that will be used during the current season. Check seed packets for treatments that may have been applied at the source. Do not heat treat seed that has been heat treated by the company. Do not attempt to heat treat pelletized seed.
Hot-Water Seed Treatment
From S.A. Miller, Ohio St. Univ.

Protocol for Tomato Seed:
Preheat seed for 10 min. at 100°F (37°C).
Transfer to 122°F (50°C) for 25 min.

Cool seed immediately and dry completely prior to sowing or re-packaging. Seed may be treated with fungicidal dust when dry.
Sanitation Practices - Greenhouse

Prior to beginning production, growers should:

   Eliminate all weeds, and remove debris from greenhouse.

   Sanitize ALL greenhouse surfaces. Useful materials include Q-salts (Greenshield, Physan, etc.), hydrogen dioxide (Zerotol), chlorine producing materials (Virkon, Clorox, etc.).

   Consider treating transplants with anti-bacterial agents like: streptomycin (anti-biotic), Oxidate (hydrogen dioxide), copper hydroxide, or Phage (viral antagonist).
Sanitation Practices - Field

Recommended practices included:

- Three year rotation
- Chlorine treatment of stakes*
- Chlorine used in tying and pruning to sanitize wands and gloves
- Anti-bacterial program on plants, including copper post-transplant
- Avoid fields when wet, and work from youngest to oldest plantings

Undecomposed debris

Sanitizing old stakes
“Sterilizing Stakes”

- Clean off dirt as much as possible.
- Submerge in water adjusted with at least 5% of standard Clorox (5.25%) or higher concentration.
- Chlorine solution should remain below pH 6.8.
- Allow stakes to remain in the bath for at least 30 min. (longer is better).
- Add more Clorox (or other chlorine product) every few hours as long as you are using it. If the water is to be used the next day, add more chlorine then as well.
- Penetration into the wood is probably the key to success.
In northern New Jersey, frequent (although not yield limiting) infections occurred on a small farm where scarce land prevents longer rotations, and horsenettle is a significant weed problem.
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