Bacterial Disease Management in Vegetable Transplant Production

Melanie Lewis Ivey
Department of Plant Pathology and Crop Physiology
LSU AgCenter

Diseases of Vegetable Seedlings

- **Bacterial Diseases**
  - Bacterial spot, speck, canker (tomato)
  - Angular leaf spot (cucurbits)
  - Black rot, peppery spot (cole crops)
  - Fruit blotch (watermelon)
  - Bacterial leaf spot (lettuce)

Vegetable Seedling Disease Management

- **Establish an Integrated Pest Management (IPM) Program**
  1. Start with clean seed or disease-free transplants.
  2. Select disease resistant varieties.
  3. Use good cultural practices.
  4. Use crop protectants.

Managing Bacterial Diseases in Vegetable Seedlings

- Many are seed-borne:
  - Tomato: bacterial canker, spot and speck
  - Pepper: bacterial spot, Syringae seedling blight and canker
  - Cole crops: black rot, peppery spot
  - Cucumber: angular leaf spot
  - Watermelon: fruit blotch

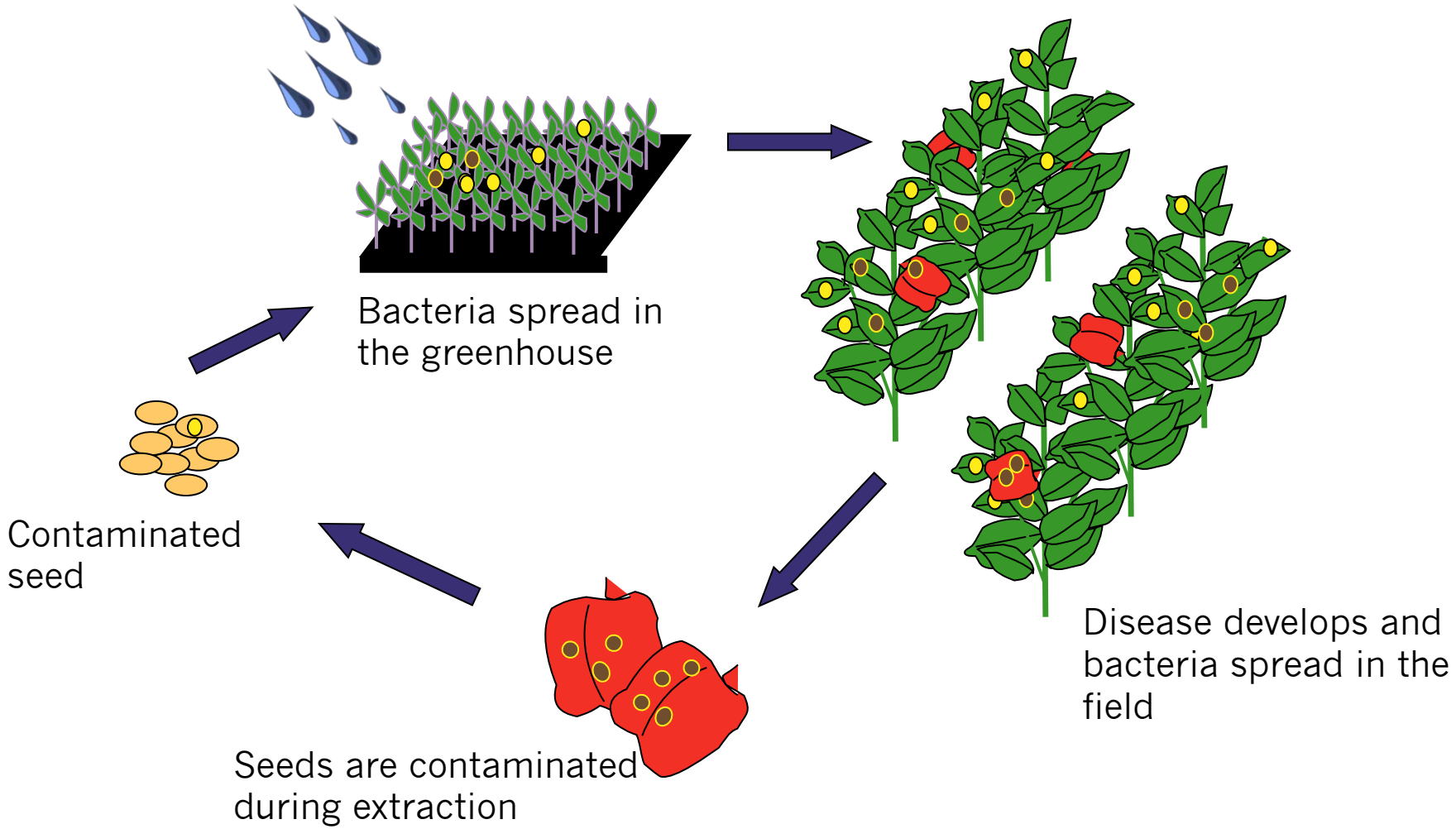
Bacterial Fruit Blotch
L.W. Jett, University Missouri

Syringae Seedling Blight

Tomato Bacterial Spot

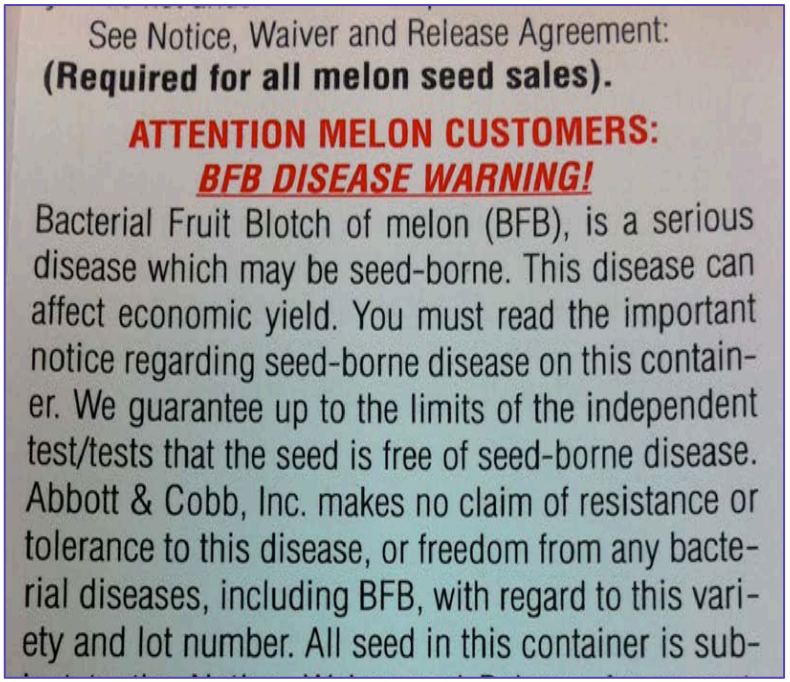
Black Rot
C. Smart, Cornell University

Seedborne Bacterial Disease Cycle



Use Clean Seed or Disease-free Transplants

- Always use certified seed
  - Seed should be pathogen tested
  - Ask for proof of certification
- Always purchase disease-free transplants
  - Ask to review transplant production practices
  - Ask for proof of certification


See Notice, Waiver and Release Agreement:
(Required for all melon seed sales).

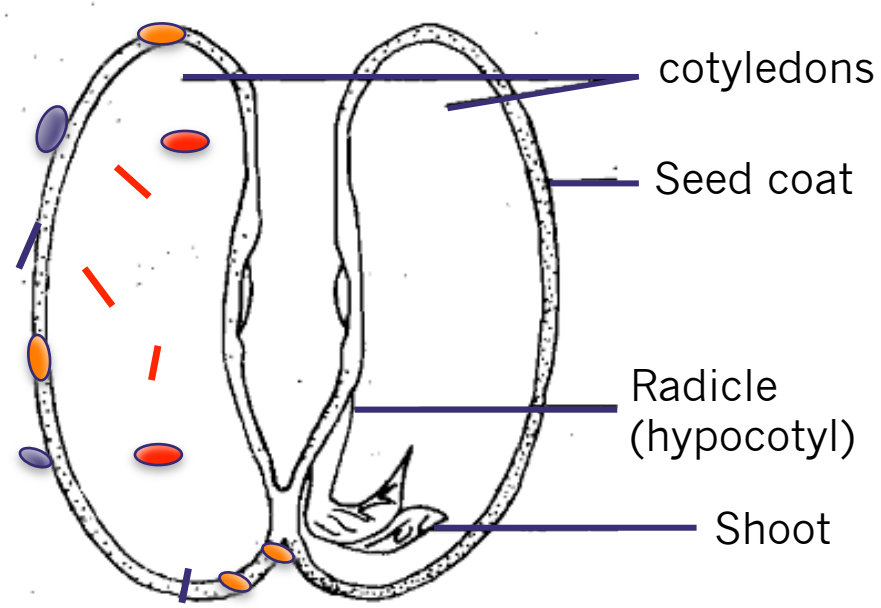
ATTENTION MELON CUSTOMERS:

BFB DISEASE WARNING!

Bacterial Fruit Blotch of melon (BFB), is a serious disease which may be seed-borne. This disease can affect economic yield. You must read the important notice regarding seed-borne disease on this container. We guarantee up to the limits of the independent test/tests that the seed is free of seed-borne disease. Abbott & Cobb, Inc. makes no claim of resistance or tolerance to this disease, or freedom from any bacterial diseases, including BFB, with regard to this variety and lot number. All seed in this container is sub-

Seed Disinfestation

- Two groups of sanitizers:
  - Eradicative
  - Protective
- Follow sanitation instructions exactly
- Pre-test a subset of seed (100 seed) before treating an entire seed lot



Seed Disinfestants for Raw Vegetable Seed

Disinfestants	Pathogens	Seed Surface	Seed Coat	Embryo
Hot Water	Bacteria Fungi	✔	✔	✗
Chlorox	Bacteria Viruses*	✔	✗	✗
Hydrochloric Acid	Bacteria	✔	✔	✗
Trisodium phosphate	Viruses*	✔	✗	✗

*Seed transmitted viruses only

Look for our *new* chapter on seed disinfestants and protectants in the *2014 Louisiana Plant Disease Management Guide*!

Clorox Treatment of Seed

- Suitable for many seed types including
  - Pepper, tomatoes
  - Cucumbers (not other cucurbits)
- **NOT** suitable for:
  - Coated seed
  - Pre-treated seed
- Store seed dry and sow within 2 weeks

•1 part clorox
•4 parts water
•1 drop surfactant

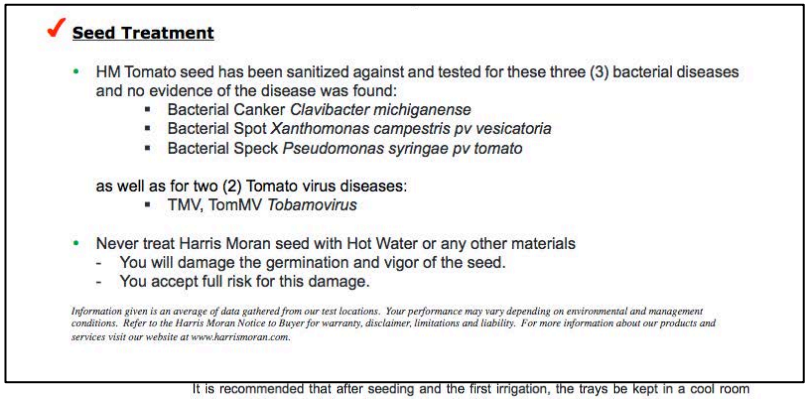
•Agitate seed for one minute
•1 gallon treatment/1 lb seed

•Rinse in cold water for five minutes

•Air dry seeds in a single layer

Hot Water Treatment of Seed

- Best suited for small-seed types
  - Tomatoes, cole crops, lettuce
- **NOT** suitable for:
  - Coated seed
  - Pre-treated seed
- **NOT** recommended for cucurbits
- All seed must be pre-warmed
  - 100°F for 10 min
- All seed must be cooled



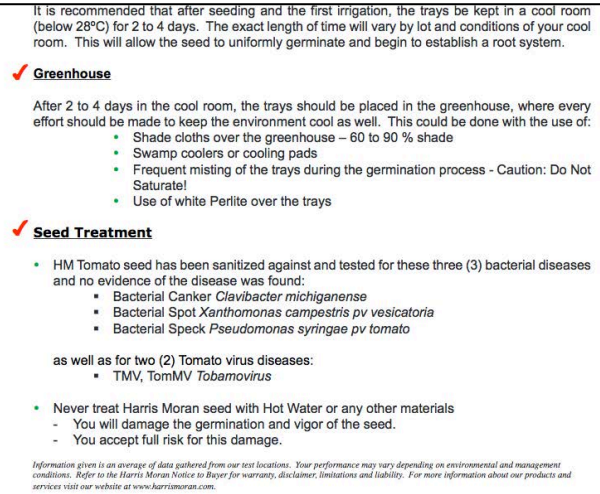
✓ **Seed Treatment**

- HM Tomato seed has been sanitized against and tested for these three (3) bacterial diseases and no evidence of the disease was found:
  - Bacterial Canker *Clavibacter michiganense*
  - Bacterial Spot *Xanthomonas campestris pv vesicatoria*
  - Bacterial Speck *Pseudomonas syringae pv tomato*

as well as for two (2) Tomato virus diseases:
  - TMV, TomMV *Tobamovirus*

- Never treat Harris Moran seed with Hot Water or any other materials
  - You will damage the germination and vigor of the seed.
  - You accept full risk for this damage.

Information given is an average of data gathered from our test locations. Your performance may vary depending on environmental and management conditions. Refer to the Harris Moran Notice to Buyer for warranty, disclaimer, limitations and liability. For more information about our products and services visit our website at www.harrismoran.com.



It is recommended that after seeding and the first irrigation, the trays be kept in a cool room (below 28ºC) for 2 to 4 days. The exact length of time will vary by lot and conditions of your cool room. This will allow the seed to uniformly germinate and begin to establish a root system.

✓ **Greenhouse**

After 2 to 4 days in the cool room, the trays should be placed in the greenhouse, where every effort should be made to keep the environment cool as well. This could be done with the use of:

- Shade cloths over the greenhouse – 60 to 90 % shade
- Swamp coolers or cooling pads
- Frequent misting of the trays during the germination process - Caution: Do Not Saturate!
- Use of white Perlite over the trays

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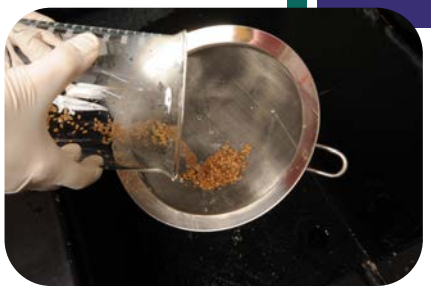
Seed*	Temperature (°F ± 1)	Minutes
Tomato, cabbage, eggplant	122	25
Collard, cauliflower, broccoli	122	20
Mustard, radish	122	15
Pepper	125	30
Lettuce, celery	118	30

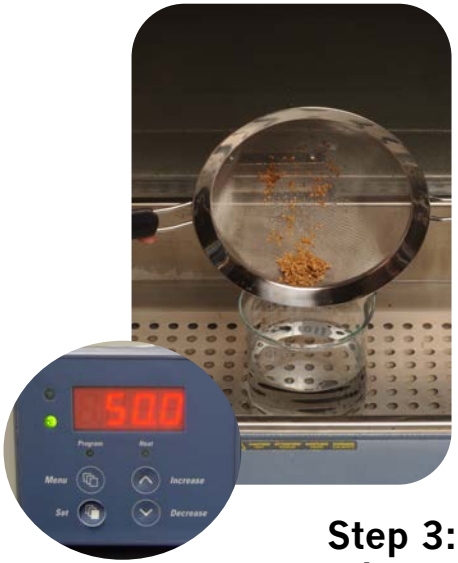
*Conditions for addition vegetable seed are listed in the *2014 Louisiana Plant Disease Management Guide*.

Hot Water Seed Treatment of Tomato

Step 1



Step 2: Pre-warm seed for 10 minutes at 37 °C (100°F)



Step 3: Treat seed for 25 minutes at 50 °C (122°F)

Step 4: Cool seed five minutes

Step 5: Air dry seeds in a single layer

Treatments to Eliminate *Salmonella* on Tomato Seed

Disinfestants	Incidence on Seed (%)	Germination (%)
Hot Water (50 C, 20 min)	43 a	98 a
Clorox (630 ppm, pH 11, 2 min)	0 b	100 a
Hydrochloric Acid (1%, 30 min)	0 b	92 a
Virkon-S (2%, 15 min)	2 b	97 a
Trichloromelamine (0.2 g/L, 2 min)	0 b	92 a
Non-treated	40 a	92 a

Preventative Management Strategies for Bacterial Diseases

- **Practice Good Sanitation**
  - Clean and disinfect all surfaces and tools
    - Clean: soap and water
    - Disinfect: 10-25% bleach solution
  - Keep floors clean and free of debris
  - Eliminate weeds
  - Do not re-use seedling mix
  - Avoid re-using flats
  - Keep flats off of the floor
    - Use breathable materials

Preventative Management Strategies for Bacterial Diseases

- **Environmental Controls**
  - Horizontal air movement
    - Continuous movement
    - Day and night
  - Maintain optimal day and night temperatures
    - Crop dependent
    - 60-85 °F
  - Maintain low-moderate relative humidity
    - 25-70%
    - Avoid plant over-crowding

Preventative Management Strategies for Bacterial Diseases

- **Water Management**
  - Use seedling-mixes with good water holding capacity
  - Water early in the day to allow time for foliage to dry
  - Allow plants and media to dry between watering
  - Water judiciously

Preventative Management Strategies for Bacterial Diseases

- **Water Management**
  - Avoid high pressure overhead watering
  - Use high quality water
    - Routine water tests are essential
    - Potable
    - Treat recirculating water

Photo courtesy of T. Kelley, Univ. Georgia

Minimizing Spread of the Pathogens

- Avoid plant over-crowding
- Scout seedlings daily
- Remove diseased seedlings immediately
- Use good sanitation practices
  - Tools
  - Hands
  - Boots

Boots and gloves

Tools

Hand sanitation

Minimizing Spread of the Pathogens

- Avoid handling seedlings when they are wet
- Manage insect and weed infestations promptly
- Apply bactericides when symptoms first appear

Bactericides to Minimize Pathogen Spread

- Always confirm that a product is labeled for use in a greenhouse
- Always follow the recommended methods of application and rates
- Do not apply to seedlings that are for human and/or animal consumption

Bactericides to Minimize Pathogen Spread

- EBDCs (M)
  - Manzate, Dithane
- Copper (M)
  - Kocide 2000 or 3000
  - Champ
- Antibiotics (NC)
  - AG Streptomycin
  - Streptomycin 17

Always check product label for current exceptions, restrictions and application rates.

Resources

- LSU Horticulture Pathology Facebook Page
  - www.facebook.com/hortpathology
- Louisiana Plant Disease Management Guide
- 2013 Southeastern U.S. Vegetable Crop Handbook
  - www.thegrower.com/south-east-vegetable-guide
- Coming Soon! LSU Horticulture Pathology Website
  - www.lsuagcenter.com/hortpathology

Contact Information

- Questions about....
  - Vegetable diseases
  - Disease management
  - Fresh produce safety
  - How to find information
- Report a disease
- Share YOUR knowledge

Melanie Lewis Ivey
mivey@agcenter.lsu.edu
225-578-8537