MANAGING TOMATO BACTERIAL CANKER

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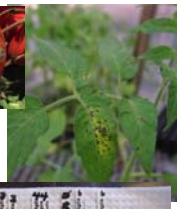
7-Step Integrated Program to Manage Bacterial Diseases

1. Diagnose the disease correctly
2. Use clean seed
3. (Choose a resistant variety)
4. Use pathogen-free transplants
5. Choose the best site and rotate
6. Use appropriate cultural practices
7. Use crop protectants as needed

1. Diagnosing Bacterial Diseases

- Symptoms
- Diagnostic lab tests
- Advanced rapid diagnostic tests
  - Canker only so far
  - Can be carried out in lab or field
  - Quick results – bypasses some lab tests



Advanced Rapid Diagnostic Tests – for Bacterial Canker

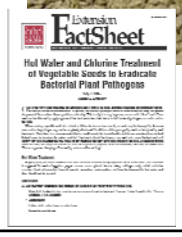
- Agdia immunostrip test
  - 5-minutes or less
  - Field usable
  - Economical
  - Problems with false positives
- Envirologix DNAble QuickStix
  - 30 minutes or more
  - Field usable
  - Expensive
  - Advertised more sensitive than immunostrip

Why is Diagnosis Important?

- Accurate diagnosis → Appropriate management tactics
- Bacterial diseases can look similar to fungal diseases at early stages
  - For example, Septoria blight and bacterial spot symptoms look similar on leaves
  - Septoria blight easily controlled with fungicides; bacterial spot is not
- Some disease management tactics differ for different bacterial diseases
  - Canker, speck – long-lived in soil (3-5 years or more)
  - Spot – short-lived in soil in temperate climates (1-2 years max)

2. Use Clean Seed

- Check with seed provider – have seed lots been tested for bacterial spot, speck and canker?
- Are you saving your own seed, e.g. heirloom varieties?
- If not tested and shown to be negative, or are saved seed:
  - Treat seed with dilute Clorox or hot water
    - http://ohioline.osu.edu/hyg-fact/3000/3085.html



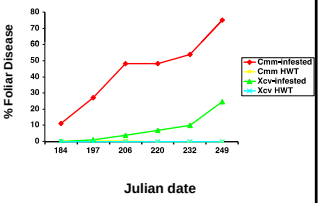
Sanitizing Seed Treatments

Treatment	Infestation rate %	*Cmm* infestation level in seed (log cfu/100 seed)	Seed vigor index (SVIS)
Control	11.8 b	5.3 a	801 ab
H_2O_2	15.3 a	4.3 bc	803 ab
Kasugamycin	10.1 bc	5.0 a	603 c
Streptomycin	6.3 d	3.9 b	766 b
Thymol	2.3 ef	3.9 b	747 c
Dry heat	7.6 cd	3.7 b	536 d
Hot water	0 f	- *	785 b
HCl	0 f	0 c	833 a
NaClO/hot water	0 f	0 c	778 b
KleenGrow	0 f	0 c	797 ab
Virkon	0 f	0 c	789 b

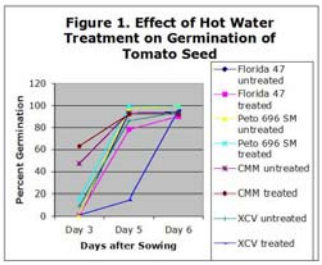
Effect of Hot Water Treatment on Bacterial Canker and Spot in Tomato

Seed hot water-treated

Seed not treated



Hot Water Treatment -Disadvantages



- May delay or reduce seed germination, especially in old or poor quality seed lots
- May reduce seedling vigor
- May reduce seed longevity
- Not necessarily compatible with other seed treatments (pelleting, priming etc.)

3. Choose Resistant Varieties

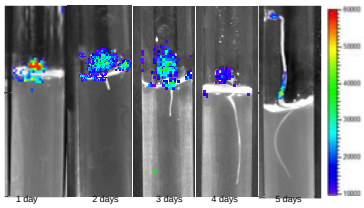
- Resistance to bacterial canker, spot and speck is rare in tomato
- Varieties vary in "tolerance" or partial resistance to bacterial diseases

4. Use Pathogen-Free Transplants

- Goal: Keep bacterial pathogen populations low (preferably zero) on seedlings
  - Seedborne bacterial pathogens can survive on tomato seedlings without causing symptoms
  - Bacteria can grow to disease-causing levels under greenhouse conditions

Bacterial canker colonization of tomato seedlings

- Bacteria inoculated onto seed coat
- Living bacteria emit light
- Some remain alive on the seed coat; others colonize seedlings
- Bacteria in position to multiply and colonize nearby plants



Engineered bacterial canker pathogen that "glows in the dark"

4. Use Pathogen-Free Transplants

- Scout regularly
- Destroy plants with symptoms
  - Confirm by diagnostic lab or kit (canker)
- Destroy surrounding flats
- Sanitize area where flats removed and all tools
- Focus additional scouting in areas adjacent to outbreak

4. Use Pathogen-Free Transplants

- Sanitation
  - Critical to prevent contamination of plants by bacterial pathogens
  - First step is a clean operation
    - Solid floors/raised benches
    - No nearby cull piles
    - No weeds
    - No volunteer tomatoes/peppers
    - No plant refuse on floors
    - No pets

Volunteer tomato with bacterial canker

4. Use Pathogen-Free Transplants

- Sanitize germination chamber often
- Thoroughly clean and sanitize house/benches/equipment/tools after each crop
- Clean clothing and shoes
- Foot baths with active disinfectant
- Use only new or sanitized plug trays

Common Disinfectants*

- Alcohols (e.g. ethanol, isopropanol)
- Halogens (e.g. chlorine bleach)
- Peroxides (e.g. Hyperox, Virkon)
- Quaternary ammonium (e.g. Chemprocide, Virocid, KleenGrow)

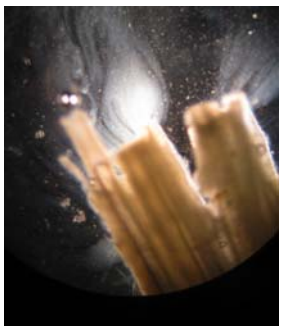
*Disinfectants in blue have been tested in our lab and are effective against bacterial canker

Get the Most from Disinfectants

- Use according to instructions on the label
- Some sanitizers are corrosive
  - Thorough rinsing with water necessary
- Organic matter destroys the activity of most sanitizers
  - Replace disinfectant regularly
- Be sure that the sanitizer is active
  - Chlorine – ORP meter, swimming pools kits
  - Test often

4. Use Pathogen-Free Transplants

- Minimize moisture – "dry growing"
- Use only municipal or well water – avoid surface water unless it is treated to kill bacteria



Bacterial canker pathogen in water

4. Use Pathogen-Free Transplants

- Prohibit the production of exotic or experimental pepper or tomato varieties unless seed was sanitized
- Apply one or two copper treatments (with mancozeb) and one application of Agri-Strep before plants leave GH

Bacterial canker of pepper

Some Points about Copper

- Residual drops quickly on leaves
  - Florida – after 5 days, little detectable residue
  - Ontario – residues at 25% 6-8 days after treatment (in some samples were near zero 6 days after treatment)
- Activity is affected by pH
  - The lower the pH (more acidic) the more active copper ions
    - BUT pH < 6.5 may cause phytotoxicity
  - Copper is a protectant – it must be applied ***before*** bacteria land on the plant and when populations are relatively low; copper is ineffective once bacteria enter the plant
  - Copper should be applied before it rains but in time for plants to dry

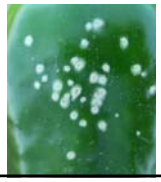
Field Production

Which Tomato Production Systems are at Risk from Bacterial Diseases?

System	Canker	Spot	Speck
Open Field Fresh market Processing	 ✓ ✓	 ✓ ✓	 ✓ ✓
High Tunnel	✓		
Greenhouse	✓		

5. Choose the Best Site and Rotate

- Site selection
  - Well-drained
  - Good air movement
  - Sunny
  - Weeds under control
- Rotate rotate rotate
  - Bacterial spot – 1-2 years
  - Canker, speck, brown spot - ≥3 years
  - Rotate out of the tomato/pepper/eggplant family



Bacterial canker on peppers

6. Use Best Cultural Practices

- Maintain reduced-stress growing conditions
  - Well-drained soil
  - Appropriate fertilizer (adequate but not excessive N)
  - Regular irrigation if needed
    - Drip/trickle is best
  - Improved organic matter content – cover crops, compost

6. Use Best Cultural Practices

- Use new or sanitized stakes, string, etc.
- Avoid moving among or handling plants when they are wet
- Sanitize hands, boots and tools between fields
- Clean and sanitize equipment between fields

6. Use Best Cultural Practices

- Pruning and other crop work
  - Remove suckers when very small – avoid large pruning wounds
  - Dip pruning tools in disinfectant after every plant or at the end of every row at a minimum

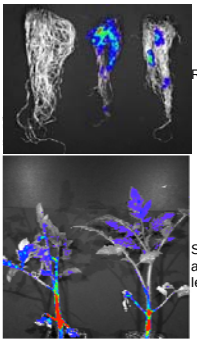
6. Use Best Cultural Practices

- Pruning and other crop work
  - If bacterial canker is identified in a high tunnel or gh
    - Remove infected and adjacent plants
      - Place in plastic garbage bag and take out without touching other plants
    - Intensify scouting
    - Intensify sanitation
    - Quarantine affected rows
      - Work in these rows last

Canker-infected plants removed from gh

6. Use Best Cultural Practices

- End of season – open field
  - Plow plants under and disk to speed residue breakdown
  - Remove plastic, stakes, string, etc.
    - Sanitize stakes and anything else to be re-used
- End of season – high tunnel
  - Plow plants under and disk to speed residue breakdown, <u>or</u>
  - Remove and dispose of planting media
  - Sanitize pots, clips, stakes, and anything else to be re-used
  - Clean and sanitize high tunnel structure



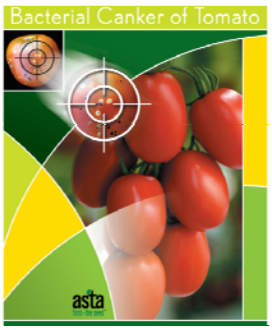
Bacterial canker pathogen in tomatoes

7. Use Crop Protectants

- Focus on reducing bacterial populations early
  - Begin early – within 7 days after transplanting recommended.
  - Include mancozeb (EBDC) with copper sprays until flowering (tomatoes)
  - Concentrate anti-bacterial treatments early season through fruit set to keep bacterial populations low.
  - Apply copper on a 5-7 day schedule until fruit are set and approx. ¼ - ½ full size. Apply Actigard within 14 days of transplanting and continue to apply on 10-14 day intervals through fruit set.

Bacterial Canker Management Brochure

- American Seed Trade Association
- Available in English and Spanish
- http://www.amseed.com/news_DiseaseGuides.asp



Thank you

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OSU Vegetable Pathology Lab