Managing Foliar Diseases on Watermelon and Other Cucurbits with Fungicides

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My Approach to Vegetable Disease Management Recommendations

- **Outcome-based**
  - “More of what works, less of what doesn’t”
  - Is the treatment better than the non-treated/non-sprayed control?

- **Replicated, repeated field experiments**

- **Rigorous statistical analysis**
  - 99% confidence intervals
Today’s Outline

- Gummy stem blight
- Anthracnose
- Brief comments
  - Alternaria leaf blight
  - Bacterial fruit blotch
- Fungicides
The Disease Triangle: Disease Is An Interaction
The Disease Triangle for Gummy Stem Blight

- Watermelon
- *Stagonosporopsis* (fungus)
- Environment
Gummy Stem Blight on Watermelon and Muskmelon
# One SC Watermelon Field, Two Outcomes

<table>
<thead>
<tr>
<th>Spring 2016</th>
<th>Fall 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014: corn</td>
<td>Spring 2016: watermelon</td>
</tr>
<tr>
<td>2015: soybean</td>
<td>Fall 2016: watermelon</td>
</tr>
<tr>
<td>2016: watermelon</td>
<td></td>
</tr>
<tr>
<td>39% of diseased leaves had gummy stem blight</td>
<td>100% of diseased leaves had gummy stem blight</td>
</tr>
</tbody>
</table>
GSB Fungus Survives in Muskmelon Crowns

July 2004 to Oct 2005

Nov 2005 to Nov 2007
Average fruiting bodies per square inch: 3015
The GSB Fungus Reproduces on Diseased Leaves of Watermelon and Muskmelon
Two Types of Spores of GSB Fungus

Conidia, Spread by Rain

Ascospores, Spread by Wind

T. A. Zitter, Cornell Univ.
Spread of Ascospores from Watermelon Debris with GSB, Fall 2016
Inspire Super Reduced the Number of Leaf Spots per Leaf (average 2016 & 2017)

Water: 0.0
Bravo: 2.0
Inspire Super: 4.0

P = 0.004
Inspire Super Reduced the Size of GSB Leaf Spots (average 2016 & 2017)

Inches

<table>
<thead>
<tr>
<th></th>
<th>Water</th>
<th>Bravo</th>
<th>Inspire Super</th>
<th>P = 0.003</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>0.70</td>
<td>0.60</td>
<td>0.40</td>
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<tr>
<td>0.10</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>0.20</td>
<td></td>
<td></td>
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<tr>
<td>0.30</td>
<td></td>
<td></td>
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<tr>
<td>0.40</td>
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<tr>
<td>0.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.60</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>0.80</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>0.90</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
Fungicides Reduced the Number of GSB Leaf Spots with Fruiting Bodies (average 2016 & 2017)

\[ P = 0.003 \]
Controlling Gummy Stem Blight and Anthracnose

- Rotate for 2-3 years
  - Summer squash in 2nd year
- Plant early
- Disease-free transplants
- Never reuse plastic mulch
- Disk fields to bury debris as soon as possible after harvest
Fungicides Recommended Against Gummy Stem Blight

**Best**
- Inspire Super
- Switch
- Luna Experience
- Aprovia Top

**Avoid**
- Fontelis (resistant)

**Useful Protectants/Contacts**
- Chlorothalonil
  - High temperatures
  - Intense sunlight
- Mancozeb
  - Use close to harvest
- Tebuconazole
  - Popular in Southeast
Anthracnose on Cucurbit Foliage and Fruit
Anthracnose Symptoms on Watermelon

- Small, angular spots on leaves
- “Spindle-shaped” spots on vines
- Fruit spots on watermelon, bottle gourd, pumpkin
- More common in South last 6 years because of drier spring weather
Anthracnose Fungus Produces Spores on Watermelon Vines and Leaves
Severe Yield Loss to Anthracnose is Possible without the Right Fungicides

<table>
<thead>
<tr>
<th></th>
<th>Fall 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best Fung.</td>
<td>38 cwt</td>
</tr>
<tr>
<td>None</td>
<td>1 cwt</td>
</tr>
<tr>
<td>Diff</td>
<td>37 cwt</td>
</tr>
<tr>
<td>Value/A</td>
<td>$740</td>
</tr>
<tr>
<td>Fungicide Applications</td>
<td>6</td>
</tr>
<tr>
<td>Fungicide + Appl. Cost/A</td>
<td>$139</td>
</tr>
<tr>
<td>Return/A*</td>
<td>$601</td>
</tr>
<tr>
<td>Return per $1 on Fungicide</td>
<td>$4.33</td>
</tr>
</tbody>
</table>

*on yield above no fungicide yield
Severe Yield Loss to Anthracnose is Possible without the Right Fungicides

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<thead>
<tr>
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<th>Fall 2013</th>
<th>Spring 2014</th>
<th>Spring 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best Fung.</td>
<td>38 cwt</td>
<td>186 cwt</td>
<td>100 cwt</td>
</tr>
<tr>
<td>None</td>
<td>1 cwt</td>
<td>50 cwt</td>
<td>24 cwt</td>
</tr>
<tr>
<td>Diff</td>
<td>37 cwt</td>
<td>136 cwt</td>
<td>76 cwt</td>
</tr>
<tr>
<td>Value/A</td>
<td>$740</td>
<td>$1904</td>
<td>$1518</td>
</tr>
<tr>
<td>Fungicide Applications</td>
<td>6</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Fungicide + Appl. Cost/A</td>
<td>$139</td>
<td>$90 (39-158)</td>
<td>$110 (45-210)</td>
</tr>
<tr>
<td>Return/A*</td>
<td>$601</td>
<td>$1814</td>
<td>$1407</td>
</tr>
<tr>
<td>Return per $1 on Fungicide</td>
<td>$4.33</td>
<td>$20.09</td>
<td>$12.73</td>
</tr>
</tbody>
</table>

*on yield above no fungicide yield
Anthracnose Reduces Sugar Content of Diseased Fruit

% Brix

2014

2017

P < 0.001

Healthy
15% An
50% An
3 Fungicides Increased Sugar Content of Healthy Fruit in 2014 (but not 2017)
### Recommended Fungicides to Manage Anthracnose

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Disease Severity</th>
<th>Marketable Yield</th>
<th>Cost ($/A) of 4 sprays</th>
</tr>
</thead>
<tbody>
<tr>
<td>mancozeb</td>
<td>Lowest</td>
<td>High</td>
<td>$63</td>
</tr>
<tr>
<td>chlorothalonil</td>
<td>Low</td>
<td>High</td>
<td>$52</td>
</tr>
<tr>
<td>Flint</td>
<td>Low</td>
<td>High</td>
<td>$211</td>
</tr>
<tr>
<td>Cabrio</td>
<td>Low</td>
<td>High</td>
<td>$159</td>
</tr>
<tr>
<td>Quadris</td>
<td>Low</td>
<td>High</td>
<td>$119</td>
</tr>
<tr>
<td>Topsin-M</td>
<td>Low</td>
<td>Not as High (High in 2017)</td>
<td>$45</td>
</tr>
</tbody>
</table>
Fungicides That Did NOT Control Anthracnose on Watermelon (Race 2) in SC

- Curzate
- Tanos
- Endura (and likely Fontelis)
- Luna Experience
- Inspire Super
- Switch

Fungicides effective against gummy stem blight do not control anthracnose
Alternaria Leaf Blight on Muskmelon

- Uncommon in SC
  - Need 20 h leaf wetness at 82 F.
  - Need 11 h leaf wetness at 75 F.
- FRAC Code 11 fungicides
- Consider Quadris Opti (Quadris + Bravo) to minimize resistance risk
  - Or alternate Group 11 with chlorothalonil
“All crop protection materials are too expensive. But not having a crop to sell is more expensive.”

Russ Shlagel, Shlagel Farms, Waldorf, Maryland
When Is It OK to Not Spray?

Some growers stop spraying when:

1. Daytime temperatures are above 95 F.
2. Weather is dry with no rain for a week.
3. Only harvesting a field one more time.

Don’t forget what happens at night:

1. Night temperatures in 70’s are favorable for disease.
2. Dew forms almost every night in the summer.
3. Downy and powdery mildew spread rapidly within a week.
Fungicides ≠ Plant Medicines

**Fungicides PREVENT disease**
- They do not “cure” disease like human antibiotics

**Spray fungicides before you see disease**
- After disease appears, check/switch fungicides

**Invest $$ up front to get best return on $$ spent on fungicides**
Step-by-Step Guide for Spraying Fungicides

1. Start with contact fungicides (chlorothalonil, mancozeb) to protect crop against foliar fungal diseases
   a. The first spray is the most critical
   b. In a dry year, protectants may be “good enough”
Step-by-Step Fungicide Guide

2. Choose follow-up fungicides that work best for disease(s) most likely to cut yields
   a. These must be identified at regional or state level
Caution: Fungicide Resistance

- Pay attention to FRAC Codes
- Be sure that fungicides used in rotation or sequence do not have the same FRAC Codes
  - This includes all components of mixtures
- NEVER rotate
  - Luna Sensation (7 + 11) with
  - Pristine (7 + 11)
  - even though from different companies
  - even though different active ingredients
  - OK with different fungicide in between
Managing Bacterial Fruit Blotch on Watermelon

- Seed/Greenhouse/Transplant problem
- Check transplants for water-soaking on cotyledons and hypocotyls
- Apply copper hydroxide
  - 0.5 lb/A (ex. Kocide 3000)
  - 6 weekly applications
  - Start 2 weeks before female flowers open
- Actigard at 0.5 oz/A
Summary Recommendations

- Rotate fields away from cucurbit crops for 2 years.
- Start with broad-spectrum, protectant fungicides early in the season.
- Switch to more specific, systemic fungicides after disease appears.
- Rotate all specific, systemic fungicides.
  - Use FRAC Codes as guide.