Fire Blight Control in Organic Pome Fruit Systems Under the Proposed Non-antibiotic Standard
Ken Johnson, Oregon State University
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http://www.extension.org/organic_production

This webinar is about fire blight suppression without antibiotics:

**Antibiotics:**
- Streptomycin < Prohibited under EU organic standard
- Oxytetracycline < 2014 NOP expiration (set by NOSB in 2011)

**My focus:**
- Floral infection in susceptible cultivars*

*Strategies and data shown are most applicable to semi-arid production regions of the western U.S.

This webinar is not about:
- Host resistance (ideal but longer-term goal)
- Management of host susceptibility (nutrition)

Materials registered and marketed for organic fire blight control

**Biologicals:**
- BlightBan A506
- Bloomtime Biological
- Blossom Protect (2012)

**Product effectiveness:**
- Poor to fair
- Poor to good
- Very good

**Antibiotic-like biological:**
- Serenade Max

**fair to good**

**Other potential materials for organic fire blight control**

**Resistance inducer:**
- Regalia

**?**

**Copper in organic acids:**
- Phyton 27AG
- Gowan GWN 9979

**very good**

**Significance of old cankers & bloom temperature**

This jump starts the cycle
Daily Fire Blight Risk - COUGARBLIGHT Model

Q1: When is the fire blight pathogen active in orchards?

Systems Approach to non-antibiotic control

Four questions:
- When is the fire blight pathogen active in orchards?
- Does delayed dormant copper effect pathogen activity?
- How does bloom thinning effect fire blight control?
- Can effective non-antibiotic control be achieved?

LAMP Surveys in Commercial Orchards

Q1: When is the fire blight pathogen active in orchards?

Is the fire blight pathogen in this bag of flowers?

Answered by ‘LAMP’ assay that detects pathogen DNA:

< 1 hour to get an answer

LAMP Surveys in Commercial Orchards

100 blossom clusters per walk (~600 flowers)

Five walks per orchard

Samples taken at mid-, full bloom and petal fall
LAMP Surveys in Commercial Orchards

Since 2008 we’ve sampled ~100 orchards

Overall probability of pathogen detection
- Mid-bloom: P(detect Ea) ~ 9%
- Petal fall: P(detect Ea) ~ 30%

LAMP Survey Results:

<table>
<thead>
<tr>
<th>Year</th>
<th>State</th>
<th>Production area</th>
<th>Host</th>
<th>No. of orchards</th>
<th>Mid-bloom</th>
<th>Full bloom</th>
<th>Petal fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>OR</td>
<td>Rogue Valley</td>
<td>Pear</td>
<td>3</td>
<td>0 of 10</td>
<td>0 of 20</td>
<td>2 of 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hood River Valley</td>
<td>Pear</td>
<td>6</td>
<td>0 of 30</td>
<td>6 of 30</td>
<td>7 of 27</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hood River Valley</td>
<td>Apple</td>
<td>2</td>
<td>0 of 2</td>
<td>2 of 3</td>
<td>4 of 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Walla Walla Valley</td>
<td>Apple</td>
<td>4</td>
<td>0 of 20</td>
<td>4 of 20</td>
<td>11 of 20</td>
</tr>
<tr>
<td></td>
<td>CA</td>
<td>Lake County</td>
<td>Pear</td>
<td>4</td>
<td>2 of 15</td>
<td>2 of 15</td>
<td>1 of 15</td>
</tr>
<tr>
<td></td>
<td>WA</td>
<td>Okanogan Valley</td>
<td>Pear</td>
<td>1</td>
<td>0 of 4</td>
<td>0 of 4</td>
<td>2 of 4</td>
</tr>
<tr>
<td></td>
<td>WA</td>
<td>Wenatchee Valley</td>
<td>Pear</td>
<td>2</td>
<td>0 of 10</td>
<td>0 of 10</td>
<td>0 of 10</td>
</tr>
<tr>
<td></td>
<td>WA</td>
<td>Columbia Basin</td>
<td>Apple</td>
<td>3</td>
<td>0 of 15</td>
<td>0 of 15</td>
<td>0 of 10</td>
</tr>
</tbody>
</table>

Dirty Orchard: 11/122 Pathogen positive walks
Clean Orchard: 14/124 Total walks

Pathogen positive walks:
- 11/122 in Dirty Orchard
- 14/124 in Clean Orchard
- 27/112 Total walks

Use of LAMP to re-examine the value of delayed dormant copper for blight control

Q2: Does delayed dormant copper effect pathogen activity?

- Delayed dormant oil plus CuOH+CuOCl (4 lbs/A)
- In 2010 & 2011 we split fourteen ~10-acre blocks
- Delayed dormant oil

Rachel Elkins
Pomology Farm Advisor
UC Lake County

California pear LAMP survey 2010

<table>
<thead>
<tr>
<th>% Flower samples positive for E. amylovora</th>
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<tr>
<td>Oil alone</td>
</tr>
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<td>Mid-bloom</td>
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California pear LAMP survey 2011

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Overall probability of pathogen detection ~ 16%
- Mid-bloom: P(detect Ea) < 5%
- Petal fall: P(detect Ea) ~ 50%

P(detect Ea) in ‘Copper + Oil’ ½ of ‘Oil alone’

Does delayed dormant copper effect pathogen build-up?
Does delayed dormant copper effect pathogen activity?

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Average Russeting</th>
<th>Russet Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper + oil</td>
<td>2.7</td>
<td>10.5</td>
</tr>
<tr>
<td>Oil alone</td>
<td>2.7</td>
<td>10.2</td>
</tr>
</tbody>
</table>

Rachel Elkins and Steve Lindow have obtained fruit finish data from all plots. No difference in Russet Severity among the ‘Copper & Oil’ and ‘Oil only’ plots.

Summary of LAMP Surveys

- When is the fire blight pathogen active in orchards?
  
  Depends on orchard, but late (PF) is more the norm

- Does delayed dormant copper effect pathogen activity?
  
  Yes, it delays time to when the pathogen is detectable (PF)

- Can I get LAMP scouting done in my orchard?
  
  The technology still requires a bit of skill (pipetting, DNA extraction)

  but this is rapidly changing:

  Andreas Bühlmann of Agriscope is using the OptiGene Genie II LAMP analyzer

Think about Questions on ‘LAMP’ and ‘Delayed Dormant Copper’

Q3: How does bloom thinning effect fire blight control?

2% Lime sulfur plus 2% fish oil

- As used for bloom thinning in apples, does it provide a benefit to fire blight suppression?

- It’s not compatible in tank mix with any of the other fire blight control products.

Q3: How does bloom thinning effect fire blight control?

Replicated, inoculated orchard trials:

Pathogen inoculated after second LS+FO

Primary effect of LS+FO is fewer flowers

But LS+FO is toxic to epiphytic pathogen cells (and epiphytic biologicals)

Speculation: LS+FO makes orchard somewhat less attractive to bees
Integrated control ✓
Frequency of treatment ✓
What is this new yeast product ✓
Lime sulfur plus fish oil ✓

LS+FO shortens the period when fire blight products are needed

Fire blight treatments started after 2nd bloom thinning: 20 & 70% bloom
LS & FO
FB, PF
fire blight products

Non-antibiotic Systems Approach:

• How does bloom thinning effect fire blight control?
LS+FO shortens period when fb products are needed

Effects of various rates of lime sulfur alone and of ATS will be evaluated in 2012

Think about Questions on 'Bloom Thinning'

Q4: Can effective non-antibiotic control be achieved?

Early bloom 30 & 70%
Combining a stigma product with a floral cup product improves control

Antibiotic approach: e.g., Bloomtime Biological then Oxytetracycline

Non-antibiotic approach: e.g., Bloomtime Biological then Serenade Max
e.g., Lime sulfur & fish oil then Blossom protect

Fire blight strikes per tree

‘Integrated control’
very good to excellent control

Q4: Can effective non-antibiotic control be achieved?

Integrated control ✓
Frequency of treatment ✓
What is this new yeast product ✓
Lime sulfur plus fish oil ✓
Q4: Can effective non-antibiotic control be achieved?

Integrated control ✓
Frequency of treatment ✓

Drawback of Blossom Protect:
A potential for fruit russet

Stefan Kurz 2011 – German scientist and inventor of Blossom Protect

Non-antibiotic Systems Approach:

Can effective non-antibiotic control be achieved?

Yes, via ‘integrated control’:

... utilizing delayed dormant copper sanitation
... in apples, using bloom thinners to further delay pathogen ‘build-up’ in flowers
... in pear, using bacterial stigma colonizers to further delay pathogen ‘build-up’ in flowers
... utilizing Blossom Protect or Serenade Max at full and late bloom to protect floral cup

Compared to antibiotics, treatments are increased

Russet index on fruit of apple cv. ‘Santana’ 2008 and 2010 after treatment with Blossom Protect (BP).

The numbers 1-4 represent the number and timing of applications.

Questions?

- LAMP scouting
- delayed dormant copper
- bloom thinning
- integrated, non-antibiotic control

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