FireWall Effects on Canker in Grapefruit
(and Round Oranges)

Wednesday January 28, 2015
2015 Florida Citrus Show
Fort Pierce, FL

Presenter:
J. Kent Morgan, Ph.D.
Project Manager for AgroSource
Findings:

- FireWall with reduced copper provided similar canker control with less copper Phytotoxicity than full copper rate.
- Following a tropical storm (Fay) FireWall was able to reduce the incidence of canker lesions on fruit 30 days after the storm.
- FireWall reduced the development of ‘post penetration infections’ (indicating systemic movement of FireWall to control invading Xcc bacteria).
Published Studies Indicate Efficacy of FireWall For Use In Citrus Canker Treatment

Published online: 18 September 2011

Monitoring for resistant populations of Xanthomonas citri subsp. citri and epiphytic bacteria on citrus trees treated with copper or streptomycin using a new semi-selective medium

Franklin Behlau · Jeffrey B. Jones · Monty E. Myers · James H. Graham

Method:
- FireWall was used as a spray regiment for canker using a 21-day spray program from March through October control over three consecutive seasons (2008-2010).

Results:
- Over the course of three season, “no copper or streptomycin resistant strains of Xanthomonas citri were isolated”.
- They observed “an increase over time in the frequency of citrus epiphytic bacteria resistant to these chemicals.” However, when application of each bactericide was suspended “the epiphytic population decreased to that of the non-treated bacterial population.”

Conclusion:
- “Availability of an alternative bactericide, such as streptomycin [FireWall], to integrate into a copper based program would reduce the amount of each bactericide sprayed in citrus orchards and possibly lower the selection pressure for bacterial resistance to these chemicals”
Published Studies Indicate Efficacy of FireWall For Use In Citrus Canker Treatment

EPA Section 18 Emergency Exemption for FireWall:

- This (and other) work by Dr. Jim Graham in cooperation with AgroSource, provided a basis for the Section 18 approval process of FireWall 17WP

- September of 2012 FireWall received Section 18 approval for FireWall for use in Canker treatment of commercially grown Florida Grapefruit
FireWall 50WP Has Replaced FireWall17 WP for Citrus Canker on Florida Grapefruit Under Section 18 Exemption

Current FireWall Section 18:

- Currently a Section 18 has been granted by the EPA for FireWall 50WP to combat citrus canker on commercially-grown grapefruit in Florida.
- FireWall 17WP nor any other bactericides are permitted for application to Florida grapefruit under the Section 18; ONLY FireWall 50WP
- The Current Section 18 runs until June 12, 2015
- Refer to the FireWall 50WP Section 18 ‘Letter’ and ‘Label’ for application instructions
FireWall 50 WP Use Recommendations for FL
Grapefruit treatment of Citrus Canker

<table>
<thead>
<tr>
<th>Application Rate:</th>
<th>11 oz. per acre; applied a maximum of two (2) times.</th>
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</thead>
<tbody>
<tr>
<td>Maximum Amt./Season:</td>
<td>22 oz. per acre</td>
</tr>
<tr>
<td>Minimum Interval between Applications:</td>
<td>21 days</td>
</tr>
<tr>
<td>REI, PHI:</td>
<td>Re-entry interval (REI): 12 hours. Pre-harvest interval (PHI): 60 days.</td>
</tr>
<tr>
<td>Integrate with Copper:</td>
<td>Tank-mix FireWall with reduced rates of copper; application of copper bactericides prior to and following FireWall™ strongly recommended.</td>
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<tr>
<td>Apply FireWall™ 50 WP:</td>
<td>When crop expert or FDACS determines weather conditions favor canker and increased risk of phytotoxicity from copper sprays exists.</td>
</tr>
</tbody>
</table>

Refer to the FireWall™ 50 WP Section 18 label for additional information and/or restrictions regarding its application to Florida grapefruit.
WARNING: AgroSource does not encourage or support any off label use for FireWall 50 WP. No product other than FireWall 50 WP is authorized for use under the EPA Section 18 Emergency Exemption. Illegal use should not occur, as this may prevent further Section 18 approval and/or prevent Section 3 full registration by the EPA for this or similar products, effectively eliminating this bactericide as a management tool for use in treating citrus bacterial diseases.
Current Citrus Canker CRADA Projects with the USDA-ARS and AgroSource

Projects:

1. ‘FireWall™ Section 18 Grapefruit Canker Field Use Evaluation’

2. ‘FireWall™ Studies to Support a Section 18 for Citrus Canker Control on Round Oranges’

Projects Principal Investigators:

**AgroSource**
- Mark Trimmer, Ph.D

**USDA-ARS**
- Robert G. Shatters, Jr. Ph.D.
- Ed Stover, Ph.D.

Project Manager:

**AgroSource**
- J. Kent Morgan, Ph.D
Objective:
- Perform bacterial resistance monitoring in Xanthomonas citri to streptomycin in the rhyzosphere & phyllosphere of FireWall 50WP treated trees

Project Location and Scope:
- Sites are located in the Indian River Citrus Florida region
- Grapefruit varieties include: White and Red grapefruit

Canker Project 1: ‘FireWall™ Section 18 Grapefruit Canker Field Use Evaluation’
## Canker Project 1: ‘FireWall™ Section 18 Grapefruit Canker Field Use Evaluation’

### FireWall 50 WP Section 18 Grapefruit Canker Site Summary

<table>
<thead>
<tr>
<th>Cooperator Grower</th>
<th>Site</th>
<th>Crop</th>
<th>Rootstock</th>
<th>Planting Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>S1</td>
<td>White grapefruit</td>
<td>Sour orange</td>
<td>Prior to 1990</td>
</tr>
<tr>
<td></td>
<td>S2</td>
<td>White grapefruit</td>
<td>Sour orange</td>
<td>Prior to 1990</td>
</tr>
<tr>
<td></td>
<td>S3</td>
<td>Red grapefruit</td>
<td>Sour orange</td>
<td>Prior to 1990 with resets in 2009</td>
</tr>
<tr>
<td>C2</td>
<td>S4</td>
<td>Red grapefruit</td>
<td>Carizzo</td>
<td>Prior to 1990</td>
</tr>
<tr>
<td></td>
<td>S5</td>
<td>Red grapefruit</td>
<td>Carizzo</td>
<td>Prior to 1990</td>
</tr>
</tbody>
</table>

10 Trees per site = 50 trees in the study (25 treated, 25 not treated)
Project Progress Summary:

- All FireWall 50WP applications have been made and sampling and lab processing have been completed
- Data analysis is presently underway

2015 Season:

- We anticipate tracking both grapefruit and round oranges for bacterial resistance monitoring with streptomycin
  - Round oranges are included in anticipation of an US EPA Section 18 emergency exemption for citrus canker treatment of round oranges with FireWall 50WP sometime in the future.
Citrus Canker on Round Oranges & Xanthomonas citri pv. citri citrus canker bacteria

Electron Images by Oliveira, AG & Andrade G.
Orange leaves infected with Xanthomonas citri pv. citri
Objective:
- Determine effects of FireWall 50WP treatment for citrus canker on round oranges
  - Due to delays in contract negotiations, we were limited to late season canker treatments for 2014

  *Important as late season canker contributes to next season infections*

Study Parameters:
- Four sites have been provided by two cooperator growers
- The sites straddle the central ridge region of south/central Florida
- Orange varieties include: **Hamlin** and **Valencia** oranges
- 120 trees total are included in the study

Trees were selected for use in the project based on three primary criteria:

  i) each has a **high incidence of citrus canker**
  ii) each has **in excess of 100 pieces of fruit per tree**
  iii) trees appear to be in (relatively) **good health**
Project Progress:
- All sites have received their designated treatments for the 2014 season with FireWall 50WP at the Section 18-label rate
- Tree assessments are performed monthly (health, disease severity, fruit drop, etc.)
- Brix/acid, juice weight and color, also analyzed to assess the economic value of the fruit in the treated blocks

Early Findings:
- Across all the sites, we have no evidence of phytotoxicity on trees treated with label rates of FireWall 50WP

2015 Plans:
- We plan to begin treatments in new trees at typical application timings performed early, mid, and late season
Advantages of Treatment with FireWall 50WP

- **Reduction in inoculum** will reduce infection in subsequent years
- Assists in management of **potential copper resistance in X. citri**
- FireWall has been demonstrated to **suppress canker in citrus following torrential rains** since it is translaminar, unlike copper
- **Canker is likely to become more severe** in FL due to inoculum spread, weakening of trees from HLB, and potential X. citri copper resistance
- **Use of FireWall 50WP in all citrus** will help to reduce the incidence of canker in the Florida citrus industry

**NOTE**: Once a canker lesion is formed, **treating with FireWall 50WP will kill the bacteria**; however, the damage will remain as scar tissue on the leaf, stem, or fruit.
Thanks and Recognition

Special Thanks to our Grower Cooperators, The Pioneering Work of Dr. Jim Graham & The CRDF for grants supporting this work

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