Management of citrus establishment with white and red-dyed kaolin

Christopher Vincent, Myrtho Pierre
civince@ufl.edu
Tree Ecophysiology
Citrus Research and Education Center
University of Florida, USA
Horticulture - Particle films

• Properties
  • Reflection
  • Shading
  • Redistribution of light within the canopy
• Reduce sunburn
• Increase whole canopy photosynthesis
• Increase leaf level water use efficiency
• Kaolin
Kaolin effects on ACP
• Physical deterrence
• Optical “repellant”
• Some colors more effective than natural white

Objectives
• Compare red-dyed kaolin, undyed kaolin and foliar insecticides for:
  • Effects on ACP
  • Effects on infection rate
  • Effects on growth, photosynthesis, and horticultural characteristics
  • Subsequently interactions with disease.
Study design

- New planting from day 1
- Randomized complete block
  - 6 blocks
  - Location
- Plots
  - 20 treated trees
  - 6 data trees
- Treatments
  - White kaolin – Surround applied “as needed” + "sticker" adjuvant (SKH)
  - Red kaolin – dye added with binding agent + "sticker" adjuvant
  - Foliar insecticide – Calendar and psyllid pressure basis
  - Untreated control – systemic insecticides for leaf miner control
- Variables
  - Reflectance
  - ACP counts weekly
    - All ACP on each tree
  - PCR CLas detection quarterly
  - Stem caliper
  - Flowering
  - Gas exchange
    - Photosynthesis, stomatal conductance, transpiration
    - $A_{\text{max}}$ : with PPFD 1,000 μmols m$^{-2}$ s$^{-1}$, VPD -1.6 kPa, 400 ppm CO$_2$
Results – Stem Diameter

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Mean flowers per tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foliar Insecticide</td>
<td>5.8</td>
</tr>
<tr>
<td>Red Kaolin</td>
<td>8.2</td>
</tr>
<tr>
<td>Untreated Control</td>
<td>0.4</td>
</tr>
<tr>
<td>White Kaolin</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Diameter (mm) vs. date

- Foliar Insecticide
- Red Kaolin
- Untreated Control
- White Kaolin

a, b indicate significant differences.
Results - Photosynthesis

A (µmol m⁻² sec⁻¹)

Foliar Insecticide  Red Kaolin  Untreated Control  White Kaolin
Mean psyllid count per plant

Treatments
- Foliar Insecticide
- Red Kaolin
- Untreated Control
- White Kaolin

Floral flush

2017

2018
Results – ACP – Dec 2017

Percent control of ACP in kaolin treatments vs. chemical or untreated controls

<table>
<thead>
<tr>
<th></th>
<th>Insectide Control</th>
<th>Untreated Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>White Kaolin</td>
<td>95</td>
<td>97</td>
</tr>
<tr>
<td>Red Kaolin</td>
<td>97</td>
<td>98</td>
</tr>
</tbody>
</table>

![Bar chart showing mean psyllid count per plant for different treatments, with statistical letters indicating significant differences.]
Results – ACP - as of August 2018

80% percent control of ACP in kaolin treatments vs. untreated control
Results – CLas infection

- Foliar Insecticide
- Red Kaolin
- Untreated Control
- White Kaolin

Proportion of plants infected

Treatment

- April 2017
- July 2017
- October 2017
- January 2018
- April 2018
Preliminary conclusions

• Kaolin particle films improve ACP management and reduce disease pressure
  • Red-dyed kaolin superior to date

• Both red and undyed kaolin films increase growth
  • Photosynthetic increase lesser in red
  • No difference in overall growth
Future Questions, Next Steps

• Kaolin
  • Continued long-term field evaluation
  • Different light qualities (dye colors)
  • Effects on HLB symptoms vs. CLas transmission
    • Effects of color treatments on acclimative photochemistry*infection
    • Whole canopy vs. leaf-level water relations
  • Stickers/rainfastness

• Tree architecture

• Flush phenology
Thank you!

Questions?