Use of Gibberellic Acid Treatments to Improve Health and Yield of HLB Diseased Trees

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Take home message

1. Another ‘Tool’ in the citrus tree health management toolbox
2. Gibberellic acid (GA) available for use in citrus in Florida
3. GA can improve fruit set, development, and yield
4. Effect of GA is ‘holistic’, response is gradual
5. Application time is critical
GA influences number of physiological processes

• Shoot elongation
• Flowering
• Fruit set
• Fruit growth
• Fruit abscission
• Fruit senescence
GA in Florida Citrus

• Labeled for use on Florida citrus
• See PGR chapter in UF/IFAS Citrus Production Guide
• Pesticide table 7 for more information on GA products available for use in Florida
• PGRs are regulated as pesticides

• Label is the Law
Valencia Orange Field Study (2016-2021)

- 10 year old ‘Valencia’ on swingle
- GA applied monthly from September to January
  - 10 fl oz per acre (Progibb LV) + 0.125% surfactant (Induce)
  - 1 gallon per tree spray volume
Valencia Orange Field Study (2016-2021)

GA provided a more synchronized bloom period
Valencia Orange Field Study (2016-2021)

GA-treated trees maintained dense tree canopies
Previous Research has shown…

...trees with denser canopies drop less fruit

Fruit Drop (%)

Valencia

Hamlin

Decreasing Canopy Density
Valencia Orange Field Study (2016-2021)

GA-treated trees drop less fruit

Fruit Drop (%)
Valencia Orange Field Study (2016-2021)

GA increased fruit yields compared to untreated plots

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Fruit yield (lb/tree) per year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016-17</td>
</tr>
<tr>
<td>Control</td>
<td>99</td>
</tr>
<tr>
<td>GA</td>
<td>172</td>
</tr>
<tr>
<td>p-value</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Due to changes in grove management, soil pH dropped below 5.5
Valencia Orange Field Study (2016-2021)

Trees treated with multiple GA applications produced more fruit

4 year average

<table>
<thead>
<tr>
<th></th>
<th>pounds/tree</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>176 b</td>
<td>0.06</td>
</tr>
<tr>
<td>GA</td>
<td>228 a</td>
<td></td>
</tr>
</tbody>
</table>

Extrapolation (150 trees/acre)

<table>
<thead>
<tr>
<th></th>
<th>Boxes per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>293</td>
</tr>
<tr>
<td>GA</td>
<td>380</td>
</tr>
</tbody>
</table>
Valencia Orange Field Study (2016-2021)

Economic benefit of GA

Average Yield % Differential
Average Profit % Differential

0
10
20
30
40
50

2018 2019 2020 2021

Courtesy Dr. Ariel Singerman
### Valencia Orange Field Study (2016-2021)

**Economic benefit of GA**

<table>
<thead>
<tr>
<th></th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit per acre based on <strong>average yield</strong> (across all plots)</td>
<td>$1030</td>
<td>$1712</td>
<td>$457</td>
<td>$1123</td>
</tr>
<tr>
<td>Profit per acre based on <strong>lowest yield</strong> (poorest response observed)</td>
<td>$-556</td>
<td>$1019</td>
<td>$260</td>
<td>$806</td>
</tr>
</tbody>
</table>

 Courtesy Dr. Ariel Singerman
GA improves tree health

In-depth molecular and chemical analysis reveals:

• Less starch build up
• Better oxidative stress mitigation
• Better plant defense response
• Better carbohydrate metabolism and translocation
How is GA helping Valencia?

- Reducing & synchronizing flowering
- More leafy inflorescences
- More vegetative growth
- Larger fruit

GA applications

- Lower fruit drop
- Overall tree health improvement
What about Hamlin?

Previous research has shown...

Reduction in GA is associated with fruit drop

GA application may help
What about Hamlin?

• Hamlin have a shorter fruit development period
• GA application in August, September, and October
  • 10 fl oz Progibb LV per acre per application
  • GA 20 g ai or 33 mg/liter per acre per application
  • 0.125% Surfactant (nonionic, low foam; Induce)
  • Spray volume: 125-150 gallons per acre
• GA application will keep the fruit green
• May extend harvest window
• May suppress early off-season bloom and result in synchronized bloom
Precautions for GA use

• **Fruit Color**
  • GA slows down the color change process or can even reverse the color change
  • It delays the rind aging
• **EXTRA PRECAUTIONS** must be taken for FRESH FRUIT
  • May need a 4-5 month gap between last GA application and harvest
  • Degreening can be an option
  • May delay harvest

‘Valencia’ Untreated (January)
‘Valencia’ GA treated (January)
Pay attention to fruit color as well as canopy density.
Precautions for GA use

Flowering

• GA suppresses flowering
  • Applying too close to bloom could negatively affect bloom/fruit set
• Do not apply after January 10, possibly December 31
• Weather can influence flowering
  • If early flowering is predicted, stop sooner than January
GA use cautions (physiological)

• Time of application is the key
• GA application during flowering can improve fruit set
  • If fruit set has been a problem, GA can be beneficial
• More fruit set is not necessarily beneficial in every case
  • A stressed tree may not retain ‘excessive’ crop load
  • Good chance of increased fruit drop
  • Tree may collapse
• Post ‘June drop’ GA application can be beneficial for fruit development
• February GA application on ‘Valencia’ caused excessive mature fruit drop
GA use considerations

• 4 hour REI
• If it rains within 2 hours of application, apply again
• Not much information on tank mixes
• Use water with a pH of 4.0 to 8.5
• Copper fungicides and/or oils within three weeks (before or after) the ProGibb LV Plus application have been known to result in significant leaf drop and fruit drop
• Phytotoxicity when GA + homobrassinolide applied
GA Use Pattern for Valencia Orange

• 5 GA applications can improve yield in Valencia
  • Sep-Jan (monthly application)
    • 10 fl oz Progibb LV plus per acre per application
      • GA 20 g ai or 33 mg/liter per acre per application
    • 0.125% Surfactant (nonionic, low foam; Induce)
    • Spray volume: 125-150 Gal/A (good spray coverage)
Thank you!

• Citrus Initiative
• CRDF (Flowering GA Trial)
• Dr. Ariel Singerman
• Peace River Packing
• ValentBiosciences
• Dr. Lisa Tang
• Sukhdeep Singh
• Mary Sutton