New Options for Decay Control of Fresh Citrus
Preharvest Fungicides
Fruit Decay - on Tree!

- Diplodia (*Lasiodiplodia theobromae*) causes fruit stem-end rot and was:
  - Consistently detected in the abscission zone and juice of HLB-infected fruit
  - Greater abundance of Diplodia was positively correlated with lower fruit detachment force
  - Fruit ethylene production is positively correlated with Diplodia infection levels
  - *Quadris Top* = multiple applications gave intermittent control under HLB conditions

Zhao et al., 2015, 2016
Materials and Methods

➢ Materials were sprayed on trees 2 or 14 days before harvest

➢ Three or four groves (experiments) per season

➢ After harvest, fruit were exposed to 5 or 6 days of degreening conditions (5 ppm ethylene, 85°F, and 90% RH)

➢ The fruit were then incubated at 75°F with 90-95% RH for up to 3 weeks and Diplodia SER and other decays were recorded weekly

➢ In 2022-23, some of the fruit were also washed, waxed, stored at 50°F, and evaluated for decay after 1 and 2 months
Materials Tested 2019-23

• CONTROL - WATER
• Topsin 4.5 FL*
  – thiophanate-methyl (45%)
• Miravis Prime*
  – fludioxonil (21.4%) + pydiflumetofen (12.8%)
• Headline
  – pyraclostrobin (23.6%)
• Cannonball *
  – fludioxonil (50%)
• Abound
  – Azoxystrobin (22.9%)

• Cannonball* + Abound
• Cannonball* + Headline
• Miravis Top
  – difenoconazole (11.5%)+ pydiflumetofen (6.9%)
• Mentor EC *
  – propiconazole (23.3%)
• Luna Sensation
  – Fluopyram (21.4%) + trifloxystrobin (21.4%)
• Veltyma
  – Pyraclostrobin (17.56%) + mefentrifluconazole (17.56%)

*not labeled preharvest for bearing FL grapefruit trees
Materials Tested 2019-23

- Switch 62.5WG
  - fludioxonil (25%) cyprodinil (37.5%)

- Quadris Top
  - azoxystrobin (19.18%) +
    difenoconazole (11.36%)

- Switch 62.5WG
  - fludioxonil (25%) +
    cyprodinil (37.5%)

- Citrus Fix (2,4-D 45%)*

- Thyme Guard
  - thyme oil (23%)

- Graduate A+*
  - fludioxonil (20.6%) +
    azoxystrobin (20.6%) postharvest rates

- Mertect 340F*
  - thiabendazole (42.3%) postharvest rates

*not labeled preharvest for bearing FL grapefruit trees
Combined postharvest Diplodia SER incidences on grapefruit of three groves at two harvest times after pre-harvest fungicide applications during 2022-23 fruit season. Standard errors were expressed on each bar of the graph. * -- indicates significant different at the same harvest time ($P \leq 0.05$) compared to controls.
Effects of pre-harvest fungicides on postharvest stem-end rot incidences on grapefruit from two harvests and after storage (50F) for 1 or 2 months during 2022-23 season. Fruit were washed and waxed before storage. Standard errors were expressed on each bar of the graph. * -- indicates significant different at the same harvest time ($P \leq 0.05$) compared to controls.
Summary

• **Topsin** 4.5FL demonstrated the best Diplodia SER control
  – but it is **NOT** registered

• Strobilurin-based fungicides (such as **Abound** and **Headline**) moderately reduced Diplodia SER when decay pressure

• **Miravis Prime** (not yet registered for grapefruit) consistently showed significant and moderate Diplodia SER control and appears to be a good candidate for grapefruit registration for Diplodia SER control
Chlorine Dioxide Gas
Figure A: Diplodia SER (%)

- Control
- 1.0g/kg
- 1.5g/kg
- 2.0g/kg

Figure B: Diplodia decay index

- Control
- 1.0g/kg
- 1.5g/kg
- 2.0g/kg

ClO₂ release materials (g/kg fruit)
Postharvest Fungicides
Materials and Methods

➢ Three experiments, each using fruit from a different grove, were conducted during the 2022-23 season

➢ TBZ, propiconazole, and natamycin dips (1 min) in 1,000 ppm solutions were compared to a water control

➢ Each treatment had three replicates containing 21 to 23 fruit

➢ Fruit were then exposed to degreening conditions for three days

➢ The fruit were then incubated at 75°F with 90-95% RH for up to 3 weeks and Diplodia SER and other decays were recorded weekly
Red grapefruit harvested Nov. 2022

Diplodia SER (%)

Control
TBZ
Propconazole
Natamycin

Fungicide
Pesticie
Maximum Residue Limits
University of Florida

UF/IFAS Postharvest Programs & Information

General Postharvest Information
Citrus Packinghouse Newsletter 2010-2019, Index, Archives
Topical Index Preharvest, Maturity & Quality, Diseases & Decay Control, Cold Storage, Sanitation & Food Safety, Marketing

Mission
To support Florida's diverse Postharvest horticulture industries through research, extension and teaching.

Calendar
- Upcoming Events
- Previous Events
- Extension Calendar

Pesticide Residues & Limits
Look up the latest citrus MRLs for selected export markets and other resources for all commodities. More...

Packinghouse Day 2021
Packinghouse Day was held on Thursday Aug. 26th via Zoom. Click here to view the presentations. More...

IFAS Resources
- EDIS: Postharvest and Handling
- IFAS Extension
- IFAS Research
- College of Agriculture and Life Sciences (CALS)

Careers
# Maximum Residue Limits (MRLs) in part-per-million (ppm)

## For Citrus - By Country

Because MRLs change frequently, no guarantee is made concerning the accuracy of the below values. Verify these values with other knowledgeable sources within specific markets of interest.

Materials EXEMPT from US tolerances or labeled only for application to NONBEARING trees are NOT included.

Proposed values are not in effect and may never be adopted, but are listed to notify of potential upcoming changes.

"E" indicates potential MRL reduction or elimination for the indicated market perhaps a year or more in the future.

**Abbreviations:**
- G = grapefruit
- O = sweet orange
- T = tangerine (mandarin)
- L = lemon
- P = pomelo


<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Brand or Trade Names (Examples only, not exhaustive)</th>
<th>U.S. Citrus</th>
<th>CODEX Citrus</th>
<th>Canada Citrus</th>
<th>EU (G &amp; O only)</th>
<th>Great Britain (G &amp; O only)</th>
<th>Japan (G &amp; O only)</th>
<th>Korea (G &amp; O only)</th>
<th>Taiwan (G &amp; O only)</th>
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<tbody>
<tr>
<td>2,4-D (2,4-Dichlorophenoxyacetic acid)</td>
<td>Citrus Fix, Hicvol</td>
<td>3</td>
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<td>1</td>
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<td>Abamectin</td>
<td>Agri-Mek, Clinch, Zephyr, ABBA, Epl-mek, Reaper, Minecto Pro</td>
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<td>0.02</td>
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<td>0.01 (G); 0.05 (O)</td>
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<td>0.01 (G); 0.7 (O)</td>
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<td>Akound, Graduate A+, Quadris Top (component)</td>
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<td>10</td>
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<td>0.3 (E)</td>
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<td>Pristine (component)</td>
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<td>2</td>
<td>10</td>
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<td>3 (G), 2 (O)</td>
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<td>0.01 (G); 2 (O)</td>
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Thank You!

• For more information, visit the UF Postharvest Website

http://irrec.ifas.ufl.edu/postharvest/