Fresh Fruit Roundup
-Decay Control
-MRLs

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Control Options

- Preharvest - No reliable replacement yet for Benlate or Topsin
  - However, copper, Aliette, and phosphorous acid products to reduce Brown rot
- Postharvest control measures
  - Good sanitation practices
  - Careful handling
  - Use of fungicides
    - Must be effective against latent organisms such as Diplodia and Anthracnose

Postharvest Fungicides

- Thiabendazole (TBZ)
  - Controls stem-end rot and green mold
  - Some effectiveness against anthracnose
  - Does not control sour rot or black rot

- Imazalil
  - Especially effective against green mold
  - Diplodia and Phomopsis - generally slightly less effective than TBZ
  - Some activity against black rot
  - Ineffective against sour rot and brown rot
Postharvest Fungicides

• Sodium o-phenylphenate (2 Phenylphenol O-phenylphenol [OPP])
  – Effective against green mold & sour rot
  – Little to no control of Diplodia or Phomopsis stem-end rot, or black rot

• Fludioxonil
  – Effective against green mold and Diplodia stem-end rot
  – Much less green mold sporulation control compared to imazalil
    • Combined with azoxystrobin (Graduate A+) = Good sporulation control
  – Compatible with chlorine

Postharvest Fungicides

• Propiconazole
  – Reported good control of sour rot
  – Not tested under FL conditions

• Phosphites (e.g., potassium phosphite)
  – Effective against brown rot & stem-end rot
  – ‘Ruby Red’ grapefruit
    • Inoculated for Brown rot
    • Natural infections of Diplodia

• Essential oils??
• Chlorine dioxide??

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Brown Rot (%)</th>
<th>Diplodia SER (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>45.0 a</td>
<td>23.8 a</td>
</tr>
<tr>
<td>TBZ</td>
<td>40.6 b</td>
<td>6.9 b</td>
</tr>
<tr>
<td>Potassium Phosphite</td>
<td>8.1 c</td>
<td>4.4 b</td>
</tr>
<tr>
<td>Potassium Phosphite + TBZ</td>
<td>13.1 c</td>
<td>0.6 b</td>
</tr>
<tr>
<td>75 F</td>
<td>38.5 a</td>
<td>9.6 a</td>
</tr>
<tr>
<td>120 F</td>
<td>17.9 b</td>
<td>5.0 b</td>
</tr>
</tbody>
</table>
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

### Treatments:
Control = Water
Thy = Thymeguard (Thyme oil)
Men = Mentor EC (Propiconazole)
Qua = Quadris Top (Azoxystrobin + Difenconazole)
Hea = Headline (Pyraclostrobin)
Mer = Mertect 340F (Thiabendazole)
Gra = Graduate A+ (Azoxystrobin + Fludioxonil)
Top = Topsin (thiophanate-methyl)

Dr. Jiaqi Yan
Dr. Jiuxu (John) Zhang
Cuifeng Hu
Maximum Residue Limits (MRLs)

- Industry vigilance is required when MRLs for export markets are lower than U.S. MRLs
  
  - Countries change MRLs periodically
  
  - Limited knowledge of how fast residues of various compounds decline under different production/postharvest conditions
http://irrec.ifas.ufl.edu/postharvest/

Or simply search for

“UF Postharvest”
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.

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

**For Citrus - By Country**

Material EXEMPT from US tolerances or only labeled for application to NONBEARING trees are NOT INCLUDED

*“Expiring”, “expired” or “non-renewed” pesticides relate to citrus registration in the respective country. Proposed MRL changes (likely elimination) may follow eventually*

**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 inclusive)</th>
<th>U.S. Citrus</th>
<th>CODEX Citrus</th>
<th>Canada Citrus</th>
<th>EU (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>
</tr>
</thead>
<tbody>
<tr>
<td>2,4-D (2,4-Dichlorophenoxyacetic acid)</td>
<td>Citrus Fix, Hicfix</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2 (1 proposed)</td>
<td>0.15</td>
<td>2</td>
</tr>
<tr>
<td>Abamectin</td>
<td>Agri-Mek, Clinch, Zephyr, ABBA, Epo-Mek, Reigger</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>0.04</td>
<td>0.01 (1 proposed)</td>
<td>0.02 (O), 0.05 (O)</td>
<td>0.01</td>
</tr>
<tr>
<td>Acarbozol</td>
<td>Kanemite</td>
<td>0.35</td>
<td>0.35</td>
<td>0.2 (G), 0.4 (O)</td>
<td>2</td>
<td>1 (0.3 O proposed)</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Acetamiprid</td>
<td>Assail</td>
<td>1</td>
<td>1</td>
<td>0.5</td>
<td>0.9</td>
<td>2</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Azterallar-S-methyl</td>
<td>Actigard</td>
<td>0.02</td>
<td>0.015</td>
<td>0.1</td>
<td>0.01</td>
<td>0.02</td>
<td>0.2 (0.015 proposed)</td>
<td></td>
</tr>
<tr>
<td>Alfapyrprox</td>
<td></td>
<td>0.015</td>
<td>0.15</td>
<td>0.01</td>
<td>0.2</td>
<td>0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alpha-aminophyll</td>
<td></td>
<td>0.35</td>
<td>0.5 (G, P, L)</td>
<td>0.3 (O, T, L)</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acyloxyfloxin</td>
<td>Axon, (Graduate A)</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Beta-Cyfluthrin</td>
<td>Baythroid XL</td>
<td>0.2</td>
<td>0.3</td>
<td>0.1</td>
<td>0.02 (proposed label non-renewal)</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Bifenthrin</td>
<td>Brigade, Capture, Telstar, Fanfare</td>
<td>0.05</td>
<td>0.05</td>
<td>0.1</td>
<td>0.05 (pending 7/1/21)</td>
<td>2</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Boscalid</td>
<td>A component of Pristine</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bromocarb</td>
<td>Bromo, Hyval</td>
<td>0.1</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buprofezin</td>
<td>Applaud, Centaur</td>
<td>4</td>
<td>1</td>
<td>0.1 (O, L, P)</td>
<td>0.91</td>
<td>3 (O), 2 (O)</td>
<td>0.5 (O), 2.5 (O)</td>
<td>0.5</td>
</tr>
</tbody>
</table>

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 only labeled 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.
"Expanding", "expired" or "non-renewed" pesticides relate to citrus registration in the respective country. Proposed MRL changes (likely elimination) may follow eventually.

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Buprofezin</td>
<td>Applaud, Centaur</td>
<td>4</td>
<td>0.1 (L, P), 4 (O, T)</td>
<td>0.01</td>
<td>3 (G), 2 (O)</td>
<td>0.5 (G), 2.5 (O)</td>
<td>0.5</td>
</tr>
<tr>
<td>Chlorpyrifos</td>
<td>Lorsban, Nufos</td>
<td>1</td>
<td>1</td>
<td>1.5 (expired)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Dimethoate</td>
<td>Dimethoate, Cygon</td>
<td>2</td>
<td>5</td>
<td>1.5</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Fenbuconazole</td>
<td>Enable</td>
<td>1</td>
<td>0.5 (G, O, T, P), 1 (L)</td>
<td>0.7 (G), 0.9 (O) (possibly expiring 4/30/21; MRL not anticipated to change through 2022)</td>
<td>1</td>
<td>0.5</td>
<td>0.01</td>
</tr>
<tr>
<td>Fenbutatin Oxide</td>
<td>Vendex</td>
<td>20</td>
<td>5</td>
<td>0.01</td>
<td>5</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Fenpropathrin</td>
<td>Ventox</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>0.5</td>
<td>5</td>
</tr>
<tr>
<td>Flufenoxuron</td>
<td></td>
<td>0.3 (G)</td>
<td>0.4 (O)</td>
<td>1 (O)</td>
<td>0.3 (0.01 proposed)</td>
<td>2 (O)</td>
<td>1 (O)</td>
</tr>
<tr>
<td>Imazalil</td>
<td>DECCOCIL EC-289, Freshgard 700, Fungafit S66EC</td>
<td>10</td>
<td>5 (G, T, P), 8 (O, L, L)</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Methomyl</td>
<td></td>
<td>2</td>
<td>1</td>
<td>0.01 (expired)</td>
<td>10</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Propargite</td>
<td>Comite, Omite</td>
<td>5 (G, L, 10 (O)</td>
<td>3</td>
<td>5</td>
<td>0.01 (G), 4 (O) (expired)</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Propiconazole</td>
<td>Banner, Bumper, Thr, Orbit, Propiflex</td>
<td>8</td>
<td>4 (G, P), 10 (O, L)</td>
<td>8</td>
<td>9 (G) 9 (O) (0.01 proposed)</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Pyridaben</td>
<td>Nester</td>
<td>0.9</td>
<td>0.9</td>
<td>0.1</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Tolerance for unlisted materials: None
Pesticide Residues & Maximum Limits

UF/IFAS Publications
- UF Pesticide Information Office Chemically Speaking Newsletter

Pesticide MRL Web Resources
- Global MRL Database - Bryant Christie, supported by the USDA Foreign Agricultural Service (FAS).
- U.S.A. Code of Federal regulations - Go to Title 40, Part 180 found here for the official list of U.S. MRLs.
  - See Subpart D—Exemptions From Tolerances
  - Substances Generally Regarded as Safe (GRAS)
- European Union - EU MRL Pesticide Database—European Commission Directorate General for Health and Consumers. Quick jump to: Grapefruit, Orange, Mandarins
- Japan - MRLs—List of Agricultural Chemicals in Foods—The Japan Food Chemical Research Foundation. See: Grapefruit, Orange. Postharvest fungicides must also be designated by Japan as Food Additives. Original website on Japan’s “Positive List System for Agricultural Chemical Residues in Foods.” See also MRL/W Notification No 498 (Exempted Substances).
Thank You!

• For more information, visit the UF Postharvest Website

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