

Update on Fungicides and Decay Control for Fresh Citrus

Mark Ritenour¹ & Jan Narciso²

¹UF/IFAS Indian River REC, Fort Pierce
²USDA/ARS USHRL, Fort Pierce



The Need



- Control of postharvest decay is always a concern.
- Many factors influence the potential for decay development:
 - Preharvest field conditions.
 - Harvesting & handling practices.
 - Postharvest temperatures, relative humidity, exposure to ethylene, etc.

Options?

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

Currently Registered Fungicides for Citrus Postharvest Treatments

- Thiabendazole (TBZ)
- Imazalil
- Sodium o-phenylphenate (SOPP)
- Fludioxonil (Graduate)
- Fludioxonil + azoxystrobin (Graduate A+)
- Pyrimethanil (Penbotec)

Postharvest Fungicide MRLs

Chemical Name	U.S. (Citrus)	Canada (Citrus)	CODEX (Citrus)	EU (Citrus)	Japan (G & O)	Taiwan (G & O)	Korea (G & O)
Azoxystrobin	15	10	15	15	No Food Additive Status	10	7 (G); 5 (O)
Fludioxonil	10	10	10	10	10	5	10 (G); 5 (O)
Imazalil	10	5	5	5	5	2	5
Pyrimethanil	10; 11 (L)	10	7	10	No Food Additive Status	7	1
SOPP (2 Phenylphenol, O-phenylphenol)	10	10	10	Expiring 9/30/12	10		10
Thiabendazole (TBZ)	10	10	7	5	10	10	10

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

Home Indian River REC Horticultural Sciences Search

General Postharvest Information

Citrus PackingHouse Newsletter
2010-2011, Index, Archive

Topical Index
Problems, Safety & Quality, Diseases & Decay Control, Cold Storage, Sanitation & Food Safety, Marketing

Pesticide Residues & Maximum Limits
US IRAS Publications
Maximum Residue Limits (MRL) for Citrus (PDF) for U.S. & Selected Export Markets Updated October 2011

Pesticide MRL Web Resources

- International Maximum Residue Level Database - IUTCA Foreign Agricultural Service (FAS)
- U.S.A. Code of Federal Regulations - Go to Title 40, Part 180 found here, or here for the official list of U.S. MRLs - Index to Title 40, Part 180 - See Subpart D - Exemptions From Tolerances - See EPA's excellent overview on Pesticides and Food
- European Union - EU MRL Pesticide Database - European Commission Directorate General for Health and Consumers
- Japan - MRLs List of Agricultural Chemicals in Foods - The Japan Food Chemical Research Foundation. See Grapefruit, Orange, Lemon, Lime, Other citrus. Pesticides/Residues must also be designated by Japan as Food Additives
- Canada - Health Canada Search MRL information
- CODEX Alimentarius - Pesticide Residues in Food - FAO/WHO Food Standards. CODEX homepage
- Taiwan - Proposed Acts and Regulations - Taiwan DOH Drafts of pesticide residue limits, May 2009 (1) (2) April 2008
- Korea - MRL database. For an explanation of their policy's decision tree, go to "Pesticide MRLs - sorted by their" on left side of page, and select "English" in upper right corner to see the translation of the decision tree policy. Korea does not accept Codex long group MRLs.
- OECD Maximum Residue Level Calculator - With the goal of harmonizing the calculation of MRLs across the OECD, the OECD has developed a MRL Calculator. Click here for discussion of switching from the IUPAC MRLs calculator to the OECD MRL Calculator.

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Thiabendazole (TBZ)

- Controls stem-end rot and green mold.
 - Some effectiveness against anthracnose.
 - Does not control sour rot or black rot.
- Recommended concentrations:
 - 1000 ppm (0.1%) as a water suspension.
 - 2000 ppm (0.2%) in a water-based wax.
- Not very soluble in water.
 - Constant agitation required.
- Include a sanitizer (e.g., chlorine) with recirculated solutions.

Imazalil

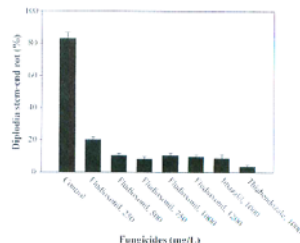
- Especially effective against green mold.
 - Diplodia and Phomopsis - generally less effective than TBZ.
 - Some activity against black rot.
 - Ineffective against sour rot and brown rot.
- Recommended concentrations
 - 1000 ppm (0.1%) as a water suspension
 - 2000 ppm (0.2%) in a water-based wax
- Not compatible with chlorine.
- Imazalil is on CA's Prop 65
 - list of substances known to the State to Cause Cancer
 - No Significant Risk Level (NSRL) = 11 µg/day

SOPP

- Sodium o-phenylphenate, also called
 - 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.
- Recommended concentration:
 - 2% aqueous solution, pH at 11.5-12.0 is the most effective treatment.
 - Some include 0.2% sodium hydroxide for pH control, and 1% hexamine to minimize phytotoxicity.

Fludioxonil

- Effective against green mold and Diplodia stem-end rot.
- Much less green mold sporulation control compared to imazalil.
- Compatible with chlorine.



Fludioxonil + Azoxystrobin

- Graduate A+
- Good sporulation control.

Fallglo Tangerines

Treatment	Diplodia (%)	Total decay (%)
Control	14.36 a	23.19 a
TBZ (1000 ppm)	4.31 b	11.74 b
Imazalil (500 ppm)	5.65 b	11.94 b
Graduate A+ (600 ppm)	5.00 b	11.25 b
Graduate A+ (1,200 ppm)	1.35 b	4.58 b
TBZ (1,000 ppm) + Graduate A+ (300 ppm)	5.93 b	7.96 b
TBZ (1,000 ppm) + Graduate A+ (600 ppm)	1.32 b	5.04 b
Significance	***	*

Harvested Sept. 24, 2009,

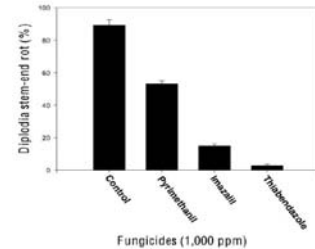
Dipped 10 sec. in respective solution (all included 100 ppm chlorine except Imazalil),

Degreened for 5 d (85F, 95% RH, 5 ppm ethylene),

Washed & waxed (carnauba) and stored at ambient temperatures for 35 d.

Pyrimethanil

- Effective against green mold
 - Much less effective against *Diplodia* stem-end rot.
 - Not evaluated against other common FL diseases.



Zhang, 2009

Acknowledgments

- Jan Narciso
- Cuifeng Hu
- Sambhav
- Jordan Yancy
- Monty Myers
- Andrew Myers
- Kendra Thomason
- Kayla Thomason



Thank You!

- For more information, visit the UF Postharvest Website

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