Potential of New Fungicides for Postharvest Disease Control of Florida Citrus

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The Impact of Postharvest Diseases on the Florida Citrus Industry

- **Citrus diseases can cause significant losses for growers, packers, shippers, and consumers.**
- **Postharvest losses are usually greater than realized because of added cost of harvesting and handling.**
- **Postharvest decay is one of the most important factors affecting fresh citrus fruit market value.**
- **An effective postharvest decay control program is critical for the Florida fresh citrus industry.**

Citrus Postharvest Disease Management System in Florida

Postharvest disease control in Florida is conducted by an integrated procedure using synthetic fungicides as the core component

Currently Registered Fungicides for Citrus Postharvest Treatments

- Thiabendazole (TBZ)
- Imazalil
- Sodium o-phenylphenate (SOPP)

Problems Associated with Currently Registered Fungicides

- No effective alternatives available to the currently registered fungicides
- Increasingly restrictive regulations
- Health risk concerns
- Pathogen resistance development

Proposed timeline for EPA review of new postharvest fungicide products

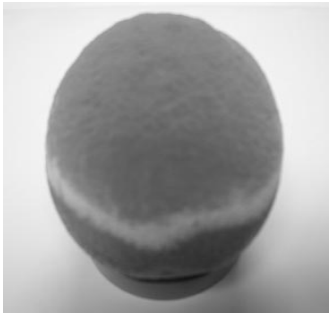
Fungicide	Active ingredient	Chemical class	EPA Review	Labeled
Penbotec (PH066)	Pyrimethanil	Pyrimidine	2003	2003
Abound	Azoxystrobin	Strobilurin	2004	2005
Scholar	Fludioxonil	Pyrrole	2004	2005

Evaluation of Abound and Scholar for Postharvest Disease Control of Florida Citrus

- **The two compounds were tested against different pathogens *in vitro*.**
- **The two compounds were also tested *in vivo* using a dip method, and simulated commercial packingline application and drench systems.**

Diplodia stem-end rot caused by *Diplodia natalensis*

Green mold caused by *Penicillium digitatum*

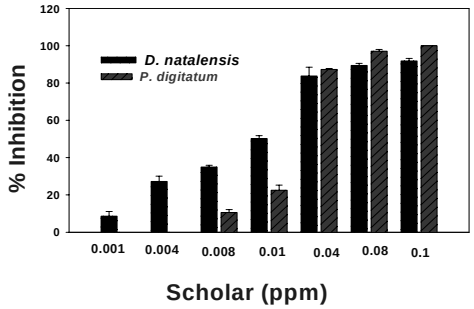


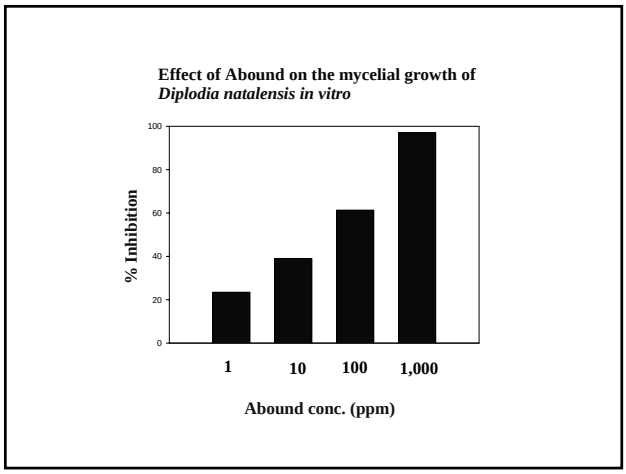
Evaluation of Abound and Scholar on Mycelial Growth of *Penicillium digitatum* and *Diplodia natalensis in vitro*

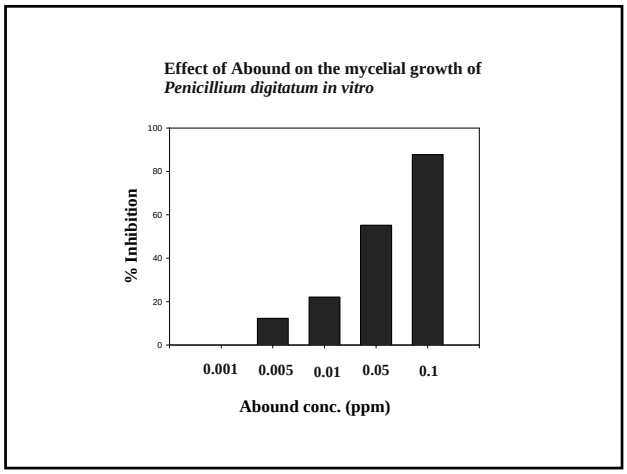
Materials and Methods

- *D. natalensis* D-11 and *P. digitatum* PD-9 were used in the tests.
- Scholar or Abound was incorporated into PDA at different concentrations.
- Fungal mycelial plugs were transferred onto fungicide amended medium, and incubated at 25C.
- Fungal colony diameters were recorded daily to determine the inhibitory activities of fungicides against the pathogens.

Effect of Scholar on mycelial growth of *Diplodia natalensis* and *Penicillium digitatum*



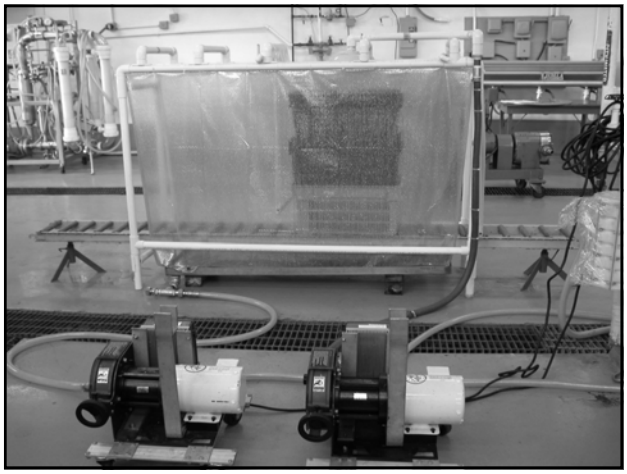




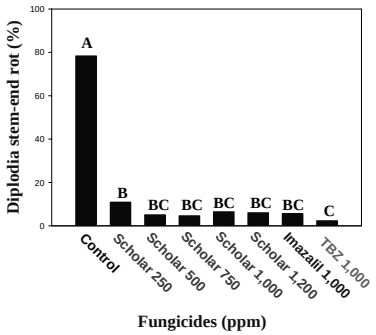
Evaluation of Abound, Penbotec and Scholar for Decay Control Using a Simulated Commercial Drench Application System

Materials and Methods

- A simulated commercial drench system was used in all tests.
- Fruit were drenched for 3 min and drained for 4 min and then degreened with ethylene at about 10 ppm for 3 days.
- Treated fruit were incubated at 21C, and decay incidence was recorded weekly.



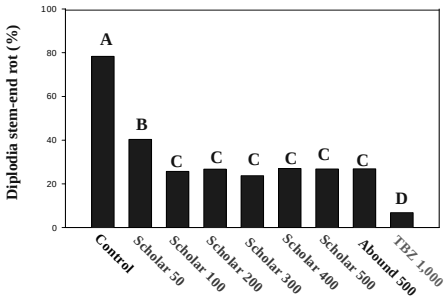
Effect of Scholar on Diplodia stem-end rot by drenching application before degreening treatment of Ambersweet orange



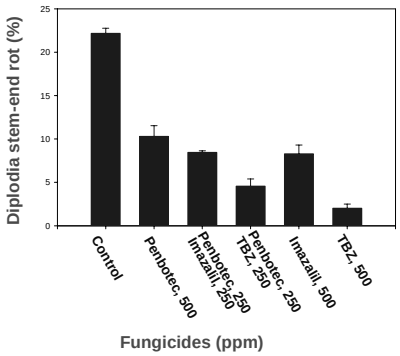
Control **Scholar, 250 ppm** **Scholar, 500 ppm**

TBZ, 1,000 ppm
Imazalil, 1,000 ppm
Scholar, 1,200 ppm
Scholar, 1,000 ppm
Scholar, 750 ppm
Scholar, 500 ppm
Scholar, 250 ppm
Control

Effects of Abound and Scholar on Diplodia stem-end rot using drench application before degreening treatment of Fallglo tangerine fruit



Effect of Penbotec on Diplodia stem-end rot on Valencia oranges using drench method

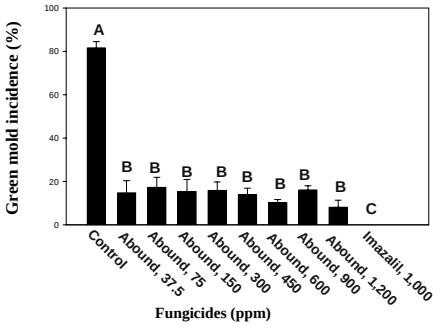


Evaluation of Abound, Penbotec and Scholar for Decay Control Using a Dip Application Method or a Simulated Commercial Packingline Drip System

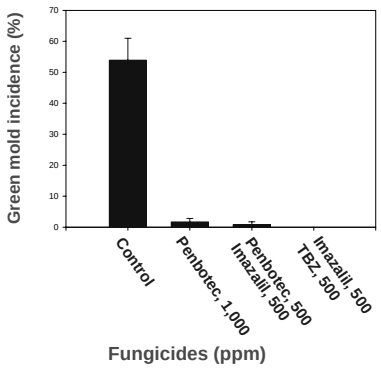
Materials and Methods

- Decay was from natural infections or inoculations.
- For dip test, fruit were immersed in fungicide suspension for 1 min, 24 hrs after fruit inoculation.
- For packingline drip test, aqueous fungicides were applied on fruit by a non-recovery drip system with 15 to 20 sec. of contact time over running brushes.
- Fruit ethylene degreening was used for Diplodia stem-end rot evaluation.
- Treated fruit were incubated at 21C, and decay incidence was recorded weekly.

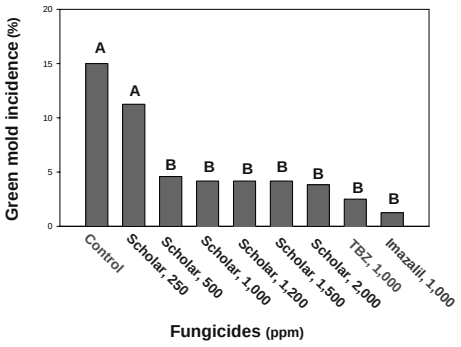
Effect of Abound at different concentrations on green mold control using dip test method and inoculated Valencia orange



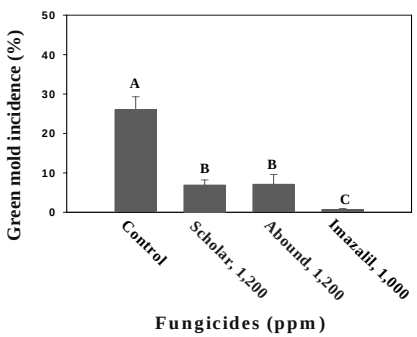
Effect of Penbotec on green mold on Valencia fruit using inoculation and dip test method

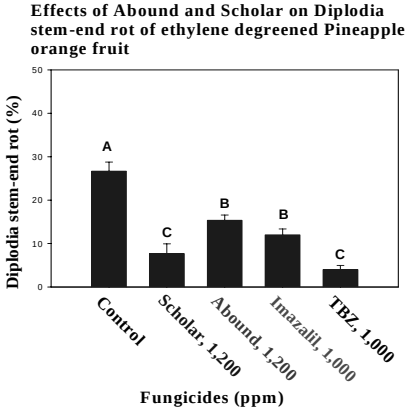


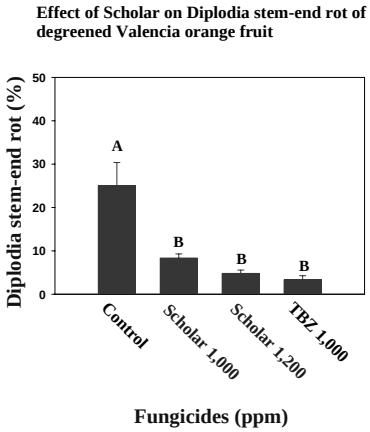
Effects of Scholar at different concentrations on green mold of Valencia fruit by packingline application



Effects of Abound and Scholar on green mold of nondegreened Pineapple orange fruit using packingline application







Summary

- **Currently registered fungicides are TBZ, Imazalil and SOPP. Three new fungicides Scholar, Abound and Penbotec are in process for EPA registration.**
- **Both Abound and Scholar**
  - **Actively suppressed the mycelial growth of green mold and stem-end rot pathogens *in vitro.***
  - **Effectively controlled Diplodia stem-end rot using a simulated commercial drench system and packingline application.**
  - **Significantly reduced green mold using a simulated commercial packingline drip application and a dip test method.**

Summary--continued

- **Scholar**
  - **Showed better control of Diplodia stem-end rot compared to Abound.**
  - **Appears to be a promising alternative to TBZ for the control of stem-end rot and green mold on citrus.**
- **Penbotec**
  - **Showed excellent control of green mold using dip test.**
  - **Showed moderate activity against Diplodia stem-end rot in drench test.**

Summary--continued

- **New fungicides, Scholar, Abound and Penbotec should provide additional chemical tools to the citrus industry to effectively control postharvest diseases and manage fungicide resistance.**
- **More tests on new fungicides will be conducted.**
- **However, TBZ and Imazalil are still excellent chemicals for decay control as long as no obvious fungicide resistance problems develop in Florida packinghouses.**

Effects of fungicides on different postharvest diseases of Florida citrus

	Stem-end Rot	Molds	Sour Rot	Anthracnose
TBZ	+++++	++++	—	+
Imazalil	++++	+++++	—	+
SOPP	+	++	+	?

Thank You For Your Time