Young Plant Research Center

Pre-Shipping Treatments on Liner Trays for *Botrytis cinerea* Control (2005 -2006)

Internal Report for Young Plant Research Center Partners.

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Background

Botrytis blight, caused by *Botrytis cinerea* is a common disease of greenhouse crops. Botrytis is also referred to as gray-mold because of the fluffy gray spores it usually produces on the surface of infected plant tissues. Although plants may be attacked at any stage, tender new growth, injured tissues and senescing or dead tissues are highly susceptible to infection. An informal survey of growers indicated that botrytis blight in shipped liner trays was a major concern for several plant species. Conditions that favor botrytis blight development include relative humidity of 93% or greater, temperatures ranging from 55 - 75 °F, and free moisture on plant tissues for 8 to 12 hours. These conditions are often present during liner production and are common during shipping. Bacopa was selected as the test crop because of a high degree of susceptibility to Botrytis. The focus of the studies were to evaluate treatments for efficacy in controlling botrytis during shipping (a protocol for evaluating pre-shipment treatments for Botrytis control during shipping was established in 2005. Efficacy trials were conducted in December 2005 and February, March and May 2006. This report will focus on the efficacy trials in 2006

Materials and Methods

Cuttings for the trials were taken from Bacopa 'Snowstorm' stock plants grown from plugs at the University of New Hampshire (UNH) greenhouses. Two weeks prior to treatments cuttings were taken and stuck in Greenway propagation media in Blackmore 105 trays. Once cuttings were rooted, an average of two weeks, they were pinched at the second node. The 105 trays were cut into smaller, 21-cell trays prior to treatment. Pre-shipment treatments began 1-2 weeks after pinching.

Materials tested included Actigard® (acibenzolar-s-methyl), Alude® (mono- and di-potassium salts of phosphorous acid), Companion® (Bacillus subtillis), Decree® (Fenhexamid), Rhapsody® (Bacillus subtillis) and ZeroTol® (hydrogen peroxide). Control treatments included 'shipped' and 'non-shipped' distilled water treatments. Actigard was applied 5 days prior to shipment. All other treatments were made two days prior to shipment. All materials were applied as foliar sprays at the labeled rate.

Plants were not inoculated for the first three trials (December – March). Due to low incidence of Botrytis plants were inoculated for the May trials. Botrytis spores were collected from 14-day old cultures and applied at a rate of 4-5 x 10^6. Inoculum was applied with an atomizer at 10 psi until droplets were visible. All treatments were inoculated. Trays were bagged immediately after inoculation.

On the "shipping day", each tray was placed in a double-layered paper seafood bag intended to simulate a shipping container. The open end of each bag was folded twice and stapled shut. Each bag was then placed in a tied plastic grocery bag to help maintain high humidity levels. The 'shipping containers' were placed in a fruit cooler and maintained at 64-68F for four days. After four days of 'shipping' the bags were opened and trays were removed and evaluated for botrytis blight (day 0). Trays were then moved to the greenhouse (temperatures approximately 68F) and evaluated four days later.

Five parameters of data were collected. 1- Plant health was evaluated on a scale of 0 – 4 (0: no surface symptoms or sporulation, 1: 1-25% leaves with symptoms, 2: visible sporulation, 3: visible cankering, 4: visible cankering, sporulation and dead or dying cells); 2- # cells with cankers; 3- # cells with sporulation; 4- # cells with dead plants; 5- # cells with blighted plants.

Results

Infection levels were very low for the December and February trials, thus only the results for the March and May trials will be presented.

<u>March Efficacy Trial (without inoculation)</u>

On day 0 (removal from 'shipping container') cankering was significantly less in the No Bag treatment. Sporulation was significantly reduced in the Actigard, Alude, Rhapsody, Zero-Tol and No Bag treatments. There was no statistical difference in blighted plants amongst the treatments because few plants were blighted at day 0 (Fig. 1). On day 4 (4 days after removal from 'shipping

container') only the No Bag treatment showed significant reductions in cankering and blighted plants. There were no statistical differences amongst the treatments for the other disease parameters measured (Fig. 2).

May Efficacy Trial (with inoculation)

On day 0 (removal from 'shipping container') cankering was significantly less in the Actigard, Companion, Decree, and Rhapsody treatments. Sporulation was significantly reduced only in the Actigard treatment. There was no statistical difference amongst the treatment groups when looking at the number of blighted cells because few plants were blighted at day 0. ZeroTol had no effect (Fig. 3).

On day 4 (4 days after removal from 'shipping container') cankering was significantly less in the Actigard, and Decree treatments. Sporulation was significantly reduced in the Actigard, Companion, Decree and Rhapsody treatments. There was no statistical difference amongst the treatment groups when looking at the number of blighted cells because few plants were blighted at day 4. ZeroTol and Alude had no effect (Fig. 4).

Discussion

Although Botrytis infection levels were low compared to the 2005 trials, the 2006 trials did yield useful data. Actigard looks promising as an effective tool for reducing Botrytis sporulation. At this time however, the labeled uses of Actigard do not include Botrytis control on greenhouse crops. If sporulation can be reduced, the aerial spread of Botrytis bight can also be reduced. Decree appears to offer good to very good Botrytis control (as it did in the 2005 trials). Although Companion and Rhapsody reduced initial cankering and sporulation after four days, it should be kept in mind that environmental conditions during the four days post-shipping were not particularly favorable for sporulation. Both products certainly warrant further study.

Why was disease incidence so low? In the December and February trials the temperatures in the UNH Greenhouse basement were below optimal (≤ 58F) for Development of Botrytis blight (thus, these trials yielded no useful data). Although optimal temperatures (64F – 68F) were maintained in the March and May trials disease incidence was still relatively low. Humidity levels may have been too low in some of the bags. In the inoculated trial in May the low levels of disease may have been due to a residual effect from the application of Spectro (Chlorothalonil and Thiophanate methyl) to the stock plants. Spectro has a 21- day, or greater residual. Treatments were made 21 days after the Spectro application, thus the fungicide likely inhibited the development of Botrytis blight.

(The authors would like to acknowledge data collection assistance from Deborah Schneider and Andrea Karambelas.)

Future Plans:

• Repeat the efficacy trial with the same materials with inoculation (10/06)

• Additional trials to determine the most effective interval for pre-shipment treatment for prevention of botrytis blight development during shipment of rooted liner trays (11/06 – 2/07).

• Treatment of stock plants with plant activators (Messenger, Actigard) and other materials to determine if treatment will have systemic effects that will carry over through the cuttings to the finished liner trays.

2006 Results (without Inoculation)

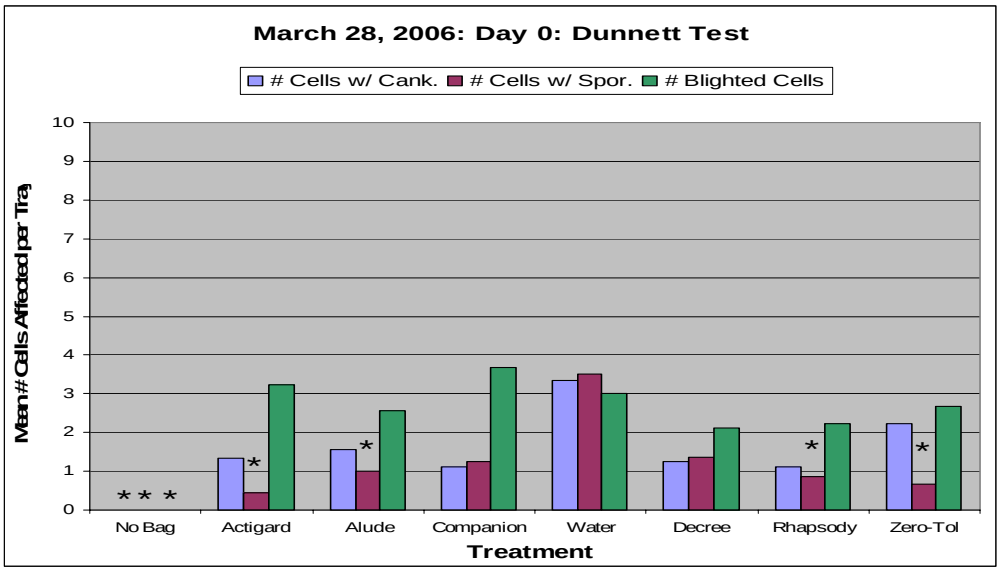

Figure 1: Mean number of cells with cankering, sporulation, dead plants and blighting on Day 0 (when trays were removed from 'shipping containers"). Dunnett's T test was employed for statistical analysis of treatment means. An asterisk (*****) above a bar indicates the treatment is significantly different from the control ("water") treatment.

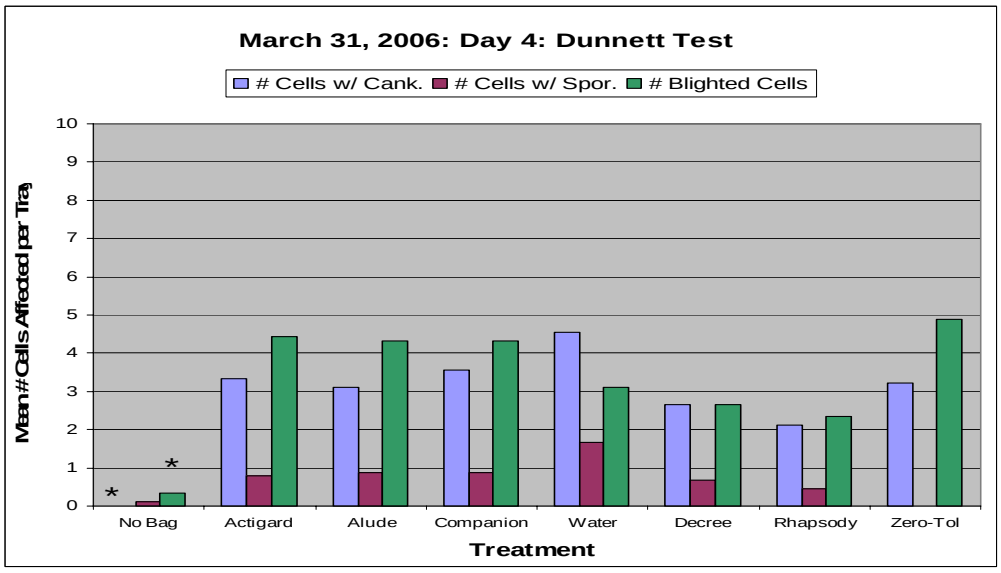

Figure 2: Mean number of cells with cankering, sporulation, dead plants and blighting on Day 4 (4 days following removal from 'shipping containers"). Dunnett's T test was employed for statistical analysis of treatment means. An asterisk (*****) above a bar indicates the treatment is significantly different from the control ("water") treatment.

2006 Results (with Inoculation)

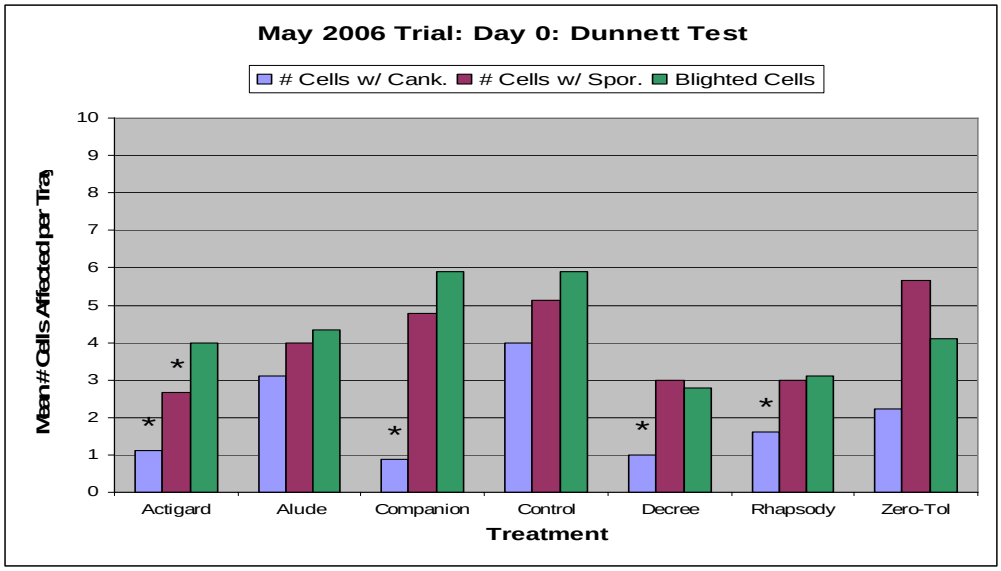

Figure 3: Mean number of cells with cankering, sporulation, dead plants and blighting on Day 0 (when trays were removed from 'shipping containers"). Dunnett's T test was employed for statistical analysis of treatment means. An asterisk (*****) above a bar indicates the treatment is significantly different from the control ("water") treatment.

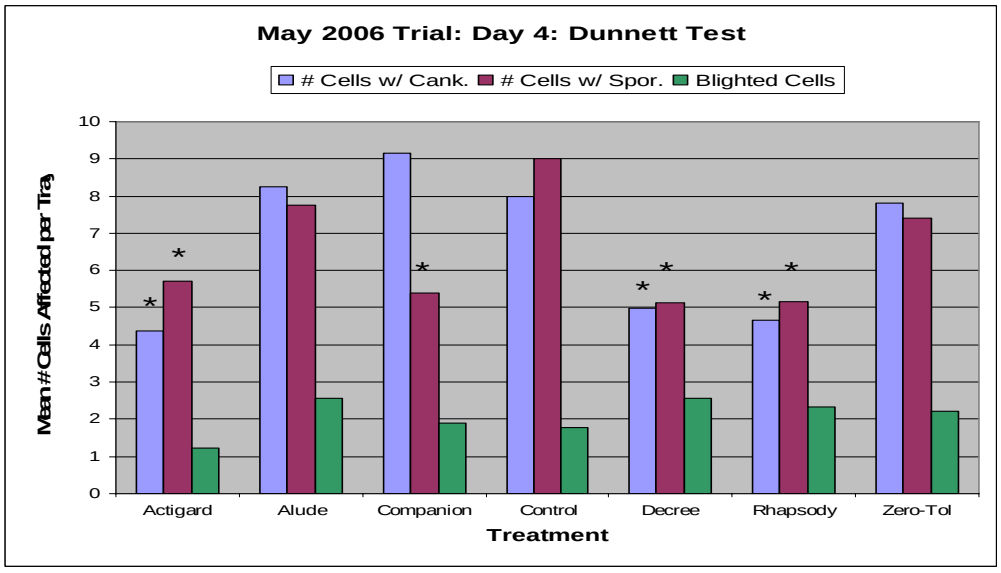

Figure 4: Mean number of cells with cankering, sporulation, dead plants and blighting on Day 4 (4 days following removal from 'shipping containers"). Dunnett's T test was employed for statistical analysis of treatment means. An asterisk (*****) above a bar indicates the treatment is significantly different from the control ("water") treatment.