Young Plant Research Center

Pre-Shipping Treatments on Liner Trays for *Botrytis cinerea* Control

Internal Report for Young Plant Research Center Partners.

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Executive Summary

In these studies, pre-shipment treatments for control of Botrytis in Bacopa cuttings and liners were explored. In a survey of growers, Bacopa was identified as a good test crop due a high level of susceptibility to Botrytis during shipping. Materials tested were plant health promoters (harpin proteins, such as Messenger™), systemic fungicides and a gas treatment with 1-MCP (EthylBloc®) to desensitize plants to ethylene.

Once a viable protocol was established, data from two subsequent studies determined that the Messenger® and EthylBloc® treatments did not significantly reduce the occurrence of *Botrytis* in the Bacopa liner trays. However, pre-shipment application of Decree® 50 WDG or Spectro™ 90WDG 2 days prior to shipping significantly reduced *Botrytis* when compared with trays that were not treated, or were treated with EthylBloc®, water or Messenger®.

Introduction

The purpose of this experiment was to evaluate different pre-shipment treatments for Botrytis prevention in rooted liner trays.

The treatments chosen were as follows:

- **Messenger**®, a harpin protein derived from a bacterial plant pathogen that is reported to activate natural plant defense mechanisms as well as increase the overall growth of the plant.
- **Decree**® 50 WDG Fungicide, in the class Hydroxyanilide, active ingredient Fenhexamid.
- **Spectro**™ 90WDG Fungicide, class Chloronitrile, active ingredients Chlorothalonil and Thiophanate methyl.
- **EthylBloc**®, active ingredient 1-Methylcyclopropene. EthylBloc comes in powder form and when mixed with a buffer solution is released as a gas. It acts by binding to the ethylene receptors on the leaf surface with the intention of blocking subsequent ethylene binding and thereby extending the life of the plant by stopping flower and leaf drop, as well as inhibiting premature wilting and leaf yellowing.

Control treatments included distilled water applied at the same time as the fungicide treatments and a 'no shipment' treatment where trays were not exposed to simulated shipping conditions.

Proven Winners Bacopa 'Snowstorm' cuttings were shipped from Pleasant View Gardens for the first of five trials, in December 2004. The cuttings for the subsequent four trials were taken from Bacopa 'Snowstorm' stock plants grown at the University of New Hampshire (UNH) greenhouses from plugs donated by Pleasant View Gardens. Two weeks before treatment applications began; cuttings were taken and stuck in Blackmore 105 trays with Greenway media.

The cuttings in the first trial received a 350ppm B-Nine spray December 17 followed with a 5ppm Sumagic spray on January 4, 2005. None of the later trials received growth regulators. Once cuttings were rooted (averaging 1-2 weeks at most), they were pinched at the second node. Fungicides were not applied to the stock plants. Treatments began one week after pinching.

Research Protocol

A total of five experiments were run from January through May 2005. The purpose of the first two experiments was to develop a dependable protocol that accurately simulated shipping conditions and produced a consistent degree of symptoms that were not unrealistically severe.

Once the protocol was established the remaining three experiments were run based on the following procedures.

All consequent trials followed the same treatment protocol.

- Messenger: 5 days before shipping (1/4 teaspoon/ quart)
- Spectro™ 90WDG Fungicide : 2 days before shipping (1.5lb/100gal)
- Decree® 50 WDG Fungicide: 2 days before shipping (1lb/100gal)
- EthylBloc®: 1 day before shipping

All applications except the EthylBloc® were made using a 32 oz spray bottle, applying just enough material to glisten the leaves.

EthylBloc® was applied the night before shipping, in an airtight chamber enclosed by greenhouse grade 6ml poly (pictured at right). It was applied at a rate of 0.2 grams EthylBloc® powder, to 5ml of buffer solution. This rate was determined based upon the total volume of the chamber constructed, which was 0.8 cubic meters. The total treatment time ran for 16 hours (overnight).

On the “shipping day”, each tray was placed in a double-layered paper bag intended to simulate a shipping box.

The open end of each bag was folded twice and stapled shut.

Each bag was then placed in a plastic grocery bag left untied to help maintain high humidity levels.

The ’shipping containers’ were placed in the basement level of the greenhouses and maintained at a constant temperature of 58^{o}F for four days.

Research Protocol Continued

After four days the 'shipping containers' were opened and the trays were removed and evaluated for Botrytis. Each treatment was then split in half; one half was placed in a humidity chamber running at 80%, while the other half was placed in a greenhouse with temperatures around 68F.

The intent of using an environment with higher humidity was to facilitate seeing the sporulation in the cells, as a check to see that *Botrytis* was actually present. Statistically, there was no difference in data between the two environments; therefore, the higher humidity environment will be omitted from future studies.

Data Collection

Four main categories of data were collected.

1. **Plant Health:** Indicates the severity of sporulation, cankering, and death visible on the surface of each tray. Based on a scale from 0-4.
    0: No surface symptoms or sporulation
    1: 1-25% Leaves w/ damage
    2: Visible Sporulation
    3: Cankering and sporulation
    4: Cankering, sporulation, dead/dying cells

2. **# Cells with Cankers:** Any plant that had cankers on the stem, or shoots.

3. **# Cells with Sporulation:** Any cell that had visible sporulation on any plant tissue.

4. **# Dead Cells**

Results

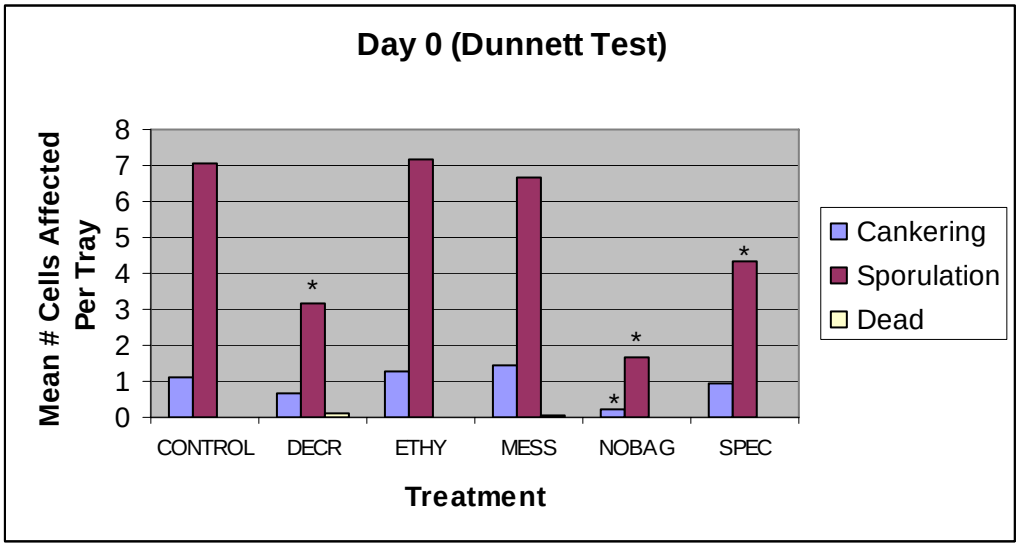

Figure 1: Dunnett statistical analysis of significant differences from Control amongst treatment groups for combined data from experiments 4 & 5 collected on Day 0 (when plants were removed from storage). An asterisk (*****) above a bar indicates that a particular treatment is significantly different from the control ("CONTROL") group. The number of cankers was significantly lower in the No Bag (NOBAG) treatment group. Sporulation was significantly less in the Decree (DECR), Spectro (SPEC), and No Bag treatment groups. There was no statistical difference amongst the treatment groups when looking at the number of dead cells because few plants were dead at day 0. Ethylbloc (ETHY) and Messenger (MESS) had no effect.

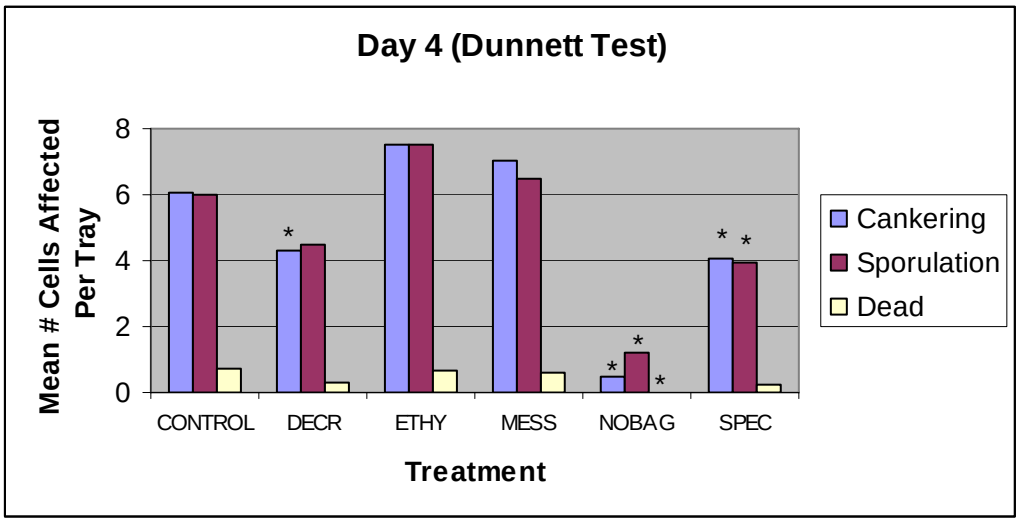

Figure 2: Dunnett statistical analysis of significant differences from Control amongst treatment groups for combined data from experiements 4 & 5 collected on Day 4. An asterisk (*****) above a bar indicates that particular treatment is significantly different from the control group. The number of cankers was significantly lower in the Decree (DECR), Spectro (SPEC), and No Bag (NOBAG) treatment groups. Sporulation was significantly less in the Spectro and No Bag treatment groups. There were significantly less dead cells in the No Bag treatment group than in the control.

Discussion

Shipping significantly increases the incidence of *Botrytis* in Bacopa liner trays.

Pre-treating liner trays with either Decree® 50 WDG or Spectro™ 90WDG fungicides significantly decreased the occurrence of *Botrytis* when compared to liner trays that did not receive any treatments prior to shipping.

Pre-treatment with Ethylbloc or Messenger had no beneficial effect.

Future investigations using this protocol may include:

- Trialing different cultivars to determine *Botrytis* sensitivity.
- Testing different fungicides to determine efficacy.
- Other non-fungicidal treatments such as hardening off with cool greenhouse temperature or growth retardant applications.
- Testing fungicide application timing and duration
    - Number of days prior to shipping
    - Most effective application window
- Varying the shipping duration.
- Altering shipping temperatures and/or finishing temperatures.