EFFECT OF PRE- AND POST-INFECTION PERIOD APPLICATIONS OF CABRIO ON THE DEVELOPMENT OF ANTHRACNOSE

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Introduction

Strawberries are the third most valuable fruit crop in New York. In 2002, NY growers produced about 6.30 million pounds of strawberries on 1100 acres retuning an estimated $8.82 million. Strawberry anthracnose, caused by the fungus *Colletotrichum acutatum*, is one of the most serious diseases in commercial strawberry production. The disease has become an increasing problem in the Northeast and has resulted in substantial yield losses when conditions favored disease development. Currently, growers rely on calendar-based protective applications of fungicides for disease management. Ideally, growers would prefer to apply fungicides only when necessary, but this requires a good understanding of the conditions suitable for disease development as well as knowledge of the efficacy of the available control options.

Wilson et al. (1990) developed predictive curves to estimate the incidence of anthracnose on immature and mature berries based on the duration of berry wetness and the average temperature during the wetting period. In general, they found that the optimum temperature for infection for both immature and mature fruit was between 25 and 30 C, with greater than 80% infection occurring after 13 hr of leaf wetness. No infection occurred on either immature or mature fruit below 4 C, nor was any infection observed on immature fruit above 35 C. The infection curves developed by Wilson et al. (1990) do not help grower's time fungicide applications to prevent disease from reaching some damage threshold, nor do they provide any insight to the level of disease that would result if a grower were to apply a fungicide under a particular set of conditions. Research was initiated to study the efficacy of pre- and post-infection period applications of Cabrio on the development of anthracnose under different environmental conditions.

Materials and Methods

Plant Production and Maintenance: Day neutral plants of the variety 'Tristar' were grown in 6 inch pots in a 6:1 ratio of Cornell mix and sand. Plants were deflowered for the first 6-8 weeks of growth to encourage uniform flowering and berry production and, afterwards, bumblebees were introduced and utilized for pollination. The plants were fertilized weekly to provide plants 50 ppm N per week. Greenhouse temperatures were kept at approximately 22 C and supplemental overhead light was used when necessary.

Inoculum Preparation and Inoculation: Local strains of *C. acutatum* were isolated from infected berries collected in commercial strawberry fields in NY in 2001 and maintained on suitable growth media. Inoculum was prepared by flooding a Petri plate containing an actively growing culture with sterile distilled water and adjusting the final concentration to 2.5×10^4 conidia/ml. The conidial suspension was applied to berries with a handheld, hand-pressurized atomizer until runoff.

Fungicide Treatments: Cabrio EC (pyraclostrobin) was applied to the berries at concentration equivalent to 12 oz/A at 3, 8, 24, and 48 hr prior to inoculation and exposure to their wetting period (defined below); these are defined as pre-infection or protective applications. Another set of plants was treated 3, 8, 24, and 48 h following inoculation and exposure to their wetting period. These are the post-infection period treatments and are designed to look at how long after a wetting event Cabrio can be applied and still give reasonable control. Elevate 50WDG was mixed with Cabrio to control *Botrytis cinerea*; Elevate has no activity against *Colletotrichum acutatum*.

Environmental Conditions: Four plants per fungicide treatment were placed in each of three walk-in mist chambers set at 14, 22, or 30 C at 100% relative humidity. The plants were removed from each of the mist chambers according to their treatment (i.e., 3, 8, 24, or 48 hr), moved to greenhouse benches and dried with box fans. (Remember, half of the plants were treated with Cabrio before exposure to their wetting period; the other half will be treated after exposure.) Six to ten days later, fruit were classified as either mature or immature and rated for the presence or absence of disease. An appropriate set of inoculated and uninoculated controls was included.

Results and Discussion

All Cabrio treatments suppressed disease compared to their corresponding untreated controls. In general, the highest incidence of disease occurred on plants subjected to long wetness durations (12 and 24 h; Fig 1A) or higher temperature treatments (22 and 30 C; Fig 1B)). As anticipated, post-infection period applications of Cabrio tended to be less effective than those applied prior to inoculation. However, there is a notable exception. Cabrio applied up to 48 hours after a short (i.e., 3 or 6 hr) wetting period gave comparable control to Cabrio applications applied protectively (Fig 1A, black and light gray symbols). It was also interesting to note that Cabrio applied 3 hr before inoculation typically had higher disease incidence than when Cabrio was applied 8 hr before inoculation; this was most evident in Figure 1B.

Results of this study suggest that growers may have some options for managing anthracnose. Currently, growers concerned about anthracnose are advised to apply fungicides on a calendar schedule or prior to rain events. In the Northeast, this recommendation is difficult to follow mainly because wetting events during fruit set and harvest are associated with sporadic thunderstorms that are difficult to predict. If a grower were to apply a fungicide each time the threat of a thunderstorm existed, they could possibly be spraying all season long. Our study suggests that for short wetting events, such as those associated with seasonal thunderstorms, growers may have the option of waiting until the infection event occurs before applying a fungicide. However, our study also suggests that for longer wetting events, such as those associated with a weather front, growers should apply fungicides protectively, i.e., before the rain starts.

The results of this study have yet to be validated under field conditions. Our next step is to develop a forecaster or a set of rules to time applications based on the results of this study. Particularly, we are interested in validating the efficacy of Cabrio as a post-infection material. It should also be emphasized that we do not expect these results to transfer to other fungicides,

particularly Captan or Switch. Additional studies would be necessary to develop similar information for these and other promising fungicides.

Literature Cited

Wilson, L.L., Madden, L.V., and Ellis, M.A. 1990. Influence of temperature and wetness duration on infection of immature and mature strawberry fruit by *Colletotrichum acutatum*. Phytopathology 80:111-116.

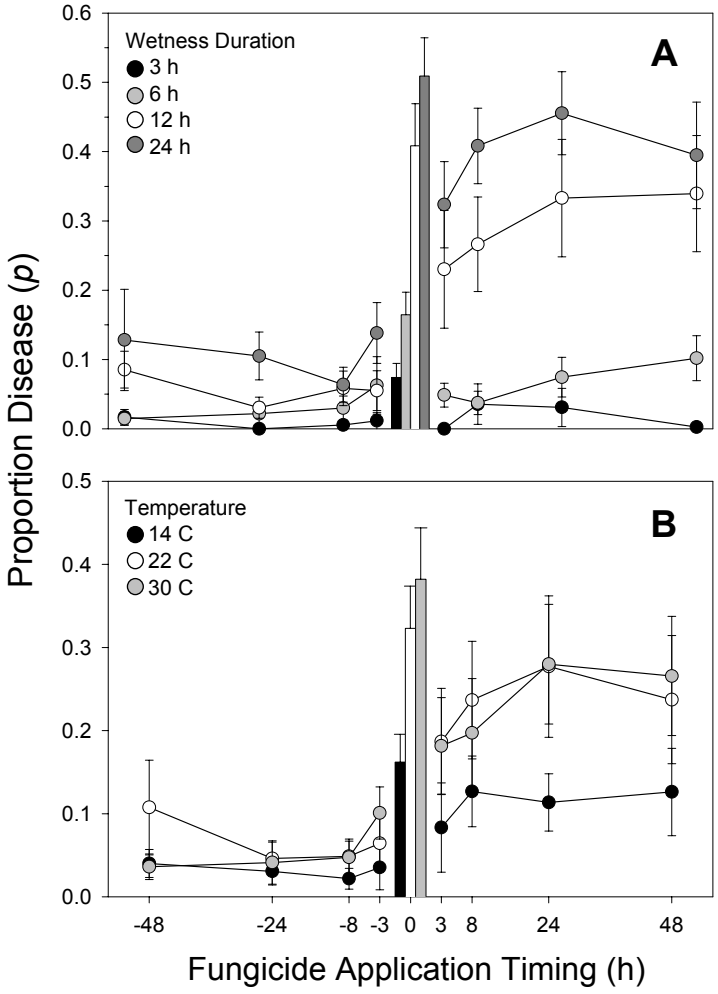

Figure 1: Incidence of anthracnose on immature and mature strawberry fruit treated with Cabrio 3, 8, 24 or 48 hr before inoculation or 3, 8, 24, or 48 after inoculation with *Colletotrichum acutatum* versus: **A)** exposure to 3, 6, 12, or 24 h of wetting (averaged across the three temperature treatments) or **B)** exposure to temperatures of 14, 22 or 30 C (averaged across the 4 wetting durations). The vertical bars show incidence of anthracnose in the untreated checks. The bar and line-symbol colors corresponds to the same treatment.