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A Warning System for Anthracnose Fruit Rot on Strawberries

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Abstract
Anthracnose fruit rot (AFR) of strawberry is caused by three Colletotrichum spp. In the Midwest, however, only Colletotrichum acutatum is found. This fungus can attach itself to apparently healthy plants and spread throughout the field without causing symptoms on the foliage. When fruit beginsto ripen and weather conditions are rainy and warm, AFR can suddenly cause great damage to the fruit. To protect against AFR where it has appeared in the past, growers need to spray every 7 to 10 days beginning at the start of bloom until harvest.

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A Warning System for Anthracnose Fruit Rot on Strawberries

RFR-A1224

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Introduction

Anthracnose fruit rot (AFR) of strawberry is caused by three *Colletotrichum* spp. In the Midwest, however, only *Colletotrichum acutatum* is found. This fungus can attach itself to apparently healthy plants and spread throughout the field without causing symptoms on the foliage. When fruit begins to ripen and weather conditions are rainy and warm, AFR can suddenly cause great damage to the fruit. To protect against AFR where it has appeared in the past, growers need to spray every 7 to 10 days beginning at the start of bloom until harvest.

A disease-warning system for AFR was developed in Florida by Natalia Peres and colleagues. Disease-warning systems are tools that help growers to optimize control while reducing fungicide and labor expenses. The strawberry AFR warning system uses in-field measurements of leaf wetness duration (LWD) and temperature to predict the risk of an AFR outbreak. This warning system has been demonstrated to be effective and economical in controlling strawberry AFR and saving fungicide sprays in Florida. Since the environmental conditions in Iowa are different from Florida, we need to test the warning system under local conditions before it can be adapted by Iowa growers.

Some of the older, broad-spectrum fungicides used in the strawberry industry may pose human health concerns. Thus this study compared the effectiveness of an alternative reduced-risk pyraclostrobin fungicide, Cabrio, to the older fungicide Captan.

This is the second year of a 4-year research project including five states: Florida, South Carolina, North Carolina, Ohio, and Iowa. The objectives of the research in Iowa were to determine 1) whether the warning system can control AFR as well as a calendar-based fungicide program in Iowa, and 2) compare the performance of the reduced-risk fungicide Cabrio to that of the broad-spectrum fungicide Captan.

Materials and Methods

On May 18, 2012, crowns of day-neutral strawberry cultivar Tristar were planted in double rows 1 ft apart in 90-ft-long rows on white-on-black plastic mulch spaced 6 ft apart. Treatment rows were alternated with unsprayed guard rows. Within treatment rows, 10-ft-long subplots containing 20 plants each were separated by 10-ft-long gaps (Figure 1). Cornstalk mulch was placed between rows after planting. Plants were drip irrigated. A weather station (CR10) was placed in the center of the field on June 1 to record hourly LWD and temperature. The data were downloaded twice weekly and used to calculate disease risk.

Five treatments were evaluated: two spray timing methods (warning-system and calendar), two fungicides (Captan and reduced-risk fungicide Cabrio), and one unsprayed control (Table 1). Each treatment was replicated four times in a randomized complete block design, with four replications. To ensure that no other inocula were present in the field, calendar treatments (Treatments 1 and 2) received two sprays (July 2 and 12) and warning system treatments (Treatments 3 and 4) received one spray (July 6) prior to inoculation. On the evening of July 18, all plants were inoculated with a suspension of *C. acutatum* (5×10^4 conidia/ml) using a backpack sprayer. Overhead irrigation was applied for 30 minutes before and after the inoculation to encourage disease development, then one application of all fungicide treatments were made July 24, six days after inoculation.

Fruit were harvested three times weekly from July 26 to September 14. Weight and number of marketable fruit, culls, and anthracnose fruit rot (AFR) were recorded. Disease incidence, marketable yield, AFR yield, and cull yield were compared to evaluate the effect of treatments.

In order to maintain yield quality, 11 lb/acre of urea was applied before planting when the plants began bearing fruit, a mixture of 20-10-20 plus urea (0.31 lb and 1.07 lb/acre, respectively) was applied using fertigation.

Tarnished plant bugs were controlled with three sprays of Dannitol (0.2 lb/acre) and one spray of Assail (2.8 oz/acre).

Results and Discussion

The warning system treatments saved two fungicide sprays and did not differ significantly ($P > 0.05$) from the calendar-based control in controlling AFR disease incidence, reducing the disease incidence by about 15 percent compared to the unsprayed treatment (Table 1). However, when comparing treatment effect using area under the disease progress curve (AUDPC) and weight of diseased fruit, the Captan-only with the warning system treatment (Treatment 3) was less effective ($P < 0.05$) than the other three treatments.

In contrast, the marketable weight comparisons revealed that the warning-system Captan-only treatment (Treatment 3) performed as well as two fungicide treatments in the calendar-based system, but the warning-system alternated-fungicides treatment (Treatment 4) had lower marketable yield than the other three. Damage on the fruit caused by other reasons, such as rot, sunburn, animal, or insect did not differ between treatments.

In order to prevent contamination by *Colletotrichum acutatum* from the nursery or plant debris, we applied fungicide before inoculation. This may not be necessary under the conditions of this experiment (annual cropping on rotated ground). In 2013, we plan to alter our methods by applying fungicides one week after inoculation, and then initiate the calendar-based and warning-system treatments.

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Table1. Treatments, anthracnose fruit rot (AFR), and yield data summary at the ISU Horticultural Research Station.

Trt	Fungicide	Rate lb/acre	Timing Sched.	Period	Spray no.	AFR[a] incidence %	AUDPC	Yield per 20 plants (g) Marketable wt[b]	AFR wt	Cull wt[c]
1	Captan 80WP	3.75	10 days	7/1-9/15	7	2.78 a	148.9 ab	223.81 a	5.78 a	22.13 a
2	Captan 80WP	3.75	10 days	7/1-7/31	7	3.08 a	159.1 ab	216.10 a	6.38 a	18.49 a
	Cabrio 20EG	0.88	10 days	8/1-9/15						
3	Captan 80WP	3.75	Warning system	7/1-9/15	5	6.61 a	357.8 b	217.51 a	16.78 b	25.10 a
4	Captan 80WP	3.75	Warning system; alternated fungicides	7/1-9/15	5	2.22 a	112.8 a	176.79 ab	3.99 a	22.26 a
	Cabrio 20EG	0.88								
5	None	NA	NA		0	19.09 b	786.3 c	149.63 b	30.40 c	20.76 a

[a]Means followed by the same letter are not significantly different within column according to Fisher's protected LSD at P ≤ 0.05.
[b]Marketable yield is the average yield of marketable fruit per 20-plant subplot.
[c]Cull yield is the average weight including fruit damaged by other rots and insect pests per 20-plant subplot.

Figure 1. Strawberry field showing subplots. Weather station was placed in the center of the field.