Iowa State Research Farm Progress Reports

2014

Testing a Warning System for Anthracnose Fruit Rot on Day-neutral Strawberry—Year 3

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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 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.

Keywords
Plant Pathology and Microbiology

Disciplines
Agricultural Science | Agriculture | Fruit Science | Plant Pathology

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RFR-A1336

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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. Because the environmental conditions in Iowa are different from Florida, we need to test the warning system under local conditions before it can be adopted by Iowa growers.

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

This is the third 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 whether the warning system can control AFR as well as a calendar-based fungicide program in Iowa, and to compare the performance of the reduced-risk fungicide Cabrio to that of the broad-spectrum fungicide Captan.

Materials and Methods

On May 15, 2013, about 900 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. 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. No spray was applied in any treatment before inoculation. On the evening of July 23, all plants were inoculated with a suspension of *C. acutatum* (5×10^6 conidia/ml) using a backpack sprayer. Overhead irrigation was applied for 30 min. before and after the inoculation to encourage disease development, then one application of all fungicide treatments was made August 1, eight days after inoculation.

Fruits were harvested three times weekly from July 26 to September 6. Weight and number of marketable fruit, culls, and AFR were recorded. Disease incidence, marketable yield, AFR yield and cull yield were compared in order 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 bug was controlled with three sprays of Dannitol (0.2 lb/acre) and two sprays of Assail (2.8 oz/acre).

Results and Discussion

Both calendar-based treatments significantly ($P<0.05$) controlled the disease and reduced the disease incidence by about 57 percent compared with the unsprayed treatment. The warning system treatments saved one fungicide spray and were as effective as the calendar-based treatments ($P>0.05$). Low disease pressure likely was the cause of lack of significant difference between the warning system treatments and unsprayed control, although the warning system resulted in a 36 percent reduction in disease incidence (Table 1). Similar trends were observed for total AFR incidence percent, area under the disease progress curve (AUDPC) and weight of ARF fruits. However, the marketable weight comparisons showed that all the treatments performed the same, and damage on the fruit caused by other reasons, such as rot, sunburn, animal or insect, did not differ between treatments.

In the growing season of 2013, the weather was not good for AFR development, because warm and humid conditions did not usually coincide. The inoculation also was delayed multiple times because of hot, dry weather and storms. Therefore, the disease pressure was comparatively low. The calendar-based sprays were applied one or two days coincidently before the warning of suitable conditions, so the fungicide residue provided good protection for plants of those treatments.

Acknowledgements

Thanks to Nick Howell, the ISU Horticulture Station crew, and the 312 Bessey field crew for crop planting, maintenance, and harvest.

Table 1. Treatments, anthracnose fruit rot (AFR) incidence, and yield data summary at ISU Horticulture Research Station.

Trt	Fungicide	Rate lb/A	Timing schedule	Period	Spray no.	AFR[1] incidence %	AUDPC[1,2]	Yield/20 plants (g) Marketable wt[1,3]	AFR wt[1]	Cull wt[1,4]
1	Captan 80WP	3.75	10 days	July1 to Sept 15	4	1.7 a	98.5 a	255.6 a	4.2 a	42.2 a
2	Captan 80WP Cabrio 20EG	3.75 0.88	10 days 10 days	July1 to July 31 Aug1 to Sept 15	4	1.4 a	82.4 a	245.6 a	2.6 a	40.0 a
3	Captan 80WP	3.75	Warning system	July1 to Sept 15	3	2.5 ab	136.2 ab	242.7 a	5.5 ab	41.1 a
4	Captan 80WP Cabrio 20EG	3.75 0.88	Warning system; alternated fungicides	July1 to Sept 15	3	2.1 ab	115.4 ab	247.7 a	4.8 ab	39.8 a
5	None	NA	NA		0	3.6 b	197.4 b	260.7 a	8.9 b	37.7 a

[1]Means followed by the same letter are not significantly different within column according to Fisher's protected LSD at P≤0.05.
[2]AUDPC=area under disease curve.
[3]Marketable yield is the average yield of marketable fruit per 20-plant subplot.
[4]Cull yield is the average weight including fruit damaged by other rots, and insect pests per 20-plant subplot.