Validation of Anthracnose Fruit Rot Disease-Warning System on Strawberry–Year 1

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Introduction

Anthracnose fruit rot (AFR), caused by the fungal pathogen *Colletotrichum acutatum*, is one of the top two disease threats (along with Botrytis fruit rot) to strawberry production in the United States. The pathogen is able to damage almost all parts of the plant and fruit rot is the most important symptom.

Transplants with infected root systems establish poorly and produce a minimal early crop. In 2013, emergence of strobilurin (Qo-I) fungicide-resistant *C. acutatum* isolates in Florida became a threat to both the disease-warning system (Strawberry Advisory System; StAS) and traditional calendar-based timing for fungicide sprays. The hidden nature of *C. acutatum* and the proliferation of strobilurin resistance threaten to destroy the value of strobilurin fungicides for strawberry growers and undermine new IPM decision tools like the StAS system.

This field trial is the first year of the 2-year research project in Iowa. The objective was to modify the existing AFR warning system (StAS) to accommodate strobilurin fungicide resistance.

Materials and Methods

On June 8, 2017, approximately 1,000 crowns of day-neutral strawberry cultivars Albion (AFR-tolerant) and Tristar (AFR-susceptible) were planted in double rows on white-on-black plastic mulch. There were 12 plants/subplot, six treatments, and two cultivars. Non-sprayed guard rows were placed between each treatment row. Fungicides used in this trial included a conventional broad-spectrum product, Captan, and a strobilurin fungicide named Cabrio (pyraclostrobin). Each row of the plastic mulch was 153 ft long, and the plants were one ft apart in rows. Cornstalk mulch was placed between rows before planting. Plants were drip irrigated. A weather station (CR10) was placed in the center of the field from June to September to record hourly leaf wetness duration (LWD) and temperature. The weather data were downloaded twice weekly and used to calculate disease risk.

Six treatments were evaluated: three *C. acutatum* inoculum types (pyraclostrobin-sensitive strains, pyraclostrobin-resistant strains, and both types of strains in combination); three spray timing methods (StAS warning system with Captan or Cabrio, StAS with Captan only, and calendar-based timing with Captan only); and one no-spray control (Table 1).

On the evening of July 24, all plants were inoculated with a suspension of *C. acutatum* (7×10^5 conidia/ml) using a backpack sprayer. Overhead irrigation was applied for 30 minutes before and after inoculation to encourage disease development. On July 28, one application of Captan 80 WP (3.75 lb/ac) was made for all the fungicide treatments, five days after inoculation.

Fruits were harvested twice weekly from July 28 to September 22. Weight and number of marketable fruit, culls, and fruit with anthracnose fruit (AFR) spots were recorded.

Disease incidence, marketable yield, and cull yield were compared to evaluate the effect of treatments.

Eleven 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/ac, respectively) was applied weekly using fertigation. Tarnished plant bug was controlled with two sprays of Sevin XLR (1.5 qt/ac) and one spray of Assail (2.8 oz/ac).

Results and Discussion

Disease pressure was comparatively low, since there were few periods of warm, rainy weather. No high-risk warning was received during this harvest season; therefore, no Cabrio was applied on treatments 1, 2, or 3. Treatment 1 and 4 received the same inoculation type and fungicide sprays, and there were no significant differences observed from all the evaluations of these two treatments. Since data for the two cultivars were not different for AFR incidence ($P > 0.125$), the cultivar data were pooled together. All fungicide treatments significantly ($P < 0.05$) controlled AFR and reduced disease incidence compared with the unsprayed treatment. However, the StAS spray strategy, which based fungicide spray timing on weather conditions, saved two fungicide sprays compared with calendar-based spray timing. Treatment 2 (inoculated with pyraclostrobin-sensitive strains) had the highest marketable yield among the different inoculation methods ($P < 0.05$). However, because no Cabrio was applied, this yield difference must be attributable to other unidentified factors.

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Table 1. Treatments, anthracnose fruit rot (AFR), and yield data summary for field experiment on strawberry at the ISU Horticulture Research Station.

Treatment[a]	Strobilurin resistance/sensitivity	Fungicide	Spray strategy	Spray #	AFR incidence (%)[c]	Marketable weight[d]	AFR weight	Cull weight[e]
1	Resistant	Captain 80WP or Cabrio 20EG	StAS[b]	3	2.47 B	1,458.15 AB	45.26 B	479.57 A
2	Sensitive	Captan 80WP or Cabrio 20EG	StAS	3	1.31 B	1,555.29 A	30.94 B	486.13 A
3	Resistant + Sensitive	Captan 80WP or Cabrio 20EG	StAS	3	2.10 B	1,360.40 AB	42.01 B	463.53 A
4	Resistant	Captan 80WP	StAS	3	3.22 B	1,429.26 AB	64.49 B	507.47 A
5	Resistant	Captan 80WP	Calendar	5	3.64 B	1,471.76 AB	81.48 B	492.09 A
6	Resistant	Non-sprayed control	N/A	0	8.51 A	1,265.65 B	167.27 A	449.13 A

[a]Two strawberry cultivars, Albion and Tristar, were used in this experiment. However, the data were pooled together for analysis since there was no difference between these two cultivars for AFR incidence.
[b]Strawberry Advisory System.
[c]Means within a column followed by the same letter are not significantly different according to Fisher's protected LSD at $P \leq 0.05$.
[d]Marketable yield is the cumulative yield of marketable fruit per 20-plant subplot.
[e]Cull yield is the cumulative weight including fruit damaged by non-AFR pathogens and insect pests/20-plant subplot.