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Evaluation of Weather Data as Inputs to a Disease Warning System for Control of Sooty Blotch and Flyspeck

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Abstract
The sooty blotch and flyspeck (SBFS) disease complex is the major target of fungicide sprays from shortly after petal fall until harvest. The fungi in this complex blemish the fruit cuticle. The result can be a loss of up to 94% of the crop's market value, because blemished fruit are downgraded from freshmarket to cider grade and water loss is accelerated during storage of SBFS-infested apples.

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Introduction

The sooty blotch and flyspeck (SBFS) disease complex is the major target of fungicide sprays from shortly after petal fall until harvest. The fungi in this complex blemish the fruit cuticle. The result can be a loss of up to 94% of the crop's market value, because blemished fruit are downgraded from fresh-market to cider grade and water loss is accelerated during storage of SBFS-infested apples.

Disease-warning systems are tools that aid growers in applying fungicides to optimize control while reducing chemical and labor expenses. Weather data are used as inputs to the disease forecast system. However, obtaining accurate weather data requires time and expense from the growers. Weather data acquisition is a primary reason that growers continue to apply fungicides using a calendar-based schedule rather than employing a disease warning system.

Commercially available site-specific weather data (i.e. ZedX, Inc., Bellefonte, PA) has potential to help growers take advantage of disease forecasting system tools. Furthermore, forecasted data, rather than data previously obtained (hindcast), may also benefit the grower in planning spray applications to avoid inclement weather conditions. Correction models have also been developed to increase the accuracy of a disease-forecasting model.

The objective of this study was to evaluate weather data sources, data acquisition periods, and model corrections used as inputs for a SBFS disease warning system.

Materials and Methods

Fungicides were applied to 18-yr-old Golden Delicious, Red Delicious, Jonathan, and McIntosh trees on M.7 rootstock at the ISU Horticulture Station. All fungicide treatments were applied to runoff at 200 psi using tractor driven sprayer. Nine treatments (Table 1) were replicated four times in a randomized complete block design; each subplot consisted of three trees.

All plots including controls were sprayed with Nova 40W at 5 oz/acre to control powdery mildew, rust, and apple scab from tight cluster through first cover (May 27). Thereafter, Captan 50WP at 1.0 lb/acre + Topsin-M 70WSB at 5 oz/acre was applied at biweekly intervals in the calendar-based control (Treatment 7). The other treatments delayed the second cover spray until leaf wetness (LW) hours accumulated at predetermined thresholds of 175 hr. Leaf wetness data were measured with either on-site equipment (Spectrum Watch Dog Plant Disease mini Station placed at the base of the tree canopy) (Treatment 9) or remotely estimated (ZedX, Inc.) with a combination of timeframe estimations and model corrections (Treatments 1 to 6) (Table 1). Treatment 8, a negative control, did not receive fungicides following first cover. Treatments that used weather data to determine the timing of the second-cover spray were subsequently sprayed biweekly with Captan 50WP at 1.0 lb/acre + Topsin-M 70WSB at 5 oz/acre until harvest.

The fungicides programs were evaluated immediately after harvest. Fifty fruit/tree

(150 fruit/replication or 600 fruit/treatment) were harvested and observed to determine the percent of fruit with SBFS with the aid of a standard area diagram.

Results and Discussion

All control regimes resulted in greater than 90% marketable apples and were not statistically different ($P < 0.05$). Unsprayed controls had statistically higher SBFS, with only 42.8% marketable (Table 1). The best control of SBFS was achieved with Treatments 1 and 7 with 6.7% and 7.9% apples with any SBFS blemishes, respectively. Remote weather estimates saved one spray in 2008 and provided same level of protection of fruits compared with traditional calendar-based fungicide applications (Table 1). No differences were found among trees within subplots.

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Table 1. Severity of sooty blotch and flyspeck (SBFS) at the ISU Horticulture Station, 2008.

Trt #	Weather data source	Time frame of data input	Model Correction[a]	Percent apples w/ SBFS[c]	Percent marketable apples[bc]	No. of sprays applied
1	ZedX, Inc.	Hindcast	none	6.7 e	97.2 a	4
7	--	Calendar-based	--	7.9 e	98.9 a	5
3	ZedX, Inc.	24-h forecast	none	12.0 de	98.7 a	4
5	ZedX, Inc.	72-h forecast	none	14.8 cd	95.5 a	4
9	On-site	Hindcast	--	18.5 cb	92.0 a	4
2	ZedX, Inc.	Hindcast	corrected	18.7 cb	90.3 a	2
4	ZedX, Inc.	24-h forecast	corrected	19.1 cb	91.0 a	2
6	ZedX, Inc.	72-h forecast	corrected	21.5 b	92.3 a	2
8	--	Unsprayed	--	46.0 a	42.8 b	0

[a]Kim et al. 2002, 2004

[b]Apples with < 2% severity of SBFS were considered to be marketable according to USDA standard.

[c]Means in each column followed by the same letter are not statistically different ($P < 0.05$).