Evaluation Of Weather-Based Models For Management Of Onion Downy Mildew In California

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INTRODUCTION

- Onion downy mildew (caused by Peronospora destructor) has the potential to cause severe damage to onion produced for processing, bulb, or seed in California.
- Weather models to detect favorable disease periods, including DOWNCAST, a variant of DOWNCAST, MILIONCAST, and ONIMIL, have been developed to describe the complex conditions required for downy mildew development.
- These models were tested in wet oceanic or humid continental climates, and have not been evaluated in the climate of California production regions.
- Fungicides are often most effective when applied preventatively before conditions are favorable for disease, but little information is available on the practical use of the models for timing fungicide applications.
- Few tools are available for growers to implement the models in commercial production.

OBJECTIVES

- Evaluate the effectiveness of weather-based models for scheduling fungicide applications for downy mildew management.
- Adapt the models into program that can be accessible to weather stations in commercial fields.

METHODS

- Small-plot trials of dehydrated onion were established in October of each year at two locations in Imperial County within the low desert production region: Holtville, CA from 2018 to 2022 and Brawley, CA, from 2020 to 2022. Six seed lines (2.5 in. apart) were planted in beds with 40 in. center spacing.
- Plots measured 2 beds x 25 ft, and were arranged in a randomized complete block with six replications. Plots were separated by 1 to 2 untreated buffer beds.
- Timing treatments were: fungicide applications made in response to triggers from one of several models; a standard calendar interval; and non-timed applications (Table 1). One fungicide rotation was used for all timing treatments (Table 2).

RESULTS

- Downy mildew pressure was low in Imperial County in 2017-2018 and 2018-2019, and disease was not observed in our trial despite one to two model trigger events during 2018 (Table 3).
- Downy mildew pressure was high in the region in 2019-2020 and downy mildew was observed at both locations. Model triggers occurred on March 11 at both locations and on April 11 at Holtville (Figure 1).
- At Brawley, downy mildew incidence was a statistically significant 70% lower on average in treated plots compared to non-treated plots (Figure 2).
- At Holtville, the standard calendar treatment, which received a single application on Feb. 25, provided nearly complete disease control, but this treatment was not statistically different from some non-treated plots (Figure 2).

KEY POINTS

- Weather-based fungicide application schedule can reduce the number of fungicide applications under no to low disease pressure.
- An application made prior to or immediately during a favorable period can reduce downy mildew under low to moderate disease pressure.
- We developed a minimally functional version of a cloud-based alert system that sends model results in daily emails.
- Models assess conditions measured in the onion canopy for the past day.

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REFERENCES


Figure 1: Weather model output at Brawley and Holtville in the 2019-2020 season. Data points indicate conditions from 0600 the previous morning through 1200 the current day favoring for downy mildew. Values are determined by converting raw model output to a 0 to 1 scale. DOWNCAST and the de Visser and Gueph variants are limited to two (0 or 100%) to four (0, 33, 67, or 100%) discrete values, whereas MILIONCAST and ONIMIL has a continuous range from 0 to 100%. Fungicide application dates are indicated by the fungicide rotation letter code that was applied on that date.

Figure 2: Downy mildew incidence at Brawley (14 April) and Holtville (10 April) in the 2019-2020 season. Treatments labeled as “non-treated” did not receive any fungicide, although most were assigned to model-based treatments in parenthesis. Raw data from each replicate plot (n=2) and each model treatment are shown as hollow circles. Vertical bars and the associated number label indicate the treatment means. Treatments associated with the same letter are not significantly different.