

NEW JERSEY AGRICULTURAL EXPERIMENT STATION

Sustainable Agriculture Research and Education

Implementing Disease Forecasting as a Sustainable Agriculture Strategy for Controlling Early Blight in Tomato

The issue

Successful tomato production in New Jersey requires repeated applications of the fungicide Bravo to protect plants against the disease early blight caused by the fungus *Alternaria solani*. In northern New Jersey sprays begin two weeks after transplanting and continue throughout the growing season. This conventional 7-day spray schedule requires as many as fourteen sprays during the season.

A reliable and easy to use forecasting system based on monitoring environmental conditions for those conducive to disease development (e.g. temperature, relative humidity, and leaf wetness) can help growers apply fungicides as needed rather than as scheduled. This results in savings and reduced pesticide use.

Beginning in the 1970s, three tomato disease forecasting systems - FAST, CUFAST, and TOM-CAST - have been developed by several researchers to predict optimal spray times to control early blight on tomato. The systems vary in the way the spray times are calculated, hence the number of recommended sprays can vary with each system. All three have been demonstrated to reduce the number of sprays under some conditions.

The TOM-CAST system provides a few advantages over the others. In this system calculations are simplified and require fewer inputs of weather data. This makes TOM-CAST practical for on-farm use. The Rutgers study however, found TOM-CAST may have potentially serious drawbacks: it required the least number of sprays, but resulted in higher incidence of fruit rot.

The study

Fresh market tomato *cultivar Celebrity* was grown either staked using the short stake cultural system or unstaked, with eight disease control schedules. All plots were grown on black plastic with trickle irrigation and fertigation. Disease control applications of Bravo 720 (2 pints/acre) were made weekly beginning at two weeks from transplanting according to FAST, CUFAST, or TOM-CAST forecasts. Foliar disease incidence was rated on a weekly basis during the growing season. The harvested fruit were graded and weighed for comparison.

Results from the 1994 study found FAST, CUFAST, and TOM-CAST schedules called for fewer applications than the weekly schedule which required



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fourteen applications (see Table 1). Conditions for the study year of 1994 were favorable for early blight.

All fungicide schedules resulted in reduced foliar disease compared with the untreated control. Total yield was not affected by staking status and not appreciably affected by disease control schedule. However, marketable yields were greater for stake than ground culture plots and were affected by disease control. Reduced number of Bravo applications resulted in increased losses from anthracnose fruit rot.

The impact

Rutgers researchers evaluating these forecast systems since 1989 demonstrated their potential to control early blight with reduced numbers of applications under Northern New Jersey climatic conditions. Results from 1989 to 1994 show each forecasting system results in an estimated annual cost savings per acre (labor, equipment, Bravo 720 at the maximum labeled rate of 3 pints/acre) of: FAST -\$210; CUFAST - \$252; and TOM-CAST -\$462.

If only one half of the 800 acres of fresh market tomatoes produced in North Jersey implemented treatment based on forecasts, the potential cost savings for three years based on the average number of sprays eliminated with TOM-CAST would have approached \$0.55 million. Reduction in pesticide inputs would have approached 30,000 lbs. active ingredient for a three year period. With the more conservative CUFAST, cost saving would have approached \$0.4 million.

In addition to the cost savings involved in the reduction of sprayings, benefits of using forecast systems include reduced worker exposure to pesticide, as well as fewer environmental impacts.

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Reduction in pesticide inputs would have approached 30,000 lbs. active ingredient for a three year period among North Jersey tomato farmers.

Table 1. Effect of disease forecasting system used to determine fungicide application timing on disease incidence and yield.

Forecast Sys	# Sprays	Disease Rating*	Marketable Yield Tons/Acre	Post Harvest Loss %	% Loss to Anthracnose
Weekly	14	4.50	25	20	5
CUF-1	11	4.75	24	19	8
CUF-2	10	4.75	24	21	8
TC15	6	4.88	23	25	22
TC20	5	5.25	21	25	21
FAST	5	6.25	21	24	17
TC25	3	5.50	23	23	17
No Sprays	0	8.50	16	25	26

*Based on a scale of 0-11, with 11 being the highest incidence of disease.