VALIDATION AND ADAPTATION OF THE "BLITECAST" MODEL FOR PREDICTING DEVELOPMENT OF POTATO LATE BLIGHT IN OREGON

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Summary

Seven commercial potato fields were monitored automatically with remote weather stations during the 1997 season. Temperature and relative humidity in the plant canopy and rainfall were recorded every 10 minutes and the data was forwarded via cellular phone daily to the Malheur Experiment Station. These data were used to estimate real-time late blight risk, and those estimates were distributed via the station web site, e-mail, and 1-800 telephone number. Also weather data from outside of the crop canopy was collected from the six AgriMet stations closest to the commercial potato fields with canopy measurements. Data from both monitoring networks was entered into the "Blitecast" late blight forecasting model. Late blight occurrence was compared with model predictions.

Late blight was forecast before it occurred in the Treasure Valley. Severity values reached 17 at Klamath Falls before late blight was found in Tulelake near Klamath Falls. Late blight occurred in the Willamette Valley before it was forecast based on the single station at Woodburn, but if the forecast had been made based on Corvallis AgriMet data, the forecast date would have been May 30. Predictions could be improved by better selection of microclimates in a growing area most susceptible to the first occurrence of late blight. Multiple measurement sites would be preferable to one each in both the Willamette Valley and near Tulelake. Late blight was not forecast at Madras in 1997 and was not found. The use of AgriMet data for use in Blitecast needs further calibration.

Introduction

Prior to the 1995 growing season, potato late blight (*Phytophthora infestans*) was not a management concern in the Treasure Valley. During the 1995 season, late blight spread rapidly throughout the valley from initial outbreaks in low lying humid areas. Growers made three to six fungicide applications in 1995. Lack of adequate late blight control in 1995 resulted in a loss of yield and a loss of some of the crop during storage. The ability to predict when the disease is most likely to occur and when conditions are conducive to rapid spread would aid in decisions as to the necessity and timing of fungicide applications. The refinement of late blight predictions could save growers money by improving the efficiency of control measures. Accurate late blight predictions are now needed for areas both where the disease normally occurs and areas such as the Treasure Valley and Klamath Falls where it has not been known to be a problem in the past. This study had three objectives:

1. Validate the accuracy of the computer model "Blitecast" in predicting the onset of potato late blight in the Pacific Northwest.

2. Automate the "Blitecast" calculations from both weather stations in growers' fields and AgriMet stations.

3. Adapt the "Blitecast" model to the relatively arid areas not originally envisioned in the development of the model. Potato growers are now suffering economic losses from late blight in these arid areas.

Methods

During the 1997 season, weather data (temperature, relative humidity, and rainfall) from 13 weather stations (six AgriMet stations and seven remote stations in commercial potato fields) were forwarded daily by cellular phone to the Malheur Experiment Station and entered into the "Blitecast" (a program module that is part of the "Wisdom" software version 1.2 for potato crop and pest management from the University of Wisconsin, Madison, Wisconsin). The model uses the duration of high relative humidity above 90 percent along with the corresponding range of temperatures to calculate the extent to which the daily environment has been favorable for disease development. The Blitecast program accumulates favorable environmental conditions for late blight which are called "severity values". When the "severity value" total reaches 18, late blight is predicted and fungicide control measures are indicated.

Seven growers' potato fields were monitored automatically in the plant canopy at Ontario, Owyhee Jct. (near Nyssa), Woodburn, Klamath Falls, and Madras, Oregon, and at Homedale and Nampa, Idaho, during the 1997 season. Relative humidity, temperature, and rainfall at the plant canopy were recorded by a Campbell data logger (Campbell Scientific, Logan, Utah) every 10 minutes and the data were forwarded via cellular phone daily to the Malheur Experiment Station. These data were used to estimate real time late blight risk, and those estimates were distributed via the station web site, e-mail, and 1-800 telephone number. Seven AgriMet stations were monitored for temperature, relative humidity, and other parameters every 15 minutes and rainfall every hour. The AgriMet weather stations used were at Glenn's Ferry, Dry Lake at Nampa, the Malheur Experiment Station at Ontario, the Parma Experiment Station, Corvallis, Tulelake, and Madras. An 80 percent relative humidity range was used from the AgriMet stations for the duration of risk in the Blitecast program.

Late blight occurrence was compared with model predictions. Here in Oregon, we are applying Blitecast to regions with hotter and drier summer weather patterns than

Wisconsin and Pennsylvania. Some additional factors may be needed to adapt the model to Pacific Northwest conditions.

Communication of forecasts. The predictions and control recommendations from the model were updated daily and made available as a recorded message on a telephone line. Access to the predictions included calls to a 1-(800) number, information distribution by regular e-mail letters, and the Malheur Experiment Station home page (http://www.primenet.com/~mesosu/) where late blight risks and treatment information were posted regularly.

Results

In 1997 we successfully collected data from seven weather stations in growers' fields and six AgriMet weather stations. Examples of the accumulated late blight "severity values" are presented in Figures 1 and 2.

The weather stations in the potato canopies in the Treasure Valley developed a range of risk estimates (Figure 1). The late blight "severity value" threshold of 18 predicting late blight was reached on June 21 at Nampa, Idaho, near the Oregon border. Late blight was confirmed in tomatoes and potatoes in a home garden in the outskirts of Boise, Idaho, on June 25 and in a commercial potato field in NuAcres, Idaho, on July 17. Late blight was controlled by fungicide spray programs, and the disease did not spread.

Late blight risk accumulated rapidly in mid-July at Woodburn, Oregon, in the Willamette Valley (Figure 2). Late blight was not predicted by Blitecast at Woodburn, but late blight developed in other fields. The field monitored and the site within this field were not representative of the locations at greatest risk. Fields with vigorously growing varieties should be selected so that the potato canopy envelops the humidity sensor.

Severity values only reached 2 at Madras, Oregon, and late blight did not occur (Figure 2). Late blight severity values reached 17 in early August at Klamath Falls, and late blight was found about a week later. In Klamath Falls, the monitored field turned out to not be representative of the locations at greatest risk because the field was exposed to more air movement and was planted to the Norkotah variety that did not grow to the extent that the canopy closed over the rows. It should be noted that there had been no record of late blight at Klamath Falls prior to 1997.

Blitecast forecasts of late blight occurrence using AgriMet weather station data and the 80 percent relative humidity criteria failed to forecast late blight east of the Cascades (Figure 3). The AgriMet station at Corvallis forecast late blight on May 30, in contrast to the weather station in the potato field at Woodburn (Figure 4).

Acknowledgments

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Figure 1. Accumulation of "Blitecast" severity values to predict potato late blight based on 90 percent relative humidity and temperature in the potato canopies in growers' fields at Ontario, Owyhee Junction, Homedale, and Nampa in 1997, Malheur Experiment Station, Oregon State University, Ontario, Oregon.

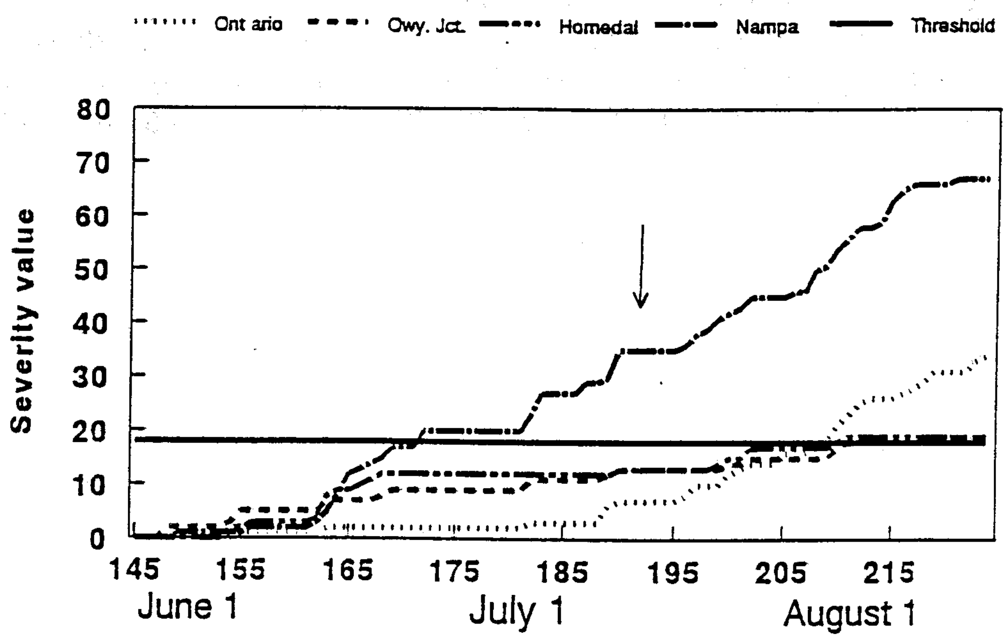

Figure 2. Accumulation of "Blitecast" severity values to predict potato late blight based on 90 percent relative humidity and temperature in the potato canopies in growers' fields at Madras, Klamath Falls, and Woodburn in 1997, Malheur Experiment Station, Oregon State University, Ontario, Oregon.

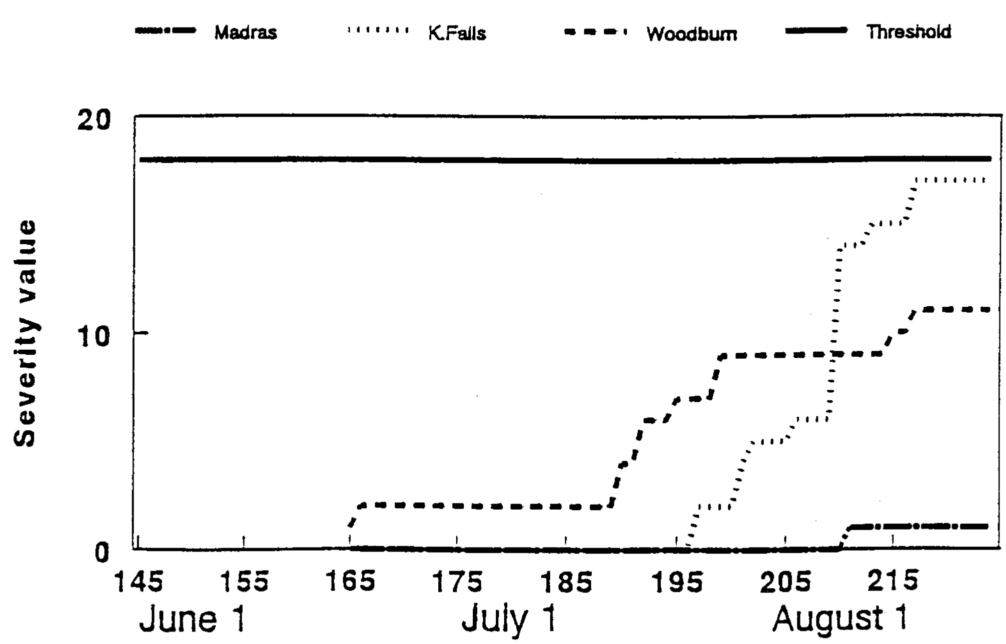

Figure 3. Accumulation of "Blitecast" severity values to predict potato late blight based on 90 percent relative humidity and temperature in the potato canopy at Dry Lake, Nampa ID compared to the prediction based on 80 percent relative humidity and temperature at the nearby Dry Lake AgriMet station near by, 1997, Malheur Experiment Station, Oregon State University, Ontario, Oregon.

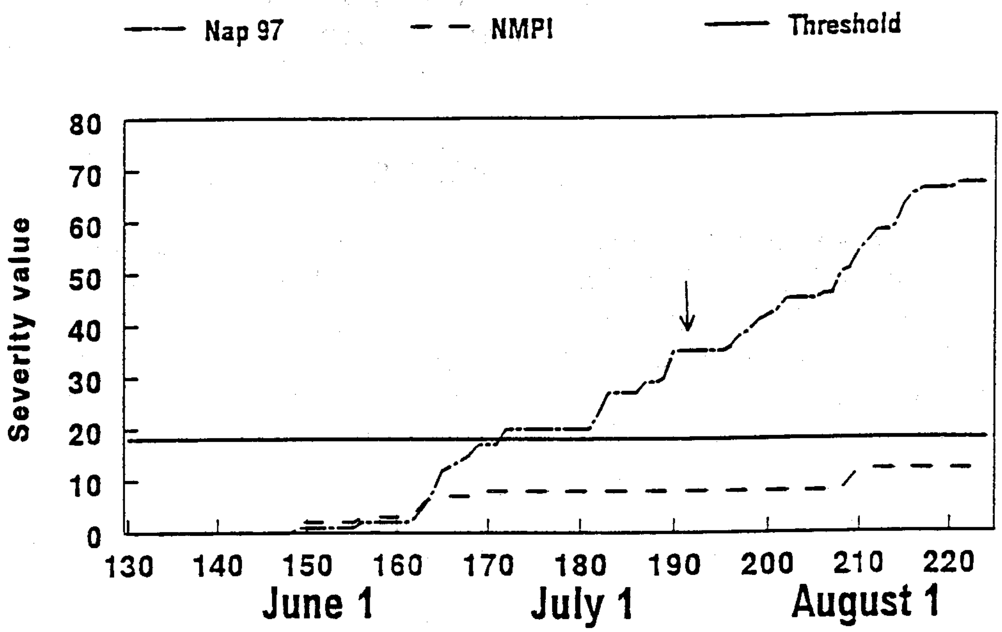

Figure 4. Accumulation of "Blitecast" severity values to predict potato late blight based on 90 percent relative humidity and temperature in the potato canopy at Woodburn, Oregon, compared to the prediction based on 80 percent relative humidity and temperature at the Corvallis AgriMet station, 1997, Malheur Experiment Station, Oregon State University, Ontario, Oregon.