PREDICTING THE ONSET AND SEVERITY OF POTATO LATE BLIGHT IN OREGON

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Summary of 1999 achievements

Service: Ten potato fields were monitored for temperature, relative humidity, and leaf wetness in the plant canopy. This data and rainfall were recorded every 10 minutes and forwarded daily via cellular phone to the Malheur Experiment Station. Data was used to estimate real time late blight risk, and those estimates were distributed 4 to 5 times a week via the station web site and E-mail.

Disease development and predictions: The 1999 season was not highly conducive to the development of late blight. Late blight was not predicted in 1999 by "Blitecast" and was not recorded at Klamath Falls, Malin, Tulelake, Culver, Madras, Ontario, Nyssa, or Adrian.

Blitecast predicted late blight in the Willamette Valley very late in the season, in contrast to previous years, due to shorter duration of high relative humidity throughout the season. Blitecast predicted late blight on August 8 at Woodburn and August 11 at Sherwood, before late blight was found in commercial fields in late August.

Programming: Visual Basic software was written to accept the potato canopy data automatically from the stations. Predictions were run using our own software.

Objectives and Rationale

Objectives for 1999.

1. Automate the collection of data from weather stations in growers' fields and AgriMet stations.

2. Adapt the Blitecast model and other late blight models to the relatively arid areas of Oregon where potatoes now are suffering economic losses from late blight. Arid summer weather was not originally envisioned in the development of the Blitecast model.

3. Make results available in real time during the 1999 season for many potato production areas of the state.

Rationale. Before the 1995 growing season, potato late blight (*Phytophthora infestans*) was not a management concern in the Treasure Valley, Central Oregon, or the Klamath Basin. During the 1995 season, late blight spread rapidly throughout the Treasure Valley from initial outbreaks in low-lying, humid areas. Treasure Valley growers made three to six fungicide applications in 1995 at great expense. Lack of adequate late blight control in 1995 in the Treasure Valley resulted in a loss of yield and a loss of some of the crop during storage. Late blight outbreaks in 1997 and 1998 in the Klamath Basin also have caused considerable economic loss.

The ability to predict when late blight is most likely to occur and when conditions are conducive to its rapid spread would aid in grower 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 needed now for areas both where the disease normally occurs and areas, such as the Treasure Valley and the Klamath Basin, where it has not been known to be a problem in the past.

According to Dr. Walter Stevenson of the University of Wisconsin, Wisconsin potato growers currently are using Blitecast to control blight while simultaneously achieving considerable savings of fungicides. These economies are possible through the adequate prediction of late and early blight. Predictions using Blitecast are made by both university personnel and private consultants. University of Wisconsin extension information is distributed through news letters, E-mail, and the university web site, and this extension information is dependent on the forecasts. The economies of production realized in Wisconsin also should be available to Oregon growers.

Procedures

During 1999, data was collected from stations in 10 potato fields and 7 AgriMet weather stations. Each of the 10 stations in growers' fields consisted of a relative humidity sensor, a temperature sensor, a tipping bucket rain gauge, two Campbell Scientific Leaf Wetness Sensors (237LW), a portable stand, a data logger with battery and solar panel, a modem, and a cellular phone. The temperature, leaf wetness, and relative humidity in the plant canopy and the rainfall were recorded every 10 minutes. The data was forwarded daily via cellular phone or notebook computer to the Malheur Experiment Station. Weather data from outside of the crop canopy was collected every 15 minutes from seven AgriMet stations closest to the monitored commercial potato fields and was forwarded electronically to the Malheur Experiment Station.

Data was used to estimate real-time late blight risk via Blitecast, and those estimates were distributed via the station web site, E-mail, and fax. Various models were tested in 1999, with special emphasis on Blitecast and late blight predictions using leaf wetness.
Blitecast is a program module for late blight prediction that is part of the "Wisdom" software for potato crop and pest management from the University of Wisconsin,

Madison. The Blitecast model uses the hours of 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 environmental conditions favorable for the development of late blight which are called "severity values". When the "severity value" total reaches 18, late blight is predicted, and additional fungicide control measures are indicated.

During 1999, a visual basic program was developed in Ontario to allow the direct application of raw field weather data to a wide range of prediction models. Model variations used in 1999 included the substitution of leaf wetness for the duration of 90 percent relative humidity.

Blitecast and other predictions were compared to the actual onset and development of late blight.

Results, Discussion, and Conclusions

Treasure Valley. Infield data was collected from four stations in 1996 and 1997, and three stations in 1998 and 1999. Late blight was predicted before it occurred in 1996 and 1997 using Blitecast. Late blight was first detected close to Parma, ID near the Idaho-Oregon border on August 21, 1996, and on July 17, 1997. In 1998 and 1999, late blight was not predicted by Blitecast and was not detected.

Starting in 1996, access to late blight predictions and low cost fungicide recommendations has assisted growers in the Treasure Valley to reduce fungicide costs and control late blight.

Central Oregon. Starting in 1997, the data collection and predictions were extended to Madras. Two stations were used near Madras during 1998 and 1999. Conventional Blitecast did not predict late blight in 1997, 1998, or 1999, and the occurrence of late blight was not recorded.

Willamette Valley. One station monitored potato canopy conditions in 1997, and that was expanded to two stations in 1998. Late blight occurred on a potato cull pile and tomatoes before potatoes emerged in 1998. Consequently, late blight spores spread even before they could be produced on potato plants, causing early onset of late blight in the Willamette Valley in 1998. Estimated severity using Blitecast rapidly accumulated severity values at Woodburn in 1998 as it had in 1997.

In 1999, Blitecast predicted late blight in the Willamette Valley very late in the season, in contrast to previous years, due to shorter duration of high relative humidity throughout the season. Blitecast predicted late blight on August 8 at Woodburn and August 11 at Sherwood, before late blight was found in commercial fields in late August.

Klamath Basin. A single station was set up south of Klamath Falls in 1997, and three stations were used in 1998 and 1999. In 1997, conventional Blitecast severity values reached 17 at Klamath Falls before late blight was found in Tulelake, California (considerably to the south of the single in-field weather station). In 1998, late blight was found on a few isolated plants on July 10 before it was predicted by Blitecast. The Klamath Falls late blight epidemic in 1998 occurred much later in August.

Leaf wetness. Leaf wetness estimates were made at all sites starting in 1998 using Campbell Scientific Leaf Wetness Sensors 237LW. The late blight "severity values" based on leaf wetness accumulated much more rapidly than the severity values based on relative humidity in the plant canopy, because the durations of the wet periods proved to be longer than the periods of high relative humidity. Marked differences were recorded for accumulated severity values based on 90 percent relative humidity and the conventional Blitecast program as compared with the use of leaf-wetness data. "Severity indices" based on leaf wetness had little association with the onset of late blight in 1999.

In conclusion, conventional Blitecast worked reasonably well with the 90 percent relative humidity criteria to predict late blight in 1999, and the automated handling of data facilitated the rapid evaluation of data and transmission of results.

Cooperators and Acknowledgments

We acknowledge the indispensable support of CAAR in 1997 and the Oregon Potato Commission for the last 4 years, as well as contributions by the regional growers' associations. This work would not have been possible without the cooperation of Steve James, Kerry Locke, Ken Rykbost, Harry Carlson, Brian Charlton, Rob Hibbs, Al Mosley, Steve Iverson, Tom Kirsh, Dave Mizuta, Bob Peterson, Roy Hasebe, Rob Hibbs, Rod Blackman, Mike McVay, Dan Chin, and Jay Hoffman. Constructive suggestions by Mary Powelson, Ken Rykbost, Bob Witters, and Al Mosley have been appreciated greatly.

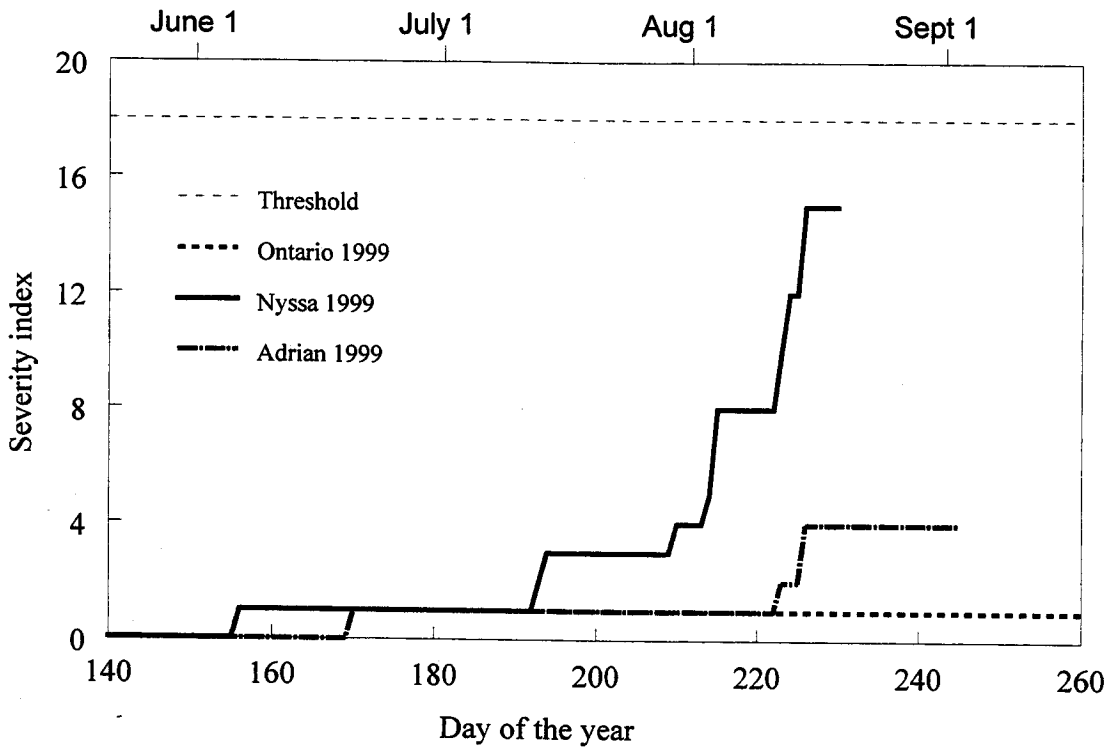

Figure 1. Comparison of three Treasure Valley locations in the accumulation of estimated late blight risk during the 1999 season; Malheur Experiment Station, Oregon State University, 1999.

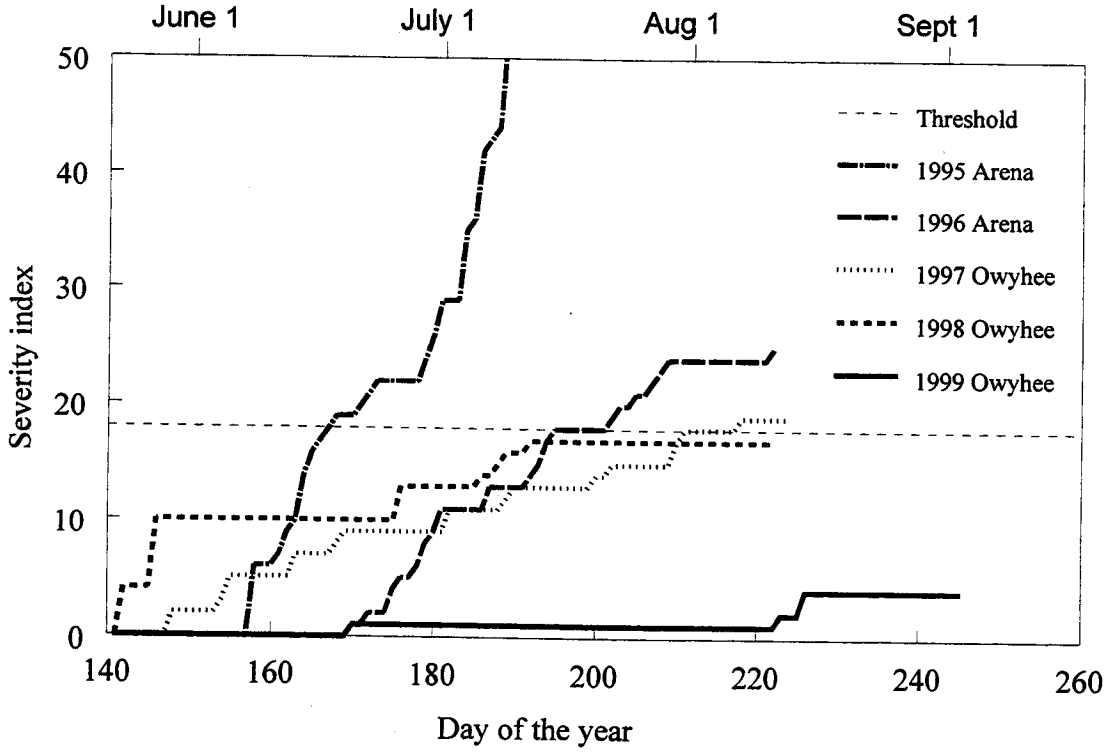

Figure 2. Comparison of late blight risk estimate over the last 5 years in the Treasure Valley; Malheur Experiment Station, Oregon State University, 1999.

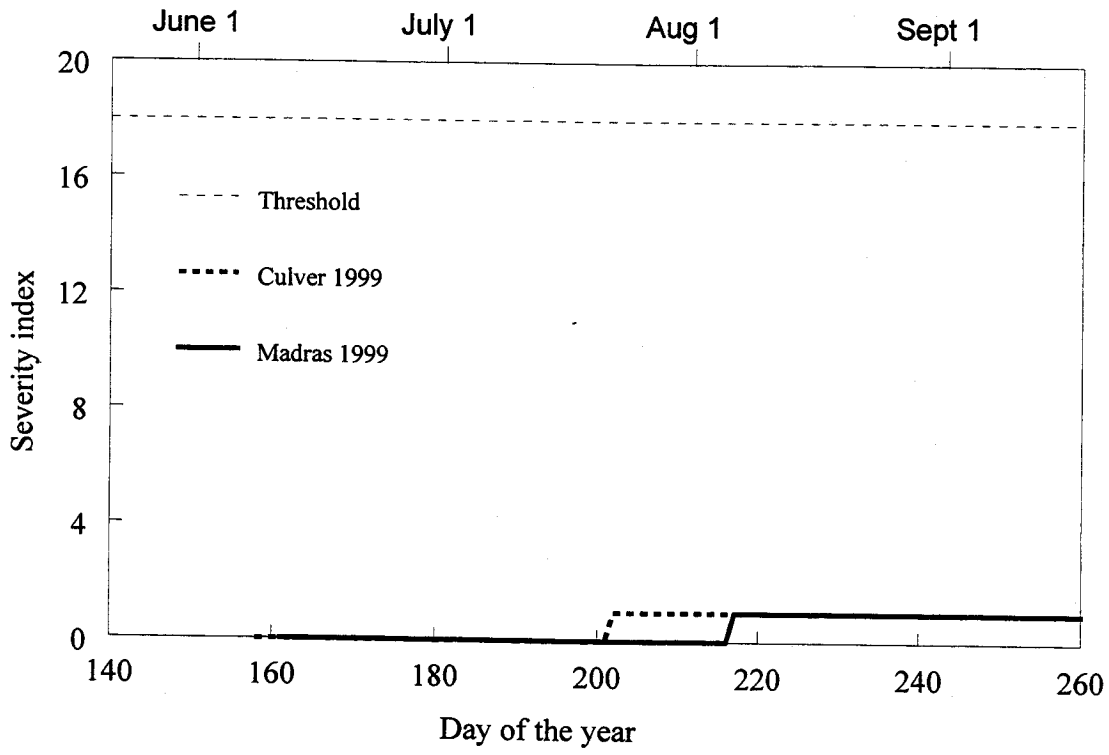

Figure 3. Comparison of two Central Oregon locations in the accumulation of estimated late blight risk during the 1999 season; Malheur Experiment Station, Oregon State University, 1999.

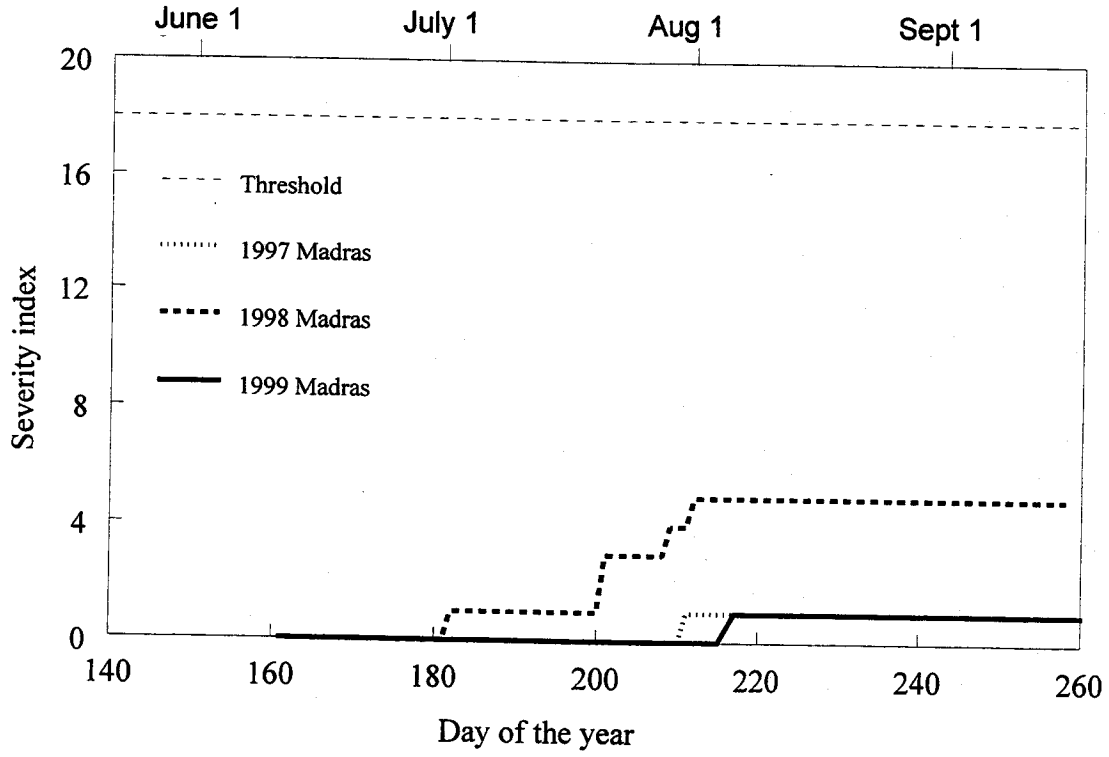

Figure 4. Comparison of late blight risk estimate over the last 3 years in Central Oregon; Malheur Experiment Station, Oregon State University, 1999.

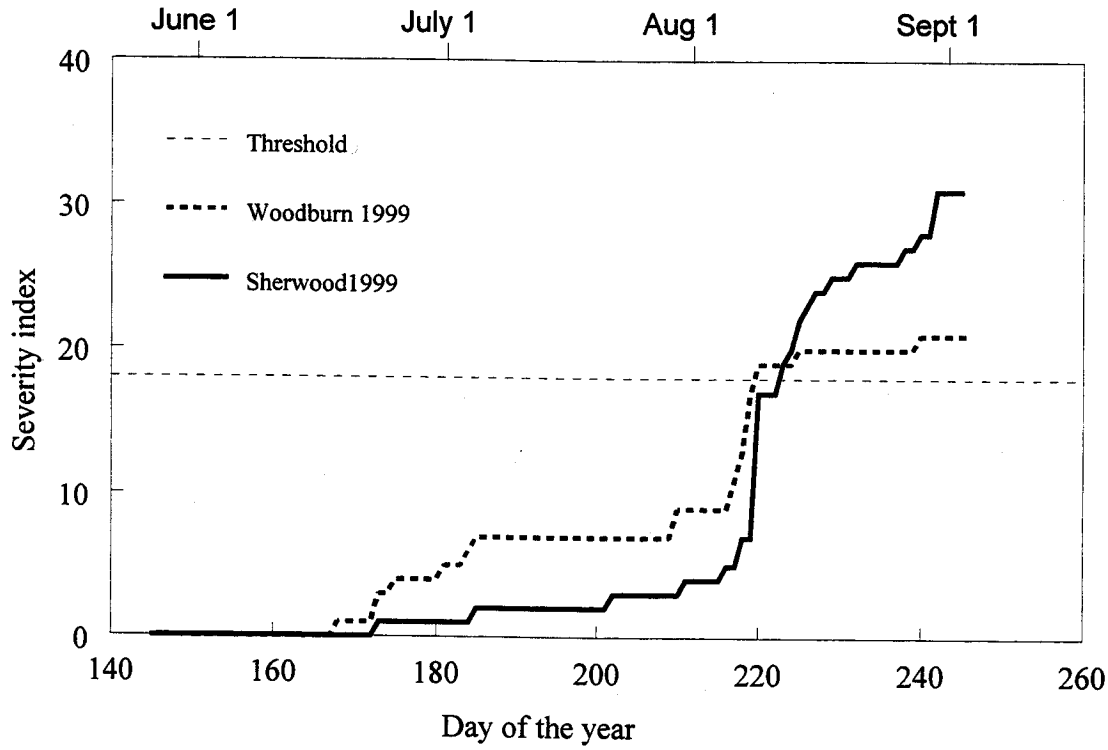

Figure 5. Comparison of two Willamette Valley locations in the accumulation of estimated late blight risk during the 1999 season; Malheur Experiment Station, Oregon State University, 1999.

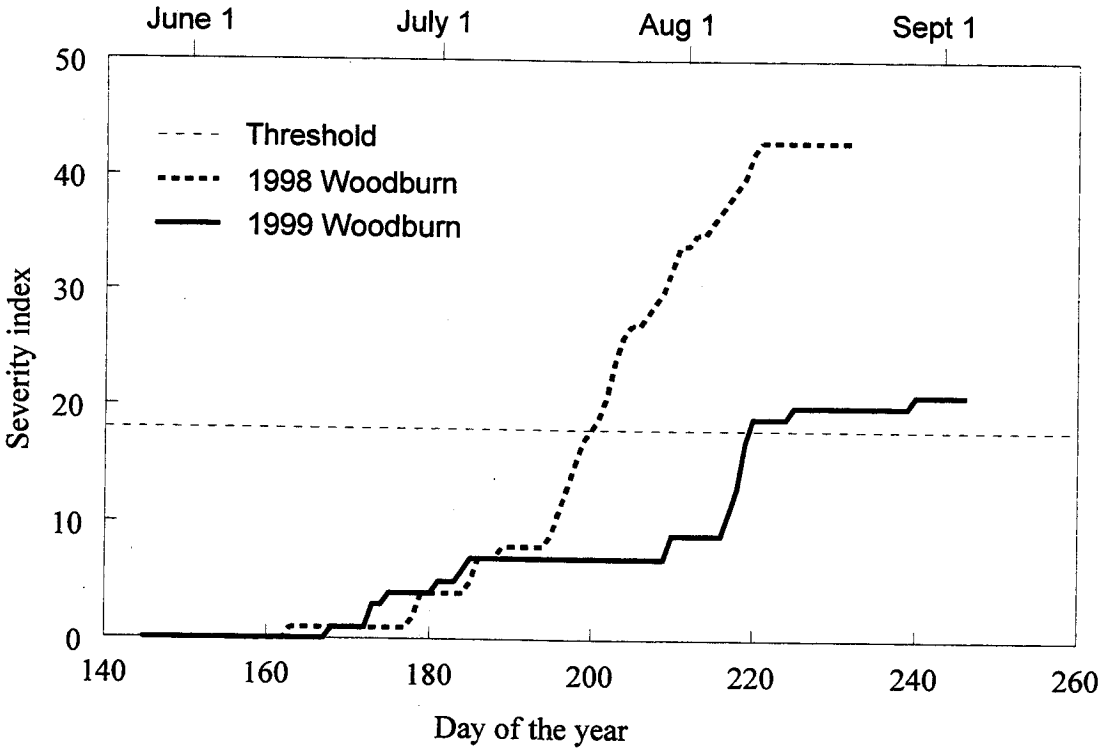

Figure 6. Comparison of late blight risk estimate over the last 2 years in the Willamette Valley; Malheur Experiment Station, Oregon State University, 1999.

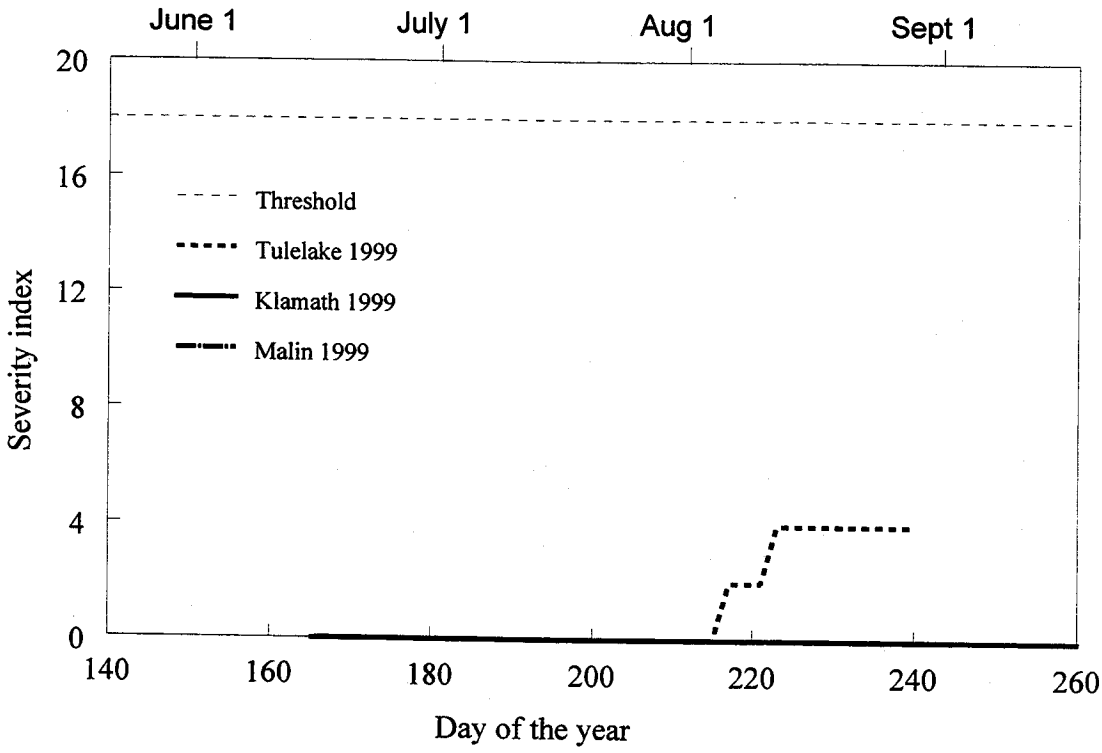

Figure 7. Comparison of three Klamath basin locations in the accumulation of estimated late blight risk during the 1999 season; Malheur Experiment Station, Oregon State University, 1999.

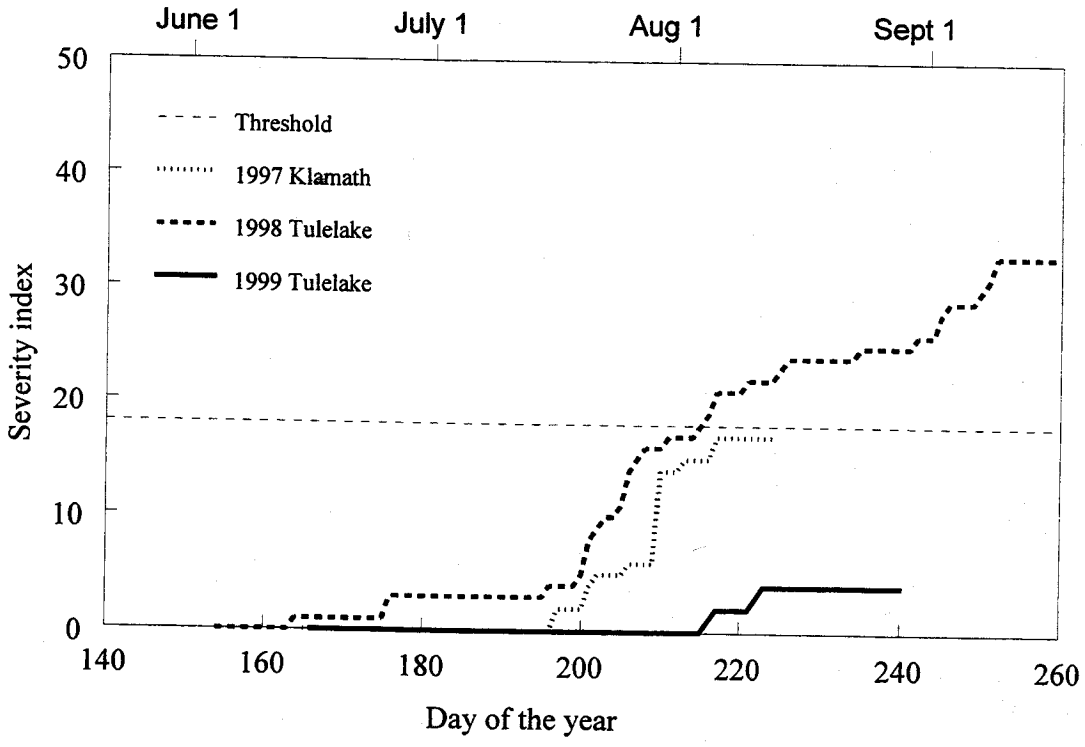

Figure 8. Comparison of late blight risk estimate over the last 3 years in the Klamath basin; Malheur Experiment Station, Oregon State University, 1999.