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Late Blight Prediction in Maine

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SUMMARY

Late blight is not controlled by predictions but is controlled by application of sound disease control principles. Late blight prevention in Maine starts with reducing initial inoculum to delay the onset of the epidemic. Elimination of dump piles, control of volunteer potatoes, and the use of seed treatments effective against seed-borne late blight are practices used to reduce initial inoculum. The potential for late blight to appear is predicted with the accumulation of severity values using the model NoBlight. As 70 severity values nears, late blight generally has reached detection levels. Tiers or risk areas are used to customize application materials in response to traditional inoculum sources. Partial to complete field destruction during the growing season has proven successful in some salvage situations.

KEY WORDS

Solanum tuberosum, late blight, prediction

INTRODUCTION

Late blight, caused by *Phytophthora infestans* (Mont.) de Bary, is a devastating potato disease and has been around over 150 years with much written about it over that time. Late blight regularly causes loss in many potato production systems (Stark and Love, 2003). Late blight prediction in Maine consists of a combination of prevention, prediction, and spread prevention.

Late Blight Prevention

Late blight prevention in Maine focuses on reducing initial inoculum. *Phytophthora infestans* over seasons in infected tubers, cull piles, and in infected volunteer plants. Reduction of initial inoculum is the cheapest and most effective method of delaying the onset of disease epidemics and therefore reducing the impact of the epidemic. Reducing the initial inoculum effectively slows or delays the portion of the disease progress that is exponentially increasing. The exponential portion is the fastest rate of disease increase during a late blight epidemic and occurs where the disease proportion in the field increases by a million fold *e.g.* from 0.000001 to 1.0 percent disease incidence.

Elimination of dump piles is an effective means of reducing the initial inoculum. In Maine, late blight epidemics traced to dump piles are virtually unheard of, that is not the case everywhere

potatoes are grown. Dump piles include refuse plies from seed cutting operations as well as a disposal pile of unmarketable potatoes. Elimination of potato dump piles is part of a holistic approach to late blight control.

Volunteer potatoes, also called self-sown potatoes or ground keepers, are surviving over-seasoned potatoes from a previous potato crop. These too, can contribute to late blight epidemics, but again are more of an issue in areas that have less severe winters that Maine.

Potato seed treatments effective against seed-borne late blight are routinely used and have proven successful in Maine. The largest contributor to late blight epidemics in Maine is seed-borne inoculum. Seed infected with *P. infestans* establishes the pathogen in the host field. Epidemics initiated from seed-borne inoculum start early in the growing season and without warning. If seed-borne *P. infestans* is present in the field and moving up and sporulating on the stems, there is no control. These plants, and possibly the entire field, should be destroyed. The destruction will help protect other fields from inoculum spread; the field most likely would never have produced a marketable or storable crop. The most effective means of reducing seed-borne *P. infestans* is through reduced disease the previous season. Reduction of the amount of inoculum on the seed-potato crop has been the most successful approach to late blight control in Maine.

Late Blight Prediction

In Maine, the potential for late blight to appear is predicted with the accumulation of severity values using the model NoBlight (Johnson, 2006). The NoBlight model initiates accumulation of severity values starting at 50 percent plant emergence. Once 18 severity values have accumulated from emergence, the first spray is recommended. Subsequent applications are recommended based on additional severity value accumulation during the previous seven days (Johnson, 2006). NoBlight (Johnson, 2006) and Blitecast (Krause, Massie, and Hyre, 1975) both weigh relative humidity more heavily than rainfall in predicting the need for an application. Most late blight prediction models, including NoBlight, operate mainly in the logarithmic phase of the disease epidemic, which is after the exponential phase. Most late blight prediction schemes operate under the assumption that initial inoculum is present, but at very low levels. No prediction scheme will be successful with high levels of initial inoculum. A Smartphone app of NoBlight is currently being tested.

In years that late blight has been present, reporting of finds has occurred at or near a total accumulation of 70 severity values. Making the assumption that a 1 percent detection threshold has occurred, the epidemic has left the exponential phase and entered the logarithmic phase. More empirical than experimentally developed, using a 70 severity value threshold has been a good predictor of when late blight would be discovered in the region.

Growers can make informed decisions as the severity value accumulation nears this value. Should predicted weather keep the grower from being able to make the next application, it may prove beneficial to reduce the spray interval. A similar situation may also lead to a change in protection material.

An additional component of late blight prediction in Maine is the use of "tiers." Tiers are approximately 12 km divisions along the eastern edge of Maine. These demarcations, partially experimentally and partially empirically derived, are in response to traditional inoculum sources.

More frequent use of translaminar fungicides in the tiers closer to the traditional inoculum sources has proven very successful in delaying the onset of late blight epidemics in the region.

Late Blight Spread

The dilemma faced by grower is which field can be salvaged and which field should be destroyed. This technique has been highly successful in many situations and should always be a first consideration. Generally, the best value from this practice is on the first localized infections early in the season. If the disease is distributed at low levels in the field, crop removal is of limited value. If local inoculum is present and continually entering the field, that too, is a situation when crop removal is of limited value. As the disease is already present in the field, the goal is containment and limiting pathogen spread. Removing the hot spots in the field combined with chemical applications is far more successful than either practice alone.

Aside from the seed-borne late blight issue, once late blight is present in a field, most of the prediction models become less useful. In fact, late blight at a very close proximity should be treated similarly to late blight in the field.

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