

PLANNING AHEAD FOR IMPROVED MANAGEMENT OF FOLIAR DISEASES

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Late blight is easily one of the most devastating and economically important diseases confronting the worldwide potato industry. The disease has an illustrious history dating back to the 1840's and over the last 150 years, growers throughout the world have faced periodic outbreaks. We have been fortunate in Wisconsin to have avoided some of the major epidemics faced by growers in other parts of the world, but still we have seen our share of late blight. The last major epidemic of late blight in Wisconsin occurred during the 1979-80 period and although we have seen an occasional field with late blight since then, we really haven't seen any late blight of consequence since 1987. This probably has not disappointed too many growers and because of a lack of late blight, the overall costs associated with disease control have been reduced.

Current Status of Late Blight in Wisconsin

During 1994, late blight was observed on July 14 in central Wisconsin (near Stevens Point). Nearby was a cull pile consisting of seedpiece remnants derived from a high volume seed cutter located on a neighboring farm. Plants emerging from the cull pile were at least 12 inches tall on July 14 and every leaf on some of the plants had at least one late blight lesion. Hairy nightshade was growing at the base of the cull pile and this weed was also heavily infected with the late blight pathogen. Fields with late blight were treated with Ridomil MZ fungicide immediately upon discovery of the first symptoms. Within 5 days of application of Ridomil, late blight lesions ceased sporulation and were desiccated. Late blight also appeared in other widely dispersed fields throughout July and August as weather conditions favored pathogen spread and plant infection. Because of the distribution pattern of disease observations, there appeared to be several sources of late blight inoculum. Presumably the planting of infected seed served to distribute the pathogen over a wide area and weather conditions, highly conducive to disease spread, favored further pathogen dispersal. By the end of August, late blight had appeared in approximately 50 fields. Pest management consultants played key roles in early detection and treatment of late blight. The Potato Crop Management software also played an important role in managing late blight by identifying periods when weather conditions were most favorable for disease spread and development. Most of the fields with late blight were in central Wisconsin, but there were 3 fields in northwest Wisconsin and 2 fields in northeast Wisconsin where some late blight was observed. Late blight was controlled in all but one field using a combination of metalaxyl plus EBDC, chlorothalonil, copper or TPTH fungicides. In preparation for harvest, growers were urged to vinekill

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their fields a minimum of two weeks before harvest. Processing contracts, where tubers were stored by the processor, required fields to be vinekilled three weeks before harvest. These strategies helped to reduce the severity of late blight in Wisconsin during 1993. There have been at least three reports of late blight in storage and while field frost, bacterial soft rot and associated decay in storage make late blight diagnosis difficult, losses to late blight in storage do not appear to be a major problem for most growers.

During the summer and fall, samples of late blight lesions were collected and assayed for metalaxyl (Ridomil) sensitivity in our lab at UW-Madison. Upon observing two fields in northwestern Wisconsin where growers were having an unusually difficult time controlling late blight and finding that the fungal isolate from one of these fields was insensitive to metalaxyl, several cultures of the late blight fungus collected in Wisconsin were forwarded to Dr. Ken Deahl, USDA Beltsville, MD and to Dr. William Fry, Cornell University, Ithaca, NY for evaluation. These scientists reported that of the samples from the two northwest Wisconsin fields, one isolate was moderately insensitive to metalaxyl and one was highly insensitive to metalaxyl. Both isolates, however, were the A2 mating type and both represent immigrant strains of the late blight pathogen. The remainder of the samples collected across Wisconsin were metalaxyl sensitive and the A1 mating type. This was the first detection of the A2 mating type and immigrant, metalaxyl insensitive strains of the late blight pathogen in Wisconsin. The detection of the immigrant strains in Wisconsin presents special concerns for control since these immigrant strains are particularly aggressive on tomatoes as well as potatoes and they are insensitive to metalaxyl fungicide. While protectant fungicides such as mancozeb, chlorothalonil, TPTH and copper fungicides provide moderate to good control of the A2 as well as the A1 isolates, it is the aggressiveness of the A2 isolates and the speed that epidemics develop with these isolates that causes concern.

The Cyclic Pattern of Late Blight in Wisconsin

The appearance of late blight is cyclic and because the spread of late blight depends on the occurrence of cool wet conditions for prolonged periods plus the presence of the fungal pathogen, we often see periodic outbreaks of late blight that usually present risks to growers for about 2-3 years at a time. Generally we see a small amount of late blight towards the end of the first growing season (year 1), a widespread problem that affects a significant portion of the industry (year 2) and an early season problem that presents concerns, but is controlled with fungicide sprays including Ridomil and a change in the weather (year 3). These outbreaks are usually associated with a wet August and September (year 1), a cool season with frequent rainfall, dew and fog (year 2) and a wet May and June followed by a hot and dry July and August (year 3). By the end of year 3, late blight is usually a distant memory and life goes on as usual. That is how late blight appears to act in Wisconsin and several years often elapse between appearances of this disease. If we look at our current situation, however, we find that late blight occurred in some northcentral states during 1992 (wet late summer and fall) and was a severe problem in several northcentral states during much of 1993 (wet and cool summer). The June 15, 1991 volcanic eruption of Mount Pinatubo in the Philippines is likely responsible for at

least a portion of the cool wet weather affecting the Midwest during 1992 - 1993 and will likely contribute to unusual weather conditions in 1994. Because of projected cool wet weather in Wisconsin during 1994, the odds that late blight will reappear in Wisconsin during the 1994 growing season are very high.

Control Strategies for Late Blight Management in 1994

There are several critical areas that need to receive attention in the year ahead if we are to control the current late blight outbreak. Every grower must become involved in an integrated management plan for the overall state program to work. The critical areas of this integrated management plan are discussed below:

Seed selection

It is clear that the late blight fungus found its way into Wisconsin during 1993 on seedlots from states with late blight during 1992. It is also pretty obvious that we will again import late blight infected seed during the 1994 growing season. Good seed (disease free seed) is expensive and I have already received questions about how much late blight infection on seed potatoes is acceptable. In answering this question, it is an interesting exercise to assume that a grower plants 18 cwt per acre (2 oz seedpiece every foot on 3 ft centers = 14,520 seedpieces per acre) and that a grower has purchased a seedlot in which 1% of all the seedpieces carry late blight infection. This would mean that the grower would plant 145 infected seedpieces per acre and in a 100 acre field, the grower would plant 14,500 infected seedpieces. If inoculum produced on plants growing from each seedpiece infects and kills a 10 ft diameter circle of plants (78.5 sq ft), roughly 25% of the plants in this field would be killed. In real life, however, this level of late blight infection would likely kill the entire field or at least large areas of the field and probably provide enough inoculum to infect fields for miles around. The grower would also have attempted to contain the problem and spent a considerable sum on fungicides for disease control. The point of this exercise is not to say that the purchase of 1% or 0.1% or even 0.01% seed tuber infection is acceptable, but to point out that a small amount of infection presents an enormous risk to the entire industry. Currently the U.S. No. 1 Seed Potato Grade Standard allows 1% tuber incidence of late blight infection. Thus it is likely that seed tubers with some tuber infection will be sold into Wisconsin during the 1994 growing season. All I can say is that planting late blight infected seed is a risky idea and a poor investment. While late blight infected seed may look attractive from a purchase price standpoint, the risk that you assume when purchasing infected seed can be huge.

Other Sources of Inoculum

Cull Piles - Because of the distribution of late blight in Wisconsin during 1993, it is likely that there is more late blight in storage than was identified last Fall. It is also likely that during the sorting and packing operations this winter, some sizable cull piles are being built. Unless these cull piles are disposed of before the start of the next growing season, there will be sources of late blight inoculum strategically located throughout Wisconsin. Attention needs to be given to these cull piles now while we still have some of the -20°F temperatures that will freeze the infected tubers when spread onto the snow in a thin layer.

Once infected tubers freeze and then rot away, you have eliminated those tubers as sources of inoculum. Other options for disposal of cull piles include feeding to livestock, grinding into a pulp that decays when spread onto fields and burying the tubers (the least attractive from an environmental standpoint). The worst thing a grower can do is to build a cull pile and then leave it until the next crop has emerged.

Cull piles consisting of seed slivers - Growers should also be aware that the slivers from seedcutters need to be handled in the same careful manner as cull potatoes. Since seed slivers have eyes, they have the potential to sprout and develop into plants. Late blight infection spreads rapidly through these tender plants and then spreads to newly emerged plants that are likely to be unprotected with fungicide.

Home Gardens - It is likely that both tomatoes and potatoes in home gardens were killed in 1993 by the late blight fungus. It is also likely that homeowner cull or refuse piles will provide sources of inoculum during the next growing season. Getting to know the landowners who surround your fields and providing information to them about late blight and control of this disease can help to improve grower relations as well as eliminate potential sources of inoculum.

Field Selection

Fields bordered by trees and other natural obstructions to air movement make control of foliar blights more difficult and should be avoided, as should small, irregularly shaped fields that are difficult to spray with fungicides. If aerial application of fungicides is planned, it is important to avoid fields where tall trees or power lines impede thorough spray coverage. There are some fields that, because of location or obstacles, should never be sprayed by air. Growers using aerial application should be prepared to use ground equipment in areas where aerial coverage is suspect because of obstacles.

Sprayer Calibration

Spray coverage with fungicide of all growth, new and old, is critical to disease control. Sprayers should be carefully calibrated and worn spray parts replaced before the growing season begins. Once the season begins, placement of water sensitive tapes in the plant canopy to monitor coverage can help in making fine adjustments to your sprayer. The fungicides chlorothalonil, mancozeb, maneb, TPTH, and copper are protectant materials that must be reapplied every 5-10 days throughout the season. Sprayers that do not adequately distribute these fungicides throughout the plant canopy will not achieve good control of late blight and early blight.

Disease Forecasting and Spray Scheduling

Disease forecasting programs help growers and IPM scouts determine if weather conditions are favorable for disease development and when diseases are likely to appear. Use of the Potato Crop Management (PCM) software last season accurately predicted the appearance of late blight in Wisconsin. The PCM software calculates severity values based on temperature and relative humidity data collected in the field and predicts the appearance of late blight 7-14 days after the accumulation of 18 severity values. The software also predicts dispersal of the early blight fungus 5-10 days after the accumulation of 300 P-Days (based on temperature). Growers using the PCM software normally begin

their fungicide sprays on the basis of 300 P-Days and if 18 severity values are reached before this time, those warnings are usually ignored because of the absence of late blight inoculum. During 1994, however, growers must assume that late blight inoculum is present in Wisconsin. **Growers are advised to closely monitor weather conditions from the time of crop emergence and to begin fungicide spray programs in 1994 when they have accumulated 18 severity values.** Once spraying with protectant fungicide commences, repeat applications should be made every 5-10 days depending on weather conditions. Frequent rainfall should shorten the spray interval while long periods of dry hot weather will extend the spray interval up to 10 days. Remember that irrigation and dew create a favorable environment for both early and late blight.

The typical fungicide spray program during 1994 will consist of mancozeb, maneb, chlorothalonil, TPTH and copper fungicides. Repeated application of these products on 5-10 day intervals will serve to protect foliage from infection by both the early and late blight pathogens. Seasonal use restrictions are currently on the labels of mancozeb, maneb and TPTH fungicides and before the start of this growing season, we may find a use restriction of 9 lb ai on the chlorothalonil fungicide label. Thus growers need to keep very accurate records on the quantity of materials applied to each field throughout the growing season. The systemic and curative fungicide, Ridomil (metalaxyl) provided excellent control of late blight on most fields last year when used after the first late blight lesions were detected. The Ridomil fungicide was not effective in northwestern Wisconsin where immigrant strains and the A2 mating type were present. During 1994, I am advocating that growers use Ridomil only if we begin to see late blight and if isolates are sensitive to this fungicide. I do not recommend widespread use of multiple Ridomil sprays on a protective schedule. Some growers are using Ridomil sprays at flowering to reduce the incidence of tuber decay in storage. This practice will continue and, depending on the appearance of late blight this coming summer, may help to control late blight in those treated fields. You will recall that Ridomil fungicide is available as Ridomil MZ58 (contains mancozeb), Ridomil/Bravo (contains chlorothalonil) and Ridomil/Copper (contains copper). All Ridomil formulations bear specific rotational restrictions that should be understood before use.

Field Scouting

Field scouting is essential to good management of late blight and early blight. Because both late and early blight have distinctive, easily recognized symptoms, field scouting activities can pay big dividends in terms of early detection and treatment. Fields should be scouted at least weekly for these diseases and if weather conditions are favorable for disease spread, more frequent scouting is recommended for those fields in high risk areas.

Monitoring for Ridomil Sensitivity

Isolates of the late blight fungus will be monitored for sensitivity to metalaxyl fungicide. Growers will be alerted to the presence of insensitive isolates as soon as data are available so that spray programs can be adjusted accordingly. Since metalaxyl insensitivity is often a flag for the presence of the A2 and immigrant strains, testing of

isolates will continue. Individual isolates that appear to be insensitive to metalaxyl will be forwarded to the USDA for confirmation and mating type identification. During the 1993 growing season, growers, industry field personnel and IPM scouts played key roles in providing samples to my program for evaluation. I expect that this same excellent cooperation will continue.

Vine Desiccation

The late blight fungus does not remain alive very long after the leaves and stems die. It is essential for control that the vines be completely dead for 2-3 weeks before harvest. This helps to insure that growers are not inoculating tubers with the late blight fungus at the time of harvest. This also helps to reduce the amount of inoculum of the early blight fungus present on the vines at the time of harvest. For those growers with late blight in the field before harvest, this is their last chance to reduce exposing the tubers to inoculum before storage.

Careful Harvesting and Storing

Storage is difficult if a high percentage of the tubers are infected with the late blight fungus. Storage under chip-stock conditions of 50-55°F and 90-95% RH is nearly impossible since the disease continues to spread under these conditions. Tubers with infection should be cooled to as low a temperature as practical, preferably 38-40°F, as quickly as possible after digging. Good air circulation and maintaining the RH below 85% will help to dry down infections. Infected tubers should not be held any longer than is absolutely necessary.