NEBRASKA
POTATO EYES
Technical News Reports for the Nebraska Potato Industry

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Editor's Note

Alex Pavlista
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The next Nebraska Potato Focus is scheduled from 12:30 p.m. Tuesday, December 13 to 4:30 p.m. Wednesday, December 14. The area covered Tuesday p.m. and Wednesday a.m. is IRRIGATION. On Wednesday afternoon, there will be a special update on LATE BLIGHT. Grower's registration will be mailed at the end of November. The speakers and topics are:

David Curwen (Univ. of Wisconsin)
"Irrigation and potato production"
"Water-stress related disorders"

Leroy Salazar (Agro-Engineering, Colorado)
"Determining irrigation needs"
"Integrated irrigation management"

Robert Jacobson (Lockwood Corp., Nebraska)
"New developments in irrigation equipment"

David Aiken (Univ. of Nebraska)
"Groundwater and agricultural conference"

Gary Franc (Univ. of Wyoming)
"Late Blight Researcher Conference"

Robert Kacvinsky (Ciba Corp., Nebraska)
"A1 and A2 testing service"

Plus a panel updating late blight in
Nebraska/Wyoming (Daryl Warday, Nebr.)
Red River Valley (Tom Harris, N. Dak.)
San Luis Valley (Gordon Hankins, Col.)

Due to popular demand, the banquet on Tuesday night will again be at Gordon Howard's Oregon Trail Prime Rib.

Last March 23, High Plains Seminar on potato late blight was held at the Panhandle Research and Extension Center. Some 80 growers came. All the speaker's talks were taped and transcribed. The transcripts have been edited and this issue of NPE is dedicated to reprinting their talks. Please note that the opinions stated therein are those of the speakers.

UPI (Sept. 1994) reported an 18% potato loss in Michigan due to late blight. Michigan chipstock yields dropped at least 10% (Fraser's Potato Newsletter). Wisconsin was also hit.

I found some old records on late blight in the Nebraska Panhandle. It seems that the earliest first report of late blight in the Scottsbluff-Alliance area is July 23 (in 1958). Early to mid-August seems to be the most common time.

In This Issue...

Potato Late Blight

Gary D. Franc
Plant Pathologist
University of Wyoming, Laramie, WY

Production areas that experienced late blight last year now have a greater disease risk due to the presence of overwintering inoculum and all production areas have increased risk due to widespread movement of infected seed tubers. Although late blight's impact cannot be predicted, sound disease management strategies will definitely reduce the potential for its development.

Symptoms -- Late blight will first appear as water-soaked spots, usually at the tips or edges of lower leaves where water or dew tends to collect. Under moist, cool conditions, water-soaked spots rapidly enlarge and a broad yellow halo may be seen surrounding the lesion. On the leaf underside, a spore-producing zone of white moldy growth approximately 0.1 - 0.2 inches wide may appear at the border of the lesion. Under continuously wet conditions, the disease progresses rapidly and warm, dry weather will slow or stop disease development. As conditions become moist and cool, disease development resumes.

Tuber lesions first appear as irregular, dark blotches. When cut open, affected tissue is water-soaked, reddish brown and extends with an irregular margin into the tuber flesh. Lesions may start as a superficial decay that continues to develop after tubers are harvested and placed into storage. Older lesions may become firm and sunken due to water loss and tubers will appear shrivelled. Infected tubers are commonly invaded by secondary decay organisms such as soft-rot bacteria and, therefore, are quite likely to decay during storage.

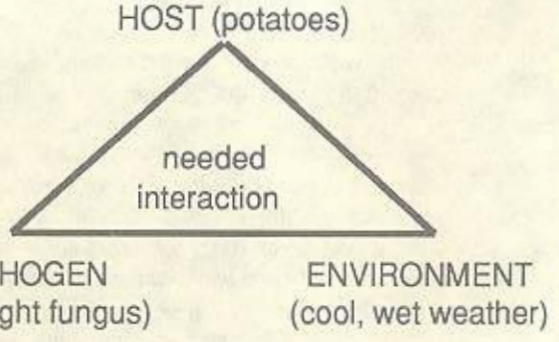
Disease Cycle -- Late Blight is caused by the fungus *Phytophthora infestans*. The late blight fungus is especially adapted for growth under conditions where water is present and cool temperatures persist. Temperatures ranging from approximately 50 to mid 90s *o*F will enable disease progression in the field.

Disease is initiated by fungus spores or "inoculum" produced on the surface of living, infected plant tissue. Infected seed tubers, tomato transplants, potato cull piles and/or other volunteer potatoes are extremely important sources of inoculum. Spores are readily disseminated among plants and fields by splashing rain, overhead irrigation and wind. Repeating cycles of spore production, dissemination, followed by additional spore production, give late blight its explosive disease potential.

Significant crop loss can result from tuber infection. Spores washed from foliage and stems can infect tubers in the hill **before** harvest and spores present on vines readily infect tubers **during** harvest. Although tuber to tuber spread may occur in storage, its significance is not known.

Disease Management -- Plant disease will not occur unless (1) the pathogen is present, (2) a susceptible host plant is present and (3) environmental conditions are favorable for disease development (Figure 1). All disease management guidelines are designed to manipulate the interaction of these factors, making disease development less likely. The most effective disease management programs will simultaneously use as many different approaches to control possible.

Figure 1. The Disease Triangle



These three factors must interact before disease development can occur. Disease management guidelines are designed to affeodt at least one of these three factors and thereby reduce disease risk.

The risk of late blight can be greatly reduced by eliminating sources of inoculum. Presently, the late blight fungus is only known to overwinter within infected, living plant tissue. In potato production areas, infected tubers from the previous growing season are the most important overwintering host. Therefore, elimination of both cull piles and/or any other source of volunteer potatoes is one of the most important methods used for late blight control.

Infected seed tubers also are an extremely important source of inoculum. Planting healthy, certified seed is necessary for reducing risk from late blight as well as other diseases. Although seed certification never guarantees freedom from any disease, planting non-certified "common" seed is an unacceptable risk. Colorado is the only state where detection of late blight at any level results in seedlot rejection. In other states, the U.S. No. 1 Seed Potato Grade

standard is followed which permits up to a 1% late blight incidence in tubers. Seedpiece treatments will not compensate for planting infected seed and will not reduce risk of late blight development. Once the crop is planted, adequate hilling to keep daughter tubers well below the soil surface will reduce risk of tuber infection.

Cultivar selection also may reduce risk of late blight. In general, potato cultivars traditionally planted by United States growers are susceptible to varying degrees with none being totally resistant or immune. Planting resistant cultivars may slow disease development sufficiently to reduce the overall need for fungicide.

Disease prediction models based on weather data are used in some production areas to schedule foliar fungicide applications. It is not well documented how useful disease forecasting is for individual fields in irrigated production areas where the amount of moisture applied to each field is likely to vary and the presence/absence of inoculum is unknown. Regardless, rigorous field scouting is needed to detect disease as early as possible. Disease development is most likely in shaded, cool, wet portions of the field. If disease is detected, spot-killing infected plants by tillage or herbicide will halt spore production and/or application of fungicides will aid in reducing disease spread. In general, fungicide should be immediately applied if there is indication of late blight. Applications made before row closure result in better coverage and are more effective than applications made when an extensive canopy is present. Fungicide applications made with ground rigs provide better coverage than those made by air.

Fungicides are highly effective tools for late blight management when used properly. Fungicides available for late blight control have either systemic activity or protectant activity. Systemics move throughout actively growing plants and will protect plant parts not directly infested fields should be destined for short term storage only. Thiabendazole (TBZ) application to tubers going into storage is not effective for late blight control.

If infected tubers are placed into storage, a high rate of air movement will dry tubers and reduce risk of decay. The trade off is decay loss versus shrinkage resulting from additional air movement. Storage at 38°F (seed potatoes) will retard decay significantly while storage at 38°F (processing potatoes) is likely to result in extensive decay. Continuous monitoring of the storage for hot or wet spots will enable better storage management and timely movement of tubers developing decay. As stated above, tuber to tuber spread in storage is suspected to occur, although its significance is not known.

Cultural Practices for Late Blight Control

Duane A. Preston
Area Potato Agent
University of Minnesota, E. Grand Forks, MN

The critical thing that you need to remember is that late blight needs living tissue to survive. When conditions are right such as the cold, wet weather and the thunder storms of 1993, late blight can survive very well and be moved as much as 50 miles in a day. For a disease to exist, it needs three things: a host, the pathogen and the right environment -- the disease triangle.

Sources of Field Infection:

Seed tubers are a major source for late blight infection of a field. With the exception of Colorado, all states have a tolerance for late blight in the seed lot.

Volunteer plants from old abandoned tubers dumped in the field are a source for late blight spread. In 1992, a lot of potatoes were dumped. Growers didn't think late blight would become a problem since its last occurrence was in 1982 in a small area. The weather changed in 1992 and became conducive to late blight. So, after the first grower call in North Dakota on July 30, extension staff began looking for late blight in the fields. Many calls followed the one on the 30th. Piles of seed potatoes that were dumped in fields were observed to have sprouts. These could readily became sources of late blight infection. A field as much as 12 miles away from another field was severly infected within six days after the first field was inspected.

Cull piles are a necessary evil in potato production and can be major sources of diseases. The big concern across the continent today is late blight. There is an increasing amount of potatoes culled due to increasing standards for processed and tablestock potatoes. Customers want a perfectly round or a perfectly red potato, or a potato without knobs, growth cracks or hollow heart. Since there aren't any dehydration or starch plants in the area, cull potatoes are dumped someplace.

Slough areas are low areas next to shelter belts and field corners where shelter belts meet.

Field Treatment:

Application of a fungicide requires a good coverage of the leaf. Metalaxyl (Ridomil) is systemic. It comes into the leaf and moves around through living parts. The recommendation is to apply the material with a ground applicator. If it can't be applied on the ground and aerial application is needed, then a minimum of five gallons of water per acre must be applied.

In the past, fungicides were not applied until late blight was visible. We can't do that anymore; it is too late. The fungicides have to be put on early. Protectants need to be applied before the late blight spores are on the leaf surface and germinate. When a spore is already present, the

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protectant will trap it on the leaf surface, and the germinated spore will enter the leaf eating it out. The protectants are great, but if late blight spores are present, we have to use the systemic, metalaxyl.

Vine desiccation at the end of the season is an important tool to eliminate living tissue and decrease late blight survival. The use of diquat (Diquat) is suggested, but make sure the vines are dead before harvest so the spores don't get into the tubers.

Tuber Infection:

Late blight spores can be washed down into the soil through cracks or by splashing. When the spores get into the ground and reach the tuber zone, they can infect the tubers. By storing infected tubers, late blight gets into the bin. Infected lots need to be placed in a field in the fall. They need to be spread and destroyed such as by disking or plowing. Some people have used snow blowers. In these ways, the tubers will completely freeze during the winter and the live tissue killed. Spreading is necessary so that heat is not built up within the cull pile and allow the microorganisms to survive.

Storage Spread:

Recently, Walter Stevenson (University of Wisconsin) found late blight spores spreading in storages of chipping potatoes. In these storages, temperatures are in the low 50s °F and the relative humidity is very high. This is a good environment for the pathogen, and the possibility had not been considered previously since late blight was infrequent in the past.

A2-Type:

As Gary Franc noted, the A2-type of late blight has recently been identified in the US. It has not appeared yet in the Red River Valley, but there were reports of infected tomato plants in the Minneapolis area. In Wisconsin, the A2-type was found in a potato field near tomatoes. Did it come from the transplanted tomatoes? The point is that tomatoes have been identified as a source of the A2-type pathogen.

The main reasons for concern about the A2 mating type are: 1) Sexual reproduction can now occur between the types, A1 being already present in North America. This will result in a greater genetic diversity. 2) This mating can result in oospores which do not need a living host. Soil survival from season to season may be possible. 3) A2 may multiply faster than the A1 mating type.

Late Blight Forecasting:

In the Red River Valley, modelling is being developed to forecast late blight in order initiate disease management strategies and minize fungicides applications. In this way, input cost can be low and potential environmental harm can be avoided. Build-up of resistance by the pathogen can be minimized. The model is based on the "favorable-day" method developed in Wisconsin.

Ideal temperatures for late blight infection are 50-60°F at night and 60-70°F in the day. A relative humidity of 90% promotes pathogen development. Spores will die in low humidity. Rain can disperse and trigger spore germination. The model indicates that infection develops when 1.2 inches of rain has fallen in the previous 10 days.

In the "favorable-day" method, a favorable day is one before which there were 5 days with below 78°F temperature and 10 days with 1.5 inch rain. Late blight is forecasted to occur one to two weeks after 10 consecutive favorable days. The recommendation categories from this model are: no application, warning to scout, and application recommended.

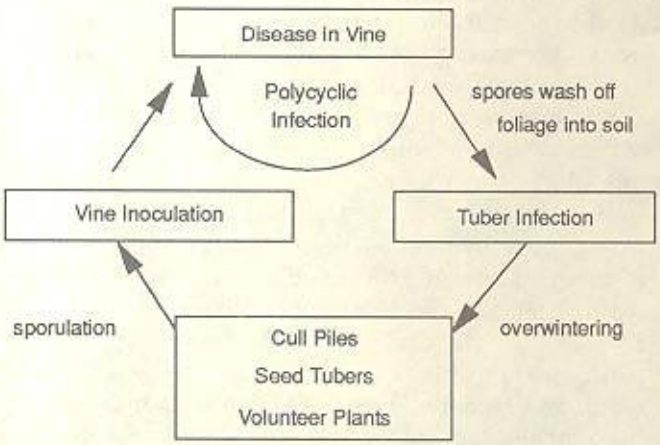
Late blight has to be treated as a community disease; it can affect everybody. So, everyone needs to do the best job they can to prevent this from spreading.

Metalaxyl and Late Blight Control

Tom Harris
Product Development Specialist
CIBA Plant Protection, Fargo, ND

You will hear me talk over and over again how metalaxyl needs to be applied early in the season to manage late blight. Late blight has to be controlled before it gets out of hand which may take only a few days. What makes late blight such an aggressive disease is its polycyclic nature (Figure 1); it goes through many disease cycles in a year. I'm not trying to scare people but, as Duane Preston's slides showed, late blight is really nothing with which to fool with. When weather conditions are conducive to late blight development, you will never see another disease that moves like it. Its ability to regenerate very quickly makes treatment critical.

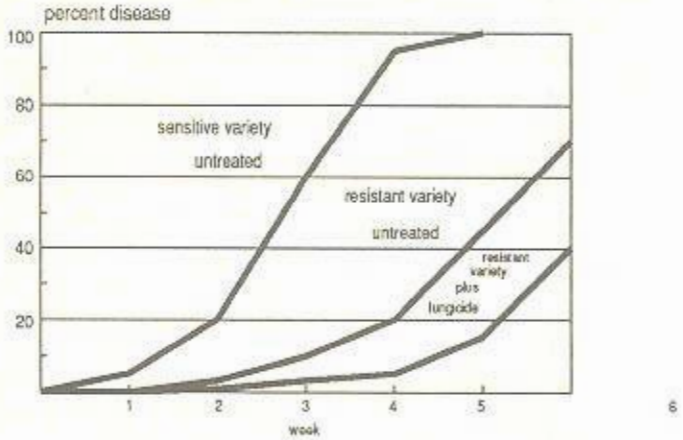
Figure 1. Late Blight in Potatoes.



Duane Preston and Gary Franc have talked about the cultural practices. Crop rotation, fallowing, drainage, sanitation to reduce the spread of soil and debris, and choosing less susceptible varieties depending on market needs to be controlled in cull piles and on volunteer plants

before the growing season. Once these practices are done, there are some field management practices available. Given no control, the level of late blight can increase rapidly. Some varieties have a little resistance to the disease and late blight's progress may be delayed. When this delay expires, the last crop medicine left to the grower is a good fungicide program (Figure 2).

Figure 2. Late Blight Progress



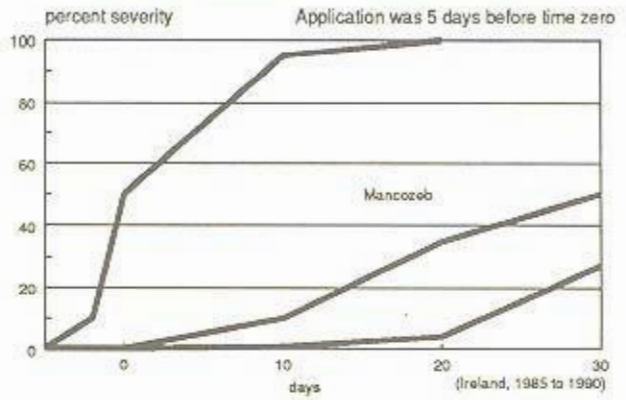
Metalaxyl, Ridomil, is the only systemic fungicide available against late blight. It tends to translocate upward in the plant but biologically significant amounts of metalaxyl also move from the foliage down into the tubers. This is the critical action which allows metalaxyl to do an efficient job controlling tuber late blight as well as foliar infection.

There are different types of fungicides. The protectant types, such as mancozeb and chlorothalonil (Bravo), adhere to the leaf surface forming a barrier; good coverage is essential. These give some help in controlling late blight, but if spores are already present, the control of late blight can be more difficult unless a systemic fungicide is also used. Metalaxyl is systemic and acts within the plant against late blight.

Fungicide Application Program -- Traditionally in the Red River Valley, application was not until late blight started, usually not until late July. In many cases, full effective control was lost due to this late application. What is really seen with an early application is a delay in the onset of the disease. The plant is kept healthy and the disease is avoided as long as possible. The severity of late blight at the end of the season is likwise reduced. The latter reduces the carryover of this disease into the following year. Also of note is that yields of potatoes are significantly increased with earlier application of metalaxyl. Early application is an important part of managing insensitivity.

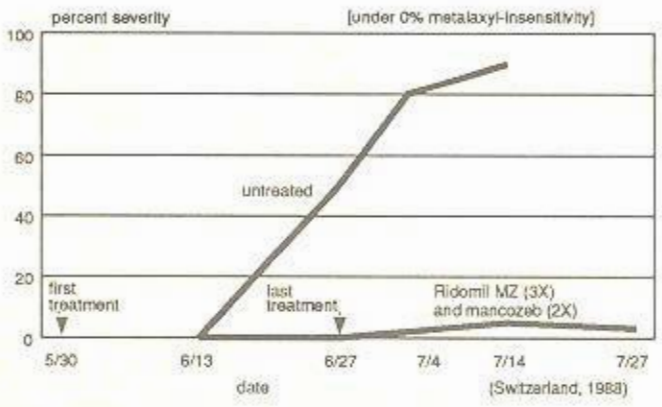
Most of what we know comes from research done in Ireland where this disease is responsible for the deaths of a million and a half people from starvation between 1845 and 1848 and where they have had to deal with this disease ever since. Treatment with the combination of mancozeb plus metalaxyl (Ridomil MZ prepack) delayed the onset of late blight. Dr. L.J. Dowley of the Irish Republic applies the material when the environment is conducive for late blight. The check plants are used for the first identification of the disease and its progress in these plants and treated plants is followed. Over a six-year testing period, late blight development was delayed by 21.7 days when plants were treated with an early application of Ridomil MZ (Figure 3). Mancozeb, the protectant fungicide, will delay late blight but the effect is short term.

Figure 3. Severity of Late Blight following single-dose applications.



With an early application, will there still be the needed control of late blight at the end of the season? When the fungicide is applied early, there is less disease and it is controlled while still getting started consequently the disease is delayed. If application is delayed then the disease has time to develop and destroy the plants.

Figure 4. Recommended Fungicide Program for Late Blight Severity.



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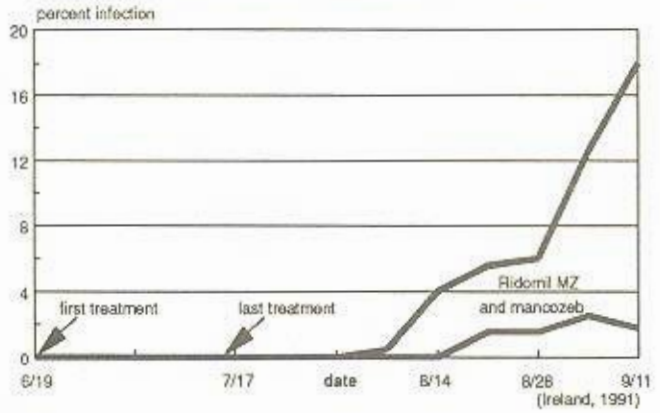
If plants are left untreated, late blight quickly gets out of control. In Switzerland, the severity of late blight development was measured in untreated plants and plants placed in a five-application treatment program (Figure 4). There were three applications of Ridomil MZ (0.18 and 1.4 lb ai/ac of metalaxyl and mancozeb, respectively, on 30 May, 13 June and 27 June, and two applications on mancozeb (2 lb ai/ac) on June 7 and 20. This fungicide program maintained excellent (near complete) contol of late blight.

In 1991, Dowley in Ireland compared the Ridomil MZ program tested in Switzerland with the application on mancozeb alone at the same applied timings. The test was conducted in the presence of a 10% metalaxyl-insensitive population of late blight. Fungicide applications were weekly beginning June 19 and ending on July 17 (Figure 5). The five-week fungicide rotation program maintained control of the disease even in the presence of the insensitive

Figure 5. Late Blight Infection with the Recommended Fungicide Program



late blight population.

Why is early application recommended? Metalaxyl tends to translocate upwardly in plants more so than downwardly. This attribute needs to be placed in the context of potato growth and the source/sink relationship. Metalaxyl needs time to translocate and the sink pressure of growing tubers will enhance the downward movement. For example, for Russet Burbank planted around April 21, dry matter starts accummulating in the tops (vines) of plants at about 40 days after planting. On about June 20, tubers are initiated and, around July 10 when plants are in full bloom, they begin to grow accummulating dry matter and water. For good translocation of metalaxyl, its first application needs to be done just prior to tuber bulking when tubers are a half-inch in diameter and flowering has begun, the last week of June. This gives metalaxyl time to get into the vine and prepare for translocation. The second application, 14 days later (July 14), is during the early phase of tuber growth taking advantage of the strong sink-strength of the tuber.

Metalaxyl Insensitivity -- Late blight insenitivity to metalaxyl has begun to unfold in North America. Metalaxyl can occur with either the A1 or the A2 mating types of late blight. In Europe, this issue began in the 1980s but the situation has been manageable in the presence of both mating types, A1 and A2. The recommendation of these early applications came from their experiences. Since late blight became a major concern in North America, fungicide application recommendations have changed with less emphasis on storage diseases, leak and pink rot. The oospore, sexual stage, of the A2-type did not become a factor in Europe. In Europe where the A2- mating type has been present for several years, metalaxyl remains the major late blight control even under high levels of insensitivity. The key is using the recommended application program. The A2-mating type and metalaxyl insensitivity are not necessary synonymous; A2 just happens to be more aggressive. Sensitive strains overwinter in tubers better than the insensitive strains. In Switzerland, 22 mixed field populations were inoculated into tubers which were placed into 6°C-storage; the insensitive strains disappeared in 14 of the subpopulations.

Storage Diseases --The recommended application scheme will also control two major storage diseases, pink rot and leak. Metalaxyl provides added benefits.

Golden Rules for Late Blight Management -- 1) Minimize risk before planting. 2) Start fungicide program early. 3) Maintain correct application interval. 4) Ensure complete foliar coverage. 5) Use the right product at the right time. 6) Minimize risk of late blight and rots in storage.

Recommended Fungicide Program

around July 1	-- first application of Ridomil MZ [for late blight]
7 days later	-- first application of Bravo [for early blight and metalaxyl-insensitivity]
7 days later	-- second application of Ridomil MZ [for late blight and storage diseases (leak and pink rot]
7 days later	-- secont application of Bravo [for early blight]
around August 1	-- last application of Ridomil MZ [Two applications may be enough depending on weather.] [for late blight and storage diseases (leak and pink rot]
after August 1	-- Maintain early blight control with a protectant.

My Late Blight Experience in the Red River Valley

David Hankey
Potato Grower
Grafton, ND

Late blight is a very fast moving disease. One really has to go with protectants early in the season. That is the first and most important point which I want to make. Early application is the cheapest and the best method, to stop late blight before it ever starts. The other major point which happened in the Red River Valley (RRV) especially in 1992 was the habit of spraying protectant fungicides as soon as the Colorado potato beetle started hatching. This worked well for early blight protection but not for late blight. What happened in 1992 and 1993 under cool conditions was that the Colorado potato beetle didn't hatch and the cool weather gave perfect conditions for late blight. The normal strategy didn't work and the RRV growers were caught off guard.

The minute late blight is found in a field; it better be treated with metalaxyl (Ridomil prepacks). There is no time to wait since this disease can take a field down in a week. If the conditions are persistent, a second treatment will be necessary. We can really look at what has happened in the RRV the last couple years. Every time someone has had a problem, something was not done right. Recommendations were not followed. Either protectants were not sprayed early enough or time was wasted and treatment delayed, hoping that the weather conditions would change, or a second treatment was skipped. The next thing that happens is that late blight breaks out and you, the growers, have to make some hard decisions.

Varietal differences can play a factor. For example, we have seen a big difference in susceptibility between Frito Lay variety 1533 which was by far the most susceptible variety and Snowden and Russet Burbank which are not very susceptible.

A customer's tolerance for problems plays a key role. Recently, for instance potato chip contracts with Frito Lay have been severly cut back in the Red River Valley. Under a tight competitive situation, a grower cannot afford problems. Once late blight is in the bin, it cannot be graded out; it will show up as a defect on the other end. Market outlook is always a consideration.

From the growers' perception, the first thing is to be able to identify late blight. The very first time that I saw it was real interesting. I walked the fields and walked the fields, and could not figure out if what I saw was late blight. Then, all of a sudden, it was all over the place and I knew that it was late blight. I didn't need an expert to tell me; it just explodes. If you have anything questionable, test it the minute you find it.

Here is another experience that I would like to share. I sprayed everything with Ridomil prepacks twice in 1993, sprayed protectants five and six times, and I was relatively sure the fields didn't have late blight. There was nothing more that could be done. Late in the season while walking the fields, I found some misses that I didn't know were there. They were just left and harvested last. Even when you think that you have all the bases covered, you still have to walk your fields and walk them close. Special attention was given to samples from lots going into storage. One person was assigned just to test samples, looking for late blight on tubers. Even if you think there is only two or three percent infection, it can amount to more. You really have to know what is going in storage.

In dealing with late blight, another factor to be prepared for is the cost. The best strategy is to alert the banker that there may be an extra $60-70 cost per acre to combat late blight. This will give the bankers time to have it approved and you won't waist time waiting. Late blight can really add to your cost and you had better be ready for it.

Although we spray by ground rigs most of the time, an emergency situation may occur where aerial spraying is needed. If aerial application is needed for late blight control, it is a good time to be on the right side of the pilot.

To sum it up, you have to go in early and scout your fields. If the field has late blight, you had better be prepared to spend the money because it will be a lot more expensive if you have a problem.

A Farmer's Check List on Late Blight:

- ❑ 1. Learn to Identify
- ❑ 2. Walk the Fields
- ❑ 3. Test Anything Questionable
- ❑ 4. Sample at Harvest
- ❑ 5. Insure Crop (if possible)
- ❑ 6. Prepare Banker of Cost
- ❑ 7. Be Ready to Apply Fungicides

Late Blight Seminar Discussion

Alexander D. Pavlista
Extension Potato Specialist
University of Nebraska, Scottsbluff, NE

After the presentations just summarized, the speakers at the seminar -- Dr. Gary Franc, Messer. Duane Preston, Tom Harris, and David Hankey -- formed a panel to answer and discuss growers' questions. The following are the questions and the edited discussion that ensued.

Question: How did potatoes get checked as they were going into storage?

(Hankey) Every truck load coming from the field had someone taking 25 to 50 lb samples which were washed and inspected. It is not fool proof. Part of the reason for vine desiccation two to three weeks before harvest is to prevent any new infections, so by the time tubers are harvested the infection should show up.

Question: Is there a test for late blight that would not take several weeks?

(Franc) Cultural tests can be used. If late blight is sporulating on the leaf, it can be identified right away. To get the fungus to sporulate put the leaf in a zip-lock bag with wet paper towel. One can also put a leaf in a styrofoam cup or container with an ice cube and paper towel, cover it with saran wrap, and by morning, it should sporulate. It just requires humidity and looking for the spores using a microscope.

Question: Can Ridomil and the protectants be chemigated on potatoes?

(Harris) Chemigation is on the Ridomil label, but it is critical that the center-pivot moves quickly and the least amount of water is used. Sometimes, too much water gets on and washes the material off. It is not a preferred method; ground application then aerial is preferred over chemigation. If chemigation is too slow, Ridomil can be pushed right into the ground and not on the leaves. This is true for applying protectants as well. A tenth of an inch per acre water would work fine but stay well under a quarter of an inch per acre. An inch per acre is about 27,000 gallons per acre.

Question: Are there any seed treatments for late blight?

(Harris) No, there aren't any. Applying Ridomil 2E at time of seeding is not approved and is discouraged primarily due to the potential of developing insensitivity. Infected seed may rot in the ground and a lot can be gotten rid that way. The best control is an early foliar application of fungicides when the disease risk justifies it.

Question: Since metalaxyl tends toward upward movement over downward, would it be better to apply it incorporated in the hill?

(Harris) That does make a lot of sense from that standpoint; one could get a lot of metalaxyl into the plant and where it is needed. But, there is a high risk of insensitivity developing. Also, the advantage of the Ridomil-protectant prepacks is the help from the protectant which needs to coat the leaves; this is the key to the management.

Question: Is there any difference between Ridomil-MZ and Ridomil Bravo?

(Harris) Ridomil-Bravo is the preferred product; it appears to be a little better than Ridomil-MZ which contains mancozeb instead of chlorothalonil (Bravo). But, one also needs to look at what is working for you for early blight control. If you have a preferred application, it doesn't make much difference; the Ridomil-Bravo will be more expensive.

Question: What are the protectants used in the Red River Valley?

(Preston) The main products used are maneb and Bravo; the majority is the EBDC family. There isn't much difference in any of them under dryland conditions when put on properly, timely and correctly.

Question: Is there any regular disinfection that can limit late blight?

(Franc) Disinfection is always a good idea for general disease control. However, no matter what degree of disinfection is used those infected tubers remain. Disinfection will prevent some spread of soft-rot and other bacteria and perhaps reduce a little bit fungus spread, but it will not give late blight control.

Question: What about disinfecting storage facilities for next year?

(Franc) The late blight isolates currently here and do not produce oospores and need living tissue to survive and persist. So if there is living tissue such as old tubers lying around in the storage, that is where sanitizing storage starts. I would always recommend sanitation. Removal of living plant tissue is what is going to get rid of the late blight inoculum.

Question: Are there sources other than potatoes for late blight?

(Franc) There are other sources of inoculum like tomato transplants. Home gardening could be a potential source since people are working out of hobby greenhouses and buying transplant from supermarkets, etc.

EBDCs

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Extension Potato Specialist
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The EPA has just amended its EBDC cancellation order. More than one EBDC active ingredient can be used on a single crop in one season. This means, for example, that Ridomil MZ, which has mancozeb as the EBDC active ingredient, can be rotated with, for instance, maneb, a different EBDC active ingredient. However, the amendment does not change the maximum allowable amount of EBDCs used in a season.

SFA Potato Chip Variety Trials

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The 1993 Snack Food Association Potato Chip Variety Trial was conducted in California, Florida, Maine, Michigan, Pennsylvania, Washington, and the Red River Valley. These trials are national and the entries are limited to chipping varieties. These trials are designed to actively involve chip processors as well as chip growers. The highest average yields, over 500 cwt/acre were obtained in California. Michigan had a late planting and Maine had drought conditions; therefore yields were lowest at these locations.

Atlantic was the highest average yielding variety across the trials. After Atlantic, the highest yielders were Suncrisp, NDA2031-2 and A80559-2. The latter two were tested in 1992 when they were also among the highest yielding entries.

Comparing 3-year averages for advanced entries, A80559-2 and W887 had similar yields as Atlantic. The entries NYE55-44, NYE55-35 and W870 yielded less than Atlantic. W870 also yielded less than Norchip.

Data averages of entries in the 1993 SFA Potato Chip Variety Trials

Entry	Total yield cwt/a	US #1 yield cwt/ac	Specific gravity	Chip color[1] Agron	SFAt char
A80559-2	340	297	1.094	59	2.0
B0178-34	328	286	1.097	62	2.0
NDA2031-2	368	300	1.091	59	2.0
NDO1496-1*	306	257	1.088	60	2.1
NY95*	290	230	1.091	58	2.2
NYE 55-35	315	251	1.095	58	2.2
NYE 55-44	311	268	1.084	61	1.8
W870	294	248	1.095	61	1.8
W887	306	275	1.094	60	2.0
Atlantic	338	306	1.095	58	1.6
Norchip	311	262	1.083	58	2.0
Suncrisp*	344	302	1.093	58	1.6
Means:	321	274	1.092	60	1.9

[1]Chip colors at harvest were determined by Dr. W. Gould using Agron values (M30, 90190) and SFA color chart (1-5 scores).

* Designates a new entry.

Data averages of entries in the SFA Potato Chip Variety Trials from 1991-1993.

Entry	Total yield cwt/a	US #1 yield cwt/ac	Specific gravity
A80559-2	319	275	1.094
NYE 55-35	303	245	1.094
NYE 55-44	291	249	1.082
W870	266	220	1.093
W887	316	279	1.093
Atlantic	315	277	1.089
Norchip	279	231	1.079
Means:	**298**	**254**	**1.089**

Potato Trivia

Folk Remedies Using Potatoes

Use potatoes to treat facial blemishes by washing your face daily with cool potato juice; treat frostbite or sunburn by applying raw grated potato or potato juice to the affected area; help a toothache by carrying a potato in your pocket; to tease a sore throat by putting a slice of baked potato in a stocking and tying it around your throat; and easing aches and pains by rubbing the affected area with the water potatoes have been boiled in.

Advancing color photography with potatoes

Chemist Louis Lumiere used microscopic grains of potato starch fixed on 9" by 12" glass plates to create the first autochromes.

Autochromes were widely used until the development of color film in the 1940s.

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