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Fungicide Application for Management of Potato Late Blight

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POTATO LATE BLIGHT MANAGEMENT

Management of potato late blight in the Columbia Basin of Washington and Oregon requires a combination of several strategies: strict sanitation practices, proper irrigation management, good cultural practices, and proper application of fungicides. Sanitation practices (such as not planting infected seed and using a seed treatment containing mancozeb or cymoxanil, and destroying cull piles before planting), and proper cultural practices (such as not planting within 80 - 100 ft of the pivot center and preventing wet areas from developing in fields) will reduce disease pressure and increase the effectiveness of foliar fungicides.

➢ **Fungicides are most effective when** they are applied to foliage 1) before infection occurs or 2) when the disease is in very early stages of development and cannot be detected yet by the human eye. Later applications are helpful in reducing the rate at which the disease spreads but are not nearly as effective as early applications. Late blight is very difficult to manage once infections become established in sprinkler-irrigated fields because the microclimate within the canopy usually favors further disease spread whenever the field is irrigated.

➢ **Total crop and canopy coverage with fungicides is essential** for late blight management. The late blight organism, *Phytophthora infestans*, will most likely find and infect any plants or plant surfaces skipped during application. Given the nature of the potato canopy after row closure, achieving complete coverage of leaves and stems with fungicides can be difficult if proper application methods are not followed.

POTATO LATE BLIGHT FUNGICIDES

Many fungicides are labeled for use against potato late blight. Each product has specific conditions for use and is labeled with details regarding rates and application method. Fungicides work against late blight by inhibiting one or more of the following: germination of spores (and as a result, reduced infection of plants), growth within the plant, production of spores (sporulation), and formation or development of lesions.

Spore suppression. Some combinations of fungicides, such as Acrobat (dimethomorph) plus an EBDC, and Curzate (cymoxanil) plus an EBDC (have post-infection activity that inhibits sporulation and/or restricts lesion expansion. These products may also help reduce tuber infection when applied during and after tuber bulking. Their use at times can be very beneficial, but they should never be used as a predetermined management tool to be used only as a "rescue" if plants in a field become infected – control likely will not be adequate. Proper use of protectant fungicides, prior to infection, will ensure good and economical protection.

Examples of late blight fungicides

1. EBDC (ethylene bis-dithiocarbamate) fungicides. Examples: Metiram (Polyram), Mancozeb (Dithane M-45, Manzate 200, and Penncozeb), and Maneb (Manex). Gavel contains mancozeb plus zoxamide.
2. Chlorothalonil (Bravo, Echo).
3. Cymoxanil (Curzate) plus an EBDC or chlorothalonil. Tanos contains 25% cymoxanil and 25% famoxadone.
4. Dimethomorph (Forum) plus an EBDC or chlorothalonil.
5. Propamocarb hydrochloride (Previcur Flex), plus EBDC or chlorothalonil.
6. Mandipropamid plus difenoconazole (Revus Top).
7. Phosphorus acid (Phostrol).

Fungicides not recommended

- ➢ Mefenoxam (Ridomil Gold, Ultraflourish) prepacks are not recommended for management of late blight; however, mefenoxam can be effective for management of pink rot and Pythium leak.
- ➢ Super Tin by itself will not adequately control severe late blight, but it is effective when mixed with Polyram or another EBDC fungicide.
- ➢ Copper fungicides should not be used alone for control of foliar late blight in the Columbia Basin.

METHODS OF FUNGICIDE APPLICATION

The choice of application method is important in managing late blight. The general methods of fungicide application, with strengths (+) and weaknesses (-) given for each are listed below:

1. **Air** (plane or helicopter)

a) +/- applies medium amount of fungicide to the canopy; applies individual drops of water containing a high concentration of fungicide, primarily to the upper canopy, and at least two applications on a weekly basis are required to ensure product has protected new foliage and redistributed by irrigation water across leaves and stems (laterally) and to the lower canopy to provide adequate protection.
b) + quickest method.
c) + uses little water (5 to 10 gallons/acre. The use of >5 GPA is no more effective than 10 GPA).
d) - ineffective in moderate or higher winds.
e) - must be scheduled with a commercial applicator.
f) - ineffective near obstacles (trees, power lines, houses).
g) - gaps of non-treated foliage may result from poor fungicide application.
h) +/- moderately expensive.

2. **Ground** (spray booms attached to self-contained or tractor-pulled equipment)

a) + applies greatest amount of fungicide to and throughout canopy providing reasonable protection throughout the canopy following application.
b) +/- faster than chemigation, but slower than air.
c) + uses little water (20 to 100 gal/acre).
d) + most effective method in high velocity winds.
e) - requires either purchase of expensive equipment or contracting with a commercial applicator.
f) - soil compaction from wheel tracks may reduce tuber yield and quality.
g) - standing water in wheel tracks may increase late blight incidence.
h) - most expensive method because of equipment cost.
i) + can be used most anywhere; even when obstructions are present.
h) + can be used as needed.

i) + redistribution of fungicide applied to the upper canopy is still required to maintain good concentration of material and protection from late blight in the lower canopy through the next week.
j) + protection skips do not occur if nozzles work properly.

3. **Chemigation** (fungicides injected into irrigation system, most often a self-propelled center pivot sprinkler irrigation system)
a) - applies least amount of fungicide that stays in the canopy (the rest washes through) but fungicide is nearly evenly distributed throughout canopy due to high water volume used and will provide protection thoughout the canopy after application.
b) - slowest method.
c) - tremendous water volumes required (5100 to 6250 gallon/acre).
d) + can be applied in winds equal to or faster than those in air application, particularly where drop nozzles are used but works best when there is little or no wind.
e) + can be scheduled and performed by trained personnel employed by grower.
f) + can be applied using equipment already at the site.
g) + least expensive application method.
h) - may require a more frequent application schedule (more often than 7 days) due to low fungicide levels applied to canopy and may not provide adequate protection particularly in the upper canopy (due to wash off) if environmental conditions favor late blight.
i) + as long as nozzles and injection pump work properly, protection skips will not occur.

4. **Attached Boom** A method in which a spray boom is attached to the center-pivot sprinkler irrigation system (applies fungicides evenly along the length of the pivot using a water system independent of the irrigation water).
a) + more efficient in applying fungicides than chemigation (equal to ground application).
b) + little water required.
c) - equipment costly but may be able to be used to apply other pesticides.
d) +/- has many of the characteristics identified in "ground" application listed above.

5. **Air/chemigation** A cost saving method that provides good protection when used on a 7-day schedule is the alternating use of air application of fungicides with chemigation. The most effective way to use this method is beginning with an air application. This method provides some of the good aspects of both methods.
a) +/- air applies medium amount of fungicide to the canopy, mostly the upper canopy; chemigation applies the least but uniform coverage.
b) +/- quickest (air) and slow (chemigation) depending of method used that week.
c) +/- uses little water (air) or high levels (chemigation).
d) +/- ineffective in moderate or higher winds (air), chemigation okay.
e) +/- must be scheduled with a commercial applicator (air), not so with chemigation.
f) +/- ineffective near obstacles (trees, power lines, houses) (air), not so with chemigation.
g) +/- gaps of non-treated foliage may result from poor fungicide application (air) not so with chemigation (if equipment is operating properly).
h) +/- moderately expensive (air), chemigation cheapest.

Additional Considerations

➢ In the Columbia Basin in 1995, aircraft application was the most commonly used method (75%), followed by chemigation (25%), and ground (very little application). The use of chemigation has

increased in recent years because it is less expensive than air application. Equipment availability and other financial considerations may determine the method more than delivery efficiency of the fungicide.

- ➢ Application methods vary in terms of how much fungicide is deposited on and within the canopy and how redistribution occurs over time within the canopy due to application amount and movement downward of irrigation water or rainwater. (For example, one study showed that chemigation deposited low amounts of chlorothalonil on and in the canopy and redistribution over time by water caused chlorothalonil levels to drop even more. In such a situation, fungicide levels could fall below those required for sufficient control of late blight, particularly near the end of a standard 7 day application interval.)
- ➢ Application methods also vary in terms of how far into the canopy (upper vs. lower leaves) the fungicides penetrate initially. If protection is needed immediately in the lower canopy, then air may not be the best application choice.
- ➢ Alternating air application with chemigation on a 7-day interval can increase fungicide residue levels in the crop canopy at a reduced cost. This methodology provides several of the benefits of both methods without the adverse effects of using one application method repetitively.
- ➢ Stems are infected at higher rates than in the past. Before the early 90's most infections were seen on leaves. Moisture on stems dries more quickly than on leaves. However at least two factors have contributed to more stem infections: 1) late blight populations are more aggressive (capable of causing diseases) than in the past; and 2) because of the upright nature of stems, less fungicide is generally found on them. Maintaining adequate levels of fungicide on **both** leaves and stems is important.

Fungicide application tips

The important components of late blight management are: proper timing of the first application, proper fungicide selection, proper frequency of fungicide use, proper rate of fungicide, and proper application method. Keep in mind the following suggestions when applying fungicides:

1. ***Consult the toll-free late blight hotline*** for timing of initial fungicide application and intervals between applications. The Columbia Basin Late Blight Forecasting Model, current disease conditions, and weather forecasts are used to determine fungicide timing. The model is based on the number of rainy days in April and May. Both hotlines in Washington and Oregon provide information on the probability of late blight occurrence in the Columbia Basin before the end of May.
2. ***Begin applications at least 7 days prior to late blight exposure.*** Usually this requires making the first application just prior to row closure and continuing on a 7-day interval for three weeks or more. These early applications are the single most important application times because of the susceptibility of the foliage and the higher chance for favorable weather conditions for late blight development. Preventing late blight early could save a number of applications later if no or little late bight is reported and weather is warm and dry. In fields where late blight is found, continued application of fungicides is required.
3. ***Continue applications UNTIL HARVEST*** at recommended intervals to protect both new and old foliage. Consult the toll-free information lines for suggested intervals. Applications in late season may be as important as early season applications, even if late blight up to that point has been a minor problem in the Basin. In late August or September, plant water use decreases while watering levels sometimes stay constant, dews begin to form, and overall temperatures are reduced, all of which extend the wetting period of foliage and can contribute to extensive late blight infection. In addition, symptom expression in these older plants can be sometimes difficult to recognize due to natural senescing of leaves, which left nontreated could further fuel a late season epidemic and further infection in tubers going into storage.
4. ***Do not skip any plants.*** Total crop coverage is essential.
5. ***Maintain adequate residue levels*** of fungicides on the foliage. Use a consistent and appropriate application interval.
6. ***Let fungicides dry*** on the foliage before beginning normal irrigation.

7. ***When disease pressure is high, use short application intervals*** (5- 7 days).
8. ***Ridomil Gold, copper, and tin fungicides are not effective against late blight by themselves.*** Super Tin is effective when mixed with metiram (Polyram) or mancozeb. Tin mixtures are most efficient from mid-season until harvest.
9. ***Apply the first fungicide application by air and then rotate with chemigation.*** This is an effective and cost-saving program for late blight fungicide application, especially when disease incidence and pressure require a 7-day application frequency.
10. ***All fields need protection from late blight.*** This includes fields scheduled for early harvest.
11. Use of phosphorus acid can reduce tuber infection.

New Plant Pest Diagnostic Lab in Pullman:

WSPC Supports Sample Processing and Shipping from Moses Lake

Washington State University now operates two plant diagnostic labs: one at the Puyallup Research and Extension Center; and the other on the main campus in Pullman. Diagnosticians at these peer labs make plant disease diagnoses, and provide disease management information. Additionally, samples of insects and weeds received by these labs will either be identified or referred to appropriate experts. Diagnosticians: Jenny Glass glass@puyallup.wsu.edu (253-445-4582) and Karen Ward karen_flint.ward@wsu.edu (509-335-3292).

The potato commission strongly supported the recent creation of the Pullman lab, including partially funding the start-up costs. The commission will offer support to potato growers using the lab by offering free packing and shipping (via UPS) of potato samples from the commission office in Moses Lake. Staff at the office will help fill out the forms, and get your sample packed and on its way to the lab. Each sample will require a $25 diagnostic fee (cash or check) with the shipment, to be paid by the grower. Depending on sample difficulty, additional fees may be incurred (see below).

There is much information about WSU's diagnostic services at the website of the Puyallup lab: http://www.puyallup.wsu.edu/plantclinic/samples/ppd.html.

WSPC Provides Information Resources to Help Growers Pass "Sustainability" Audits

As many of you know, various buyers of potatoes are beginning to require farm audits that deal with "sustainability" issues including integrated pest management, pesticide use patterns, etc. A number of resources helpful in these audits can be found at the research section of the WSPC website: www.potatoes.com/research.cfm. Some examples include:

1. Information on pesticide resistance management.
2. Lists of pesticides registered for use on potatoes, including relative toxicity, modes of action, spectra of control, and various other information.
3. Electronic versions of all 19 pest/disease/beneficial information cards.
4. The research library, which includes all past Proceedings from the potato conference, all past issues of Potato Progress, and much more.
5. PNW Insect and Mite Management Guidelines, authored and updated annually by regional entomologists.

Contact Andy Jensen at the commission office anytime for help finding what you need.

Potato Late Blight

See also: http://www.potatoes.com/research.cfm

Foliar Late Blight

Leaf infections show areas of dead or dying tissue surrounded by a pale halo. Lesions are not delimited by leaf veins. Also, note the whitish sporulation of the pathogen around the dead tissue.

Stems are also infected, and show typical sporulation at high humidity and moderate temperature.

Field infections can start from infected seed or sprouts from volunteer plants.

Management

1. Prevention is key
2. Manage volunteer potatoes and cull piles
3. Plant healthy seed
4. Use a seed treatment containing mancozeb or other preventive fungicide
5. Treat with foliar fungicides according to recommendations of WSU
   (for eastern Washington, access the lateblight information line at: 800-984-7400)
6. Monitor fields carefully for late blight infections, especially early in season
7. Avoid planting potatoes in ground that is expected to be excessively wet, such as pivot centers and pivot overlaps

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