

Potato Disease Management Suggestions for July
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During the month of July potato growers should anticipate making management decisions for Early Blight, Late Blight, and Sclerotinia White Mold since these diseases usually become important after row closure and during flowering.

Early Blight

Early blight caused by the fungus, *Alternaria solani*, is perhaps one of the most common potato diseases, whereas late blight caused by *Phytophthora infestans* is rare in MT, although weather conditions in late June and early July have been favorable for late blight. In Montana, based on fungicide trials, yield losses from Early blight infections are approximately 10% if the disease is not controlled with fungicides. Losses on early maturing varieties are typically higher than full season varieties and are higher where plants are deficient in nitrogen. In addition to direct yield losses from destruction of photosynthetic tissue, the fungus can cause tuber decay. The tuber decay stage appears to be rare in MT. The fungus survives on crop and weed host residues and spores are windblown long distances. Sporulation and infection are favored by night temperatures over the range of 40-86^oF (optimum 68^oF) and relative humidity's > 96%. Spores deposited on leaves can remain viable for at least 8 weeks. Infection is not just related to the fungus since the potato plant does not become highly susceptible until the tuber set to bulking periods. It is interesting that airborne spore levels will typically peak at this time. The first infections will appear on lower leaves and infections and epidemic spread are not common until 300-350 P-Days after emergence for early maturing varieties and more than 400 P-Days for late maturing varieties. The P-day calculations are available from the Wisdom program and included in the weekly weather station reports from the Potato Lab.

Management of this disease in MT is dependent on monitoring nitrogen levels in petioles and initiating fungicide sprays when P-day thresholds are met. Growers should begin petiole sampling 30 days after emergence and continue on a 7-10 day basis until a week before vine kill. Plants should be sampled by removal of the 4th petiole down from the top exposed petiole. Sampling of 20-50 petioles from random areas of the field should provide good information on nitrogen status. Table 1. is from the University of Wisconsin and provides optimal petiole nitrogen levels for Norland, Norkotah and Russet Burbank at various times after emergence. You can have your soil fertility lab do these analyses or do them yourself with a Horiba Cardy nitrogen meter (they also make a potassium meter). These meters are ~\$250.00 and are available from several catalogues one website is <http://www.agriculturesolutions.com/Nitrogen-Meters/Horiba-Cardy-NO3-Compact-Ion-Meter>

Late Blight

While we have not seen late blight in MT for more than 10 years, conditions this year are near ideal. While our own seed should not be a source of inoculum, inoculum could come from seed brought into MT from other states for home garden use, imported tomatoes or petunias, or possibly from wind-blown spores. Most late blight scientists feel that wind transport of spores is limited to 10's of miles, not 100's. Weather

conditions and sources of inoculum will determine whether we see late blight this year- you can have ideal conditions but without inoculum no disease will develop! We have produced a news release targeting home gardeners. If this has not been published in your local paper, you might encourage them to do so. This will be our most likely source of late blight inoculums.

Late blight is present in surrounding states (OR, WA, ND) and provinces (Manitoba and Alberta) with some fields experiencing severe damage, indicating the disease has been present for several weeks. At this point, we think it prudent to apply a protective contact fungicide. Applications of Headline or Quadris for black dot will also give protection from late blight. Growers should reserve the most effective products listed in Table 2. for use after late blight has been identified.

Table 2. lists fungicides and their effectiveness for control of early blight, late blight, Pythium leak and Phytophthora Pink Rot

Table 1. Optimum petiole nitrate- nitrogen levels for Norland, Norkotah and Russet Burbank

	Dry weight Basis % NO ₃ -N		Sap Basis ppm NO ₃ -N	
	Norland Norkotah	Russet Burbank	Norland Norkotah	Russet Burbank
Days after emergence				
30	2.5-2.8	2.0-2.3	1900-2100	1600-1800
40	2.3-2.5	1.7-2.2	1800-2000	1600-1700
50	1.8-2.3	1.2-1.6	1400-1800	1000-1300
60	1.3-1.9	0.8-1.1	1100-1500	700-900
70	0.8-1.1	0.5-0.8	700-900	500-700

Table 2. Information on fungicide controls and their effectiveness for control of early blight, late blight, Pythium leak and Phytophthora pink rot.

N= no control, P=poor control, G= good control, E= excellent control

Fungicide	Late Blight	Early Blight	Leak	Pink Rot	White Mold
<i>Type</i>					
<i>Protective Contact</i>					
Chlorothalonil	G	G	N	N	P
Bravo 720					
Bravo Ultrex					
Bravo Weather Stik					
Bravo weather Stik Zn					
Bravo Zn					
Echo 720					
Echo 90 DF					
Echo Zn					

Dithiocarbamate	G	G	N	N	N
Dithane 75DF					
Dithane Rainshield NT					
Maneb 75 DF					
Maneb plus Zinc					
Manzate Flowable					
Manzate Pro-Stik					
Pencozeb 75DF					
Polyram 80DF					
Triphenyltin hydroxide	E	E	N	N	N
Super-Tin 80 WP, 4L					
Agri Tin 80WP					
Carboxamid					
Endura	N	G	N	N	G-E
Scala SC	N	G	N	N	N
(use Scala with protective contact for late blight)					
Benzamide					
Gavel 75 DF	E	G	N	N	N
(zoxamide + mancozeb)					
<i>Systemic/translaminar</i>					
QoI, Strobilurin, Group 11	F-E	E	N	N	N
<i>To get best control of late blight higher label rates should be used</i>					
Gem					
Headline					
Tanos	E	E	N	N	N
(famoxadone + Cymoxanil)					
Reason 500SC					
Quadris					
Quadris Opti (Quadris + Bravo)	F-G	E	N	N	N
Evito 480 SC	P-F	E	N	N	N
Phenyl Amide					
(most strains of late blight are resistant to Ridomil (metalaxyl or mefozam)- control of late blight and early blight will be from partner)					
Ridomil Gold MZ	F-G	F	G	G	N
Ridomil Gold/Bravo	F-G	F-G	G	G	N
Ridomil Gold/Bravo L	F-G	F-G	G	G	N
Metastar	P	N	G	G	N
Ultra Flourish	P	N	G	G	N
Other					
Acrobat	E	N	N	N	N
Curzate DF(Cymoxanil)	E	N	N	N	N
(Mix with protective contact for early blight)					
Forum	E	P	N	N	N
Omega 500F	E	P	N	N	G-E

Previcur Flex	E	P	N	N	N
Ranman	E	N	N	E	N
Revus Top	E	E	N	N	N
Phosphorous acid compounds					
	P	N	G	G	N

Crop-Phite, Fosphite

Phostrol, Resist 57, Topaz

These phosphorus acid compounds are most effective against pink rot and late blight tuber decay. Recent data from North Dakota indicates that these products may be useful for control of both silver scurf and Fusarium dry rot

Pythium Leak

Pythium leak is caused by the common soil inhabiting oomycete, *Pythium ultimum* var. *ultimum*. This pathogen is found in all soils and enters potatoes only through wounds and is active only at temperatures greater than 50⁰F and temperatures of 69-86⁰F. Typically this is a problem in MT when we have a warm wet harvest period. For optimal control growers can use an infurrow spray at planting and an application at flowering plus 14 days and 28 days. A maximum of three applications are allowed per season. These same timings will work for Phytophthora pink rot although this disease is not common in MT. Ridomil Gold MZ, Ridomil Gold /Bravo, or Ridomil Gold/Bravo L, Metastar and Ultra Florish will give control. Growers should avoid where possible harvesting when soil temperatures are above 69⁰F. Be sure skins are well set and avoid harvest injury. Allow tuber injuries to suberize in storage at temperatures less than 60⁰F at high humidity. Avoid free water! If leak occurs in storage increase air movement, cool to less than 50⁰F and turn off humidification as quickly as possible.

Sclerotinia White Mold

Sclerotinia white mold is caused by *Sclerotinia sclerotiorum* on potato and infection typically takes place at first flowering. The Sclerotinia fungus survives between crops as sclerotia (black irregular structure about the size of rodent feces) and those sclerotia within 1” of the soil surface will produce apothecia (small mushroom like structures about ½” in diameter) and ascospores that infect blossoms. Sclerotia deep in the soil will not contribute to the current year disease therefore moldboard plowing may help reduce disease. Sclerotia can survive more than 3 years so fields planted back where this disease has been a problem are at high risk if wet weather or overhead irrigation occurs during bloom. Hosts for Sclerotinia include; alfalfa, soybean, sunflower, canola, potato, pumpkin and several other vegetable crops. Several weeds are good hosts including dandelion. The disease will be most severe when canopies are dense (avoid excessive nitrogen applications) and the soil surface is wet from bloom through harvest. There has been significant debate about the economics of white mold control on potato, with some researchers showing little economic benefit from fungicide application. However, in trials the last two years here in Montana, we demonstrated a 10% increase in yield and a significant increase in tubers in the 4-8 oz size range and a reduction of tubers in the 1.5-4 oz size range when we used Endura at the 7 oz/ A rate at first flower. Application

at initial bloom is critical if control is to be effective. A second application may be need under severe disease conditions. The fungicides listed below are all labeled for use, however optimal disease control will be with Endura or Omega based on recent research.

Botran 5 F- 1.2 to 3.6 qt /A. Begin at first flower drop or at time of full bloom of primary flower inflorescences. Apply by chemigation (preferred) or by ground (30gal/A if directed nozzles or 100 gal/A if full canopy spray). 12 hr. reentry period. A second application can be applied 7-10 days later.

Iprodione active ingredient fungicides- Nevado 4F 1-2 pts/A applied at first bloom by chemigation- 24 hr. reentry period. Rovral 4F 2 pts / A. applied at first bloom by chemigation-24 hr. reentry period. Iprodione will also control early blight and Botrytis stem rot. A second application can be made 14-21 days later.

Endura- 5.5-10 oz/A apply at full bloom of primary flower inflorescences. Application can be by ground, air or chemigation-12 hr. reentry. This product will also control Early Blight and will suppress Botrytis stem rot.

Omega 500F- 5.5-8.0oz /A at row closure or when first blossoms begin to fall by air or chemigation- 96 hr. reentry. This product will also control late blight but **will not** control early blight but **will** control late blight.

Thiophanate- methyl active ingredient fungicides-T-Methyl 4.5F AG- 20-30 fl. Oz/A applied by ground at full bloom of primary flower inflorescences - 12 hr. reentry. Topsin M WSB 1.0-1.5 lb/A applied by ground at full bloom of primary flower inflorescences. 12 hr reentry. This fungicide must be mixed with other fungicides if early blight or late blight are to be controlled.