

## Management of Potato Diseases in Montana-June-2011

Barry J. Jacobsen and Nina Zidack

Disease	Active Ingredient (FRAC Group)	Rate Product/A	PHI days	Comments
<b>Bacterial Ring Rot</b> <b>Bacterial Black leg</b>	Sodium hypochlorite Quaternary ammonium compounds Formaldehyde  phenol	4 cups of 40% solution per 10 gallons of water 1-3% solution		Use only approved tissue culture derived nuclear stocks Wash and disinfect cellars, all handling and cutting equipment. Wet with disinfectant for 10-15 min. <b>Disinfect cutter between each lot</b> Do not allow any trucks from off the farm to be cleaned out on premises Be sure to use quaternary ammonia disinfectant foot baths Work with Potato lab on any suspected infections
<b>Bacterial Soft Rot</b>	Sodium hypochlorite Quaternary ammonium compounds			Avoid harvest at > 65-75F-especially when wet Have good skin set before harvest-10-14 days post vine kill Provide protection from sunscald of harvested tubers-tarp loads if long exposure Remove symptomatic or damaged tubers before binning No drops >6-8" during harvest, handling, binning Place in disinfected storage with "clean" equipment Allow for suberization for 10-14 days @50-55F , aeration with no moisture condensation <i>If frost damage or significant damage from dry soil-separate if possible-consider use of BioSave, Oxidate, Purogene</i> - <i>If possible wait to harvest so symptomatic tubers are obvious</i> - <i>Pile separately- use as shallow a pile as possible</i> - <i>Use dry air to dry out as fast as possible</i> - <i>Use lower temperatures – get to 38-40F as fast as possible</i>

<b>Black dot</b>	Azoxystrobin 11 <sup>1</sup>	Quadris	14	Apply infurrow 0.4-0.8 fl oz /1000 row ft Apply Quadris Opti, Headline mancozeb or chlorothalonil when plants are 6-12” Other products have labels but this has provided the best control in our trials. Plant disease-free seed
	Azoxystrobin + Chlorothalonil	Quadris Opti	14	
	pyraclostrobin	Headline	3	
	Mancozeb M3 Chlorothalonil M5	Many product names	3 7	
<b>Early Blight</b>	Use adequate Nitrogen for yield objectives, Use P day forecasting system to initiate fungicide applications- <a href="http://uspest.org">uspest.org</a>			
<b>Late Blight</b>	Eliminate cull piles before crop emergence, plant disease-free seed, control volunteers, Scout fields for symptoms, use weather based late blight prediction system- <a href="http://uspest.org">uspest.org</a>			
<b>Early Blight</b> <b>Late Blight</b>	Azoxystrobin- 11 <sup>1</sup>	Quadris 6.2- 14 fl oz	14	Use no more than 2.88qt/a per season
	Azoxystrobin+ chlorothalonil	Quadris Opti 1.6 pt	14	Use no more than 3 gal/a per season
	Chlorothalonil M5	Bravo, Equus, Echo, Initiate, Applause, etc	7	Many formulations follow label
	Cymoxanil+ famoxadone 11	Tanos-6 oz for early blight, 8 Oz for late blight	14	Mix with M5 group fungicide
	Fenamidone 11	Reason 5.5-8.2 fl oz	14	30 day PHI for wheat, 1 year all other crops. Do not exceed 24.6 oz/season
	Fluoxastrobin 11	Evito 3.8 fl oz	7	Do not exceed 22.8 oz/season
	Pyraclostrobin 11	Headline 6-9 fl oz for early blight 6-12 oz for late blight	3	Do not exceed 2.25 qt/a per season
	Trifloxystrobin 11	Gem 6-8 oz , Gem 500SC 2.9-3.8 fl oz use highest rate for late	7	Do not exceed 48 oz (23 fl oz-Gem 500SC)/ season

		blight		
	Boscalid 7	Endura 2.5-4.5 oz	30	<b>Early Blight only</b> No more than 2 sequential applications, no more than 4 applications/season
	Maneb M3	Maneb 80 WP-1.5 -2.0 lb Manex 4F 1.2-1.5qt	3	Do not exceed more than 11.2 lb ai/season
	Mancozeb-M3	Dithane F45- 1-2 lb Manzate 200, Penncozeb-1- 2lb	3	Do not exceed more than 11.2 lb ai/season
	Mandiproamide 40+ Difenoconazole 3	Revus Top 5.5-7.0 fl oz	14	Use primarily for Late blight. No more than 2 consecutive applications. No more than 28 fl oz/season
	Pyrimethanil-9	Scala 7 fl oz	7	<b>Early Blight only</b> Does not control late blight –use in combination with a class M , 7 or 30 material
	TPTH- triphenyltin hydroxide 30	SuperTin 4L 4-6 fl oz, SuperTin 80 WP, Agri Tin 80WP 2.5- 3.75 oz	7 21	Do not use more than 18 oz/season SuperTin4L or 11.25 oz/ season of 80WP formulations. Do not use with emulsifiable pesticides or MH30. Some phytotoxicity to Superior and Norland varieties. Note 24 hr reentry period. May be mixed with maneb or mancozeb products for improved early blight control
	Zoximid-22 + Mancozeb M3	Gavel 1.5-2.0 lb	3	Do not exceed 12lb/season Primarily for late blight. Note field workers should be advised that this fungicide is dermal and oral sensitizer
	Metiram M3	Polyram 1.5-2.0 lb	14	No more than 14 lb/ season-do not feed to livestock
<b>Late Blight-only</b>	Cyazofamid-21	Ranman 1.4-2.75 fl oz	7	No more than 27.5 fl oz/season. Note for crops not on label 30 day limit before planting

	Dimethomorph 15	Forum 4-6 oz	4	Tank mix with M class fungicide. Do not mix with mefenoxam or metalaxyl. Do not exceed 30 oz/season. May be used after vine kill to prevent tuber infection
	Propamocarb hydrochloride 28	Previcur Flex 0.7-1.2 pt	14	Tank mix with M class fungicide. No more than 6 oz/season
	Fluazinam 29	Omega 5.5 fl oz	14	Tank mix with M class fungicide. No more than 3.5 pt/season
	Mandipropamid 40	Revus 5.5-8.0 fl oz	14	Do not apply more than 32 fl oz/A/season
	Fluopicolide 43	Presidio 4.0 fl oz	7	Tank mix with other than group 43 fungicide that is effective against late blight. Use a 7-10 day schedule
<b>Rhizoctonia stem canker and black scurf</b>	Azoxystrobin	Quadris 0.4-0.8 fl oz/1000 row ft	na	Apply in-furrow at planting. Will also control Silver Scurf and Black dot. See seed treatment label for Dynasty
	PCNB	Blocker 10G 1.65 lb/1000 row ft	na	Apply in-furrow over the seed piece at planting in 8.5 inch band
	pyraclostrobin	Headline 4-8 fl oz/1000 row ft	na	Apply in-furrow at planting
	Flutolanil-7	Moncut 70-F 0.71-1.1lb	na	Apply in-furrow over the seed piece at planting in 4-8 inch band- Use a minimum of 3 gal/a water
<b>Pythium leak and Pink Rot</b>	Mefenoxam 4	Ridomil Gold EC 0.42 oz/1000 row ft Ultra Flourish 0.84 fl oz/1000 row ft	na	Use a minimum of 3 gal/a water in 6-8 inch band over seed piece. Apply at planting with Quadris=Quadris Ridomil Gold
	Mefenoxam +Clorothalonil	Ridomil Gold Bravo Flouronil 2 lb	14	At total of 3 applications at 14 day intervals starting at flowering
	Mefenoxam + mancozeb	Ridomil Gold MZ 2.5 lb	3	At total of 3 applications at 14 day intervals starting at flowering

	cyazofamid	Ranman 0.42fl oz/1000 row ft 2.75 fl oz at layby		Use full label rate
	fluopicolide	Presidio 4 fl oz	7	Apply in 6-8 inch band directly over the seed piece or as side dress at hilling
	Phosphoric acid	Phostrol See label	0	Apply in-furrow with Ultra Flourish and with foliar sprays. Start at tuber initiation use 3 applications at 14 day interval. May be used postharvest 12.8 fl oz/ton in 0.5 gal/ton
<b>White Mold</b>	Boscalid	Endura 5.5-10 oz	30	1-2 applications starting at 1 <sup>st</sup> flower. Can be used to replace early blight spray
	Fluazinam	Omega 5.5-8.0 fl oz	14	1-2 applications starting at 1 <sup>st</sup> flower. Must combine with M class fungicide to control early blight. This is a very good late blight fungicide
	Coniothyrium minitans	Contans	0	Apply 1-4 lbs/a in fall (preferred) or spring- incorporate lightly
<b>Fusarium Dry rot-storage</b>	Pseudomonas	BioSave	0	Apply with 1-2 qt/ton of water. <b>Avoid bruising</b> Note ~ 50% of isolates in MT are resistant to thiabendazole (Mertect)
<b>Scab</b>	Our trials have shown the Blocker as applied for Rhizoctonia or Maxim MZ seed treatment plus Quadris applied in-furrow will give partial control. Be sure that soil moisture is >80% field holding capacity from tuber set through bulking. Use resistant varieties where possible. Integrated management is critical.			

**FRAC Group # refer to fungicides with similar modes of action with the exception of group M or 30 never use the same fungicide FRAC group in consecutive sprays. For example Quadris, Headline, and Gem are all group 11, therefore another fungicide group should be alternated before a group 11 fungicide is sprayed again. Group 11 fungicides must be used at high label rates for good late blight control**

**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

<b>Fungicide</b>	<b>Late Blight</b>	<b>Early Blight</b>	<b>Leak</b>	<b>Pink Rot</b>	<b>White Mold</b>
<i>Type</i>					
<b><i>Protective Contact</i></b>					
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)					

<b>Fungicide</b>	<b>Late Blight</b>	<b>Early Blight</b>	<b>Leak</b>	<b>Pink Rot</b>	<b>White Mold</b>
<b>Benzamide</b>					
Gavel 75 DF (zoxamide + mancozeb)	E	G	N	N	N
<i>Systemic/translaminar</i>					
<b>QoI, Strobilurin, Group 11</b>	F-E	E	N	N	N
<i>To get best control of late blight higher label rates should be used</i>					
<b>Gem</b>					
Headline					
Tanos (famoxadone + Cymoxanil)	E	E	N	N	N
Reason 500SC					
Quadris					
Quadris Opti (Quadris + Bravo)	F-G	E	N	N	N
Evito 480 SC	P-F	E	N	N	N
<b>Phenyl Amide</b>					
(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
<b>Other</b>					
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

<b>Fungicide</b>	<b>Late Blight</b>	<b>Early Blight</b>	<b>Leak</b>	<b>Pink Rot</b>	<b>White Mold</b>
Previcur Flex	E	P	N	N	N
Ranman	E	N	N	E	N
Revus Top	E	E	N	N	N
Revus	E	N	N	N	N

Phosphorous acid Compounds Crop-Phite, Fosphite Phostrol, Resist 57, Topaz	P	N	G	G	N
---	---	---	---	---	---

*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*

#### **Additional Comments for late blight**

<b>Disease level</b>	<b>Fungicides</b>
<b>none</b>	<b>Chlorothalonil, maneb, mancozeb, metiram, Omega, Curzate, Tanos, Forum, Gavel, Previcur-Flex, Revus Top, Revus, Ranman, Headline, Gem, Quadris, Reason- apply on 7 to 10 day interval</b>
<b>Trace to 1% foliar infection</b>	<b>Curzate, Tanos, Previcur-Flex, Revus Top, these fungicides +SuperTin or AgriTin-apply on 5-7 day interval</b>
<b>Overall field &lt;1% but with heavily infected loci</b>	<b>Kill heavily infected area with Regalone, spray with Curzate, Tanos, Previcur-Flex, Revus Top, Ranman these fungicides +SuperTin or AgriTin-apply on 5-7 day interval</b>
<b>20-100% crop infected</b>	<b>Kill with Regalone, apply SuperTin or AgriTin, Ranman</b>

**Comparison of late blight control fungicides based on the highest labeled rate**

Fungicide	Effectiveness				Mode of action			Rain fastness	Type of fungicide
	Leaf Blight	New growth	Stem blight	Tuber Blight	Protectant	Curative	Anti-sporulant		
<b>Chlorothalonil Many products</b>	G	NO	P	NO	G	NO	NO	G	<b>PROTECTIVE CONTACT</b>
<b>Mancozeb, Maneb metiram Many products</b>	G	NO	P	NO	G	NO	NO	F	<b>PROTECTIVE CONTACT</b>
<b>Curzate</b>	G	?	F	NO	G	E	P	G	<b>TRANSLAMINAR</b>
<b>Forum</b>	G	?	F	F	G	P	G	G	<b>TRANSLAMINAR</b>
<b>Gavel</b>	E	NO	P	F	E	NO	NO	G	<b>PROTECTIVE CONTACT</b>
<b>Omega</b>	E	NO	P	G	E	NO	NO	G	<b>PROTECTIVE CONTACT</b>
<b>Previcur-Flex</b>	G	G	G	NO	G	G	G	E	<b>SYSTEMIC</b>
<b>Phosporus acid Several products</b>	P	P	P	G	P	NO	?	G	
<b>Ranman</b>	E	NO	P	E	E	NO	NO	E	<b>PROTECTIVE CONTACT</b>
<b>Tanos</b>	G	?	F	NO	G	E	P	G	<b>TRANSLAMINAR</b>
<b>Revus Top</b>	E	?	F	G	E	P	F	E	<b>TRANSLAMINAR PROTECTIVE CONTACT</b>
<b>TPTH SuperTin, AgriTin</b>	E	NO	E	E	G	NO	E	F	<b>PROTECTIVE CONTACT</b>
<b>Headline, Gem, Quadris, Reason</b>	G-E	P-F	F	NO	G	G	P	G-E	<b>TRANSLAMINAR</b>

NO= no effect; P=poor; G=good; E=excellent; ? = unknown

### Potato Fungicide Seed Treatments

Fungicide/ FRAC Group #	Trade name	Rate /CWT	comments
Fludioxonil -12+ Mancozeb-M3	Maxim MZ	0.5 lb	Excellent seed piece treatment will provide control of Fusarium seed piece decay, scab, silver scurf, seed born late blight
Fludioxonil-7	Maxim FS	0.08 fl oz	<b>DO NOT USE UNLESS MANCOZEB OR MANEB IS ADDED***</b> Resistance has been reported and as seed producing state we do not want to ship Fusarium resistant to this important fungicide.
Flutolanil-7 + Mancozeb-M3	MonCoat MZ	0.75 lb	Excellent seed piece treatment will provide control of Fusarium seed piece decay, scab, silver scurf.
Thiophanate-Methyl-B1 + Mancozeb-M3	Tops MZ	0.75	Good seed treatment for seed borne Rhizoctonia and scab. Because of resistance it may not be effective for Fusarium or Silver Scurf
Maneb/ mancozeb-M3	Many products	Rate varies with formulation	Good for seed borne scab- good fungicide resistance management partner for fludioxonil and cymoxanil
Cymoxanil-27	Curzate 60 DF	0.25-1 oz	Excellent where seed borne late blight is suspected-use with maneb or mancozeb
Thiophanate methyl B1+ Mancozeb M3+Cymoxanil 27	Evolve		Dust treatment where seed borne late blight is suspected
Mandipropamid F5	Revus	0.3-0.4 fl oz/cwt	Montana use only-Seed borne late blight. <b>If used as a seed treatment, foliar use is limited to two applications</b>
azoxystrobin	Dynasty	0.1-3.75 fl oz/cwt	Excellent for seedborne Rhizoctonia, Silver Scurf, And Black dot- also some soil activity but perhaps not as good as infurrow application of Quadris