



2018 Montana Seed Potato Disease Management Guide

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EXTENSION

The state of Montana dedicates approximately 11,000 acres to the production of the nation’s finest seed potatoes. Many products are available to help manage diseases affecting seed potato. The following tables represent a quick reference guide concerning many products for seed treatments, disease management, comparisons among products, and disinfectants used for potato handling and storage for your convenience. For guidelines concerning viral diseases, please see the [Montana Seed Potato Viral Disease Management Guide](#). Additional publications available: [Bacterial and Fungal Diseases of Potato and their Management](#), [Montana Seed Potato Late Blight Quick Reference Guide](#), and [Late Blight for Gardeners](#). Publications coming soon: Biopesticides for Potato Production. For more information, please visit msuextension.org/pspp or montanaspud.org. Please check these websites periodically for weather station updates, new information, alerts, and new factsheets. Follow [MtExtPSPP](#) on Twitter for updates. Products listed here are for educational purposes only and do not constitute an exhaustive list. Please consult product labels and cdms.net. Information about FRAC group can be found at frac.info. If you have any additional questions or concerns please call Jessica at 406-404-0789 or Nina at 406-994-3150.

2018 Montana Seed Potato Disease Management Guide

Disease	Active Ingredient (FRAC Group)	Product/Rate	PHI days	Comments
Aerial Stem Rot	Copper hydroxide	See product labels. Use at highest label rate. See table on disinfectants.		Use with/without Mancozeb following hail event.
	Cymoxanil 27+ famoxadone 11	Tanos , 8 oz/acre /application. See product label.	14	48 oz/acre maximum per cropping cycle. 72 oz/acre maximum per 12 month period. Tank mix or alternate with copper and/or Mancozeb.
Bacterial Ring Rot or Black Leg	Sodium/ calcium hypochlorite	See product labels. Use at highest label rate. See table on disinfectants.		Use only approved tissue culture derived nuclear stocks. Wash and disinfect cellars, air duct pipes, & all handling/cutting equipment with soapy water, then with disinfectant, keeping wet for 10-15 minutes. Disinfect cutter between each lot. Do not use old sacks. Do not allow any off-farm trucks to be cleaned out on premises. When possible, have truck prewashed with soapy water followed by Quaternary ammonium compound. Use quaternary ammonia disinfectant foot baths. Work with potato lab on any suspected infections.
	quaternary ammonium compounds			
	peroxyacetic acid			
	hydrogen peroxide			
	formaldehyde			
	phenol			
	copper quinolate			
iodine compounds				

Disease	Ingredient FRAC Group	Product/Rate	PHI day	Comments
Bacterial Soft Rot	Same as above.	See product labels. Use at highest label rate. See table on disinfectants.		Avoid harvest at greater than 65-75F, especially when wet. Have good skin set before harvest (10-14 days post vine kill). Provide protection from sun scald of harvested tubers. Tarp loads if long exposure. Remove symptomatic or damaged tubers before binning . Do not drop potatoes farther than 6-8" during harvest, handling, and binning. Place in disinfected storage with "clean" equipment. Allow for suberization for 10-14 days @50-55F, aerations with no moisture condensation. If frost damage or significant damage from dry soil-seperate if possible-consider use of Biosave, Oxidate, SaniDate, StorOx, JetOxide, Jet-ASg. Do not use BioSave with other products. If possible, wait to harvest so symptomatic tubers are obvious. Pile seperately-use as shallow a pile as possible, Use dry air to dry out as fast as possible. Use lower temperatures get to 38-40F as fast as possible
	Chlorine dioxide			
	sodium/ calcium hydrochlorite			
	mixtures of peroxyacetic acid and hydrogen peroxide			
Black Dot	Pre-emergence			
	Azoxystrobin 11	Quadris , Apply infurrow 0.4-0.82 fl oz /1000 row ft	n/a	Plant disease-free seed, several products: Quadris Ridomil Gold SL,
	Penthiopyrad 7	Vertisan , Apply infurrow 0.7-1.6 fl oz/1000 row ft	n/a	max rate/A=24 oz
	Fluapyroxad 7+ pyraclostrobin 11	Priaxor , Apply infurrow at 0.48-0.6 fl oz/1000 row ft	n/a	Apply again foliar (4-8 Oz/A) when plants are 6-12 inches and again before row closure
	Post-emergence			
	Azoxystrobin 11	Quadris Flowable , 6.0-15.5 fl oz/acre	14	Apply Quadris prior to disease and continue disease control 7-14 day interval. Rotate with other MOA.
	Azoxystrobin 11+ Chlorothalonil M5	Quadris Opti , 1.6 pts/acre	14	Apply Quadris Opti when plants are 6-12", Do not apply more than 1.5 lb ai of azoxystrobin per acre per year.
	Azoxystrobin 11+ Difenconazole 3	Quadris Top, 8-14 fl oz/ acre	14	Apply Quadris Top prior to disease and continue disease control 7-14 day interval. Rotate with other MOA.
	Pyraclostrobin 11	Headline/Headline SC , 6-9 fl oz/acre	3	Apply Headline when plant are 6-12', Max product rate per season 72 fl/oz/acre
	Mancozeb M3	Dithane F-45 : 1-2 lb/acre, Manzate Prostick : 1-2 lbs/acre, Penncozeb : 0.5-2lb/acre	3	Do not exceed more than 11.2 lb ai/season
Chlorothalonil M5	Bravo : 2-1/2 to 4-1/4 pints/acre, Bravo Weatherstik : ¾ pt/acre, Bravo ZN 1 1/8 pt/acre, Equus DF : 0.7 lb/acre then 0.9-1.36 lb/acre, Equus 720 SST : 0.75, then 1-1.5 pt/acre, Echo 720 : 0.75, then 1-1.5 pts/acre, Initiate ZN : 1.125, then 1.5-2.25 pt/acre, Orondis Opti B , 0.75, then 1.5 pt/acre	7	Many formulations. Follow labels for specific rates and spray intervals. Do not apply more than 15 pints of Orondis Opti B (11.25 lb ai) per acre during each growing season.	

Disease	Active Ingredient (FRAC Group)	Product/Rate	PHI days	Comments
Black dot	Difenoconazole 3	Top MP , 5.5-7 fl oz/acre	14	Use no more than 2 consecutive sprays, rotate to another mode of action. Do not apply more than 28 fl. oz./A
	Penthiopyrad 7	Vertisan , see label, 14- 24 fl oz/acre	7	No more than 2 consecutive applications no more than 28 oz/A /season No more than two consecutive applications and no more than 72 fl oz/season/A
	Fluapyroxad 7+ Pyraclostrobin 11	Priaxor Xemium , see label, 4-8 fl. oz/acre	7	No more than two consecutive applications and no more than 3 applications (4-8 oz/A) or 24 oz/season
	Azoxystrobin 11+ Benzovindiflupyr 7	Elatus , 0.34-0.5 oz/1,000 ft	n/a	Apply in-furrow at planting. No more than 9.5 oz/acre banded. See label.
	Pyraclostrobin 11+ Metiram M3	Cabrio Plus , 2-2.9 lb/acre	14	No more than two consecutive applications of group 11 fungicide , No more than 17.4 lbs/acre/season
	Zoxamide 22+ Chlorothalonil M5	Zing! , 24-34 fl oz/acre	7	Apply on a preventative schedule. Use the maximum labeled rate at row fill. Do not make more than 2 sequential applications before alternating with a fungicide that has a different mode of action. Do not make more than 8 applications or apply more than 1.52 lb zoxamide and 8.88 lb chlorothalonil per acre per season.
	Metconazole 3	Quash , 2.5-4 oz/acre	1	No more than 4 applications per season, no more than 16 oz, no more than 2 sequential applications
Early Blight	Use adequate Nitrogen for yield objectives. Use P day forecasting system to initiate fungicide applications: uspest.org			
Late Blight	Eliminate cull piles before crop emergence, plant disease-free seed, control volunteers, scout fields for symptoms, use weather based late blight forecasting models uspest.org and montanaspud.org			
Early Blight and Late Blight	Azoxystrobin 11	Quadris Flowable , 6-15.5 fl oz/acre	14	Early Blight: For a 7 day application schedule, use 6.2 fl oz/acre. For a 14 day application use 12 oz/acre. Late Blight: For a 7-day schedule apply Quadris at 12.0 fl oz/acre. Use no more than 2.88qt/a per season. Alternate away from Group 11 fungicides to manage resistance.
	Azoxystrobin 11+ chlorothalonil M5	Quadris Opti , 1.6 pt/acre	14	Alternate away from Group 11 fungicides to manage resistance. Use no more than 3 gal/a per season
	Azoxystrobin+ difenoconazole 3	Quadris Top , 8-14 fl oz./acre	14	Begin applications prior to disease development, continue on a 7-14 day interval. No more than 2 consecutive applications. The addition of a spreading/penetrating type adjuvant such as a non-ionic based surfactant or crop oil concentrate or blend is recommended.
	<i>Bacillus mycooides</i> isolate J	Life Gard WG , 1-4.5 fl oz /acre.	0	NOP and OMRI Certified, may be applied up to 5 times per crop cycle. Apply in an alternating or tank mix program with labeled fungicides as part of a disease management program. Mix only with fungicides having label instructions that do not prohibit such mixtures. See label for specific rates.
	Chlorothalonil M5	Bravo ZN : 1 1/8, then 1 1/2 to 2 1/4 pts/acre, Bravo Weather Stik 0.75, then 1-1.5 pts/acre, Equus 720 SST : 0.75, then 1.0-1.5 pt/acre Equus DF : 0.7, then 0.9-1.36 lbs/acre, Echo 720 : 0.75, then 1-1.5 pts/acre Initiate 720 : 0.75, then 1-1.5 pts/acre, Initiate ZN : 1 1/8, then 1 1/2 to 2 1/4 pts/acre	7	Many formulations, follow labels for specific rates and spray intervals

Disease	Active Ingredient (FRAC Group)	Product/Rate	PHI days	Comments
Early Blight and Late Blight	Cymoxanil 27 + famoxadone 11	Early blight: Tanos , 6 fl oz./acre, Late blight: 6-8 fl oz/acre	14	Mix with M5 group fungicide, consult label
	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 : Early blight: 2-3.8 fl oz, Late blight: 3.8 fl oz, Aftershock : Early blight: 2.0- 3.8 fl oz, Late blight 3.8 fl oz	7	Do not exceed 22.8 oz/season
	Pyraclostrobin 11	Headline Early blight: 6-9 fl oz, Late blight: 6-12 oz	3	Do not exceed 2.25 qt/a per season
	Pyraclostrobin 11+metiram M3	Cabrio Plus Early Blight 2-2.9 lb/acre, Late Blight 2.9 lbs/acre	14	No more than 2 consecutive applications. No more than 17.4 lbs/season
	Metaconazole 3	Quash Early Blight only: 2-4 oz	1	No more than 2 consecutive applications. No more than 16 oz/A/season
	Fluapyroxad 7+ Pyraclostrobin 11	Priaxor Early Blight and Late Blight 4-8 oz/A	1	No more than two consecutive applications and no more than 3 applications (4-8 oz/A) or 24 oz/season
	Trifloxystrobin 11	Gem 6-8 oz , Gem 500SC 2.9-3.8 fl oz use highest rate for late blight	7	Do not exceed 48 oz (23 fl oz-Gem 500SC)/ season
	Boscalid 7	Endura 2.5-4.5 oz	30	Early Blight only: 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/acre, Manzate : 0.4-1.6 fl oz/acre, Penncozeb : 0.5-2lb/acre	3	Do not exceed more than 11.2 lb ai/season
	Mandiproamide 40+ Difenoconazole 3	Revus Top , 5.5-7.0 fl oz/acre	14	Use primarily for Late blight. No more than 2 consecutive applications. No more than 28 fl oz/season
	Difenoconazole 3	Top MP , 5.5-7 fl oz/acre	14	No more than 2 consecutive applications. No more than 28 fl oz/season Maybe tank mixed with Omega for late blight
	Pyrimethanil 9	Scala , 7 fl oz	7	Early Blight only: Does not control late blight –use in combination with a class M, 7 or 30 material
	Fluopyram 7+pyrimethanil 9	Luna Tranquility , 8-11.2 fl oz/acre	7	Early Blight only: No more than consecutive applications, no more than 43.6 fl oz/A (ground application) or 33.6 fl oz/A (aerial application)

Disease	Active Ingredient (FRAC Group)	Product/Rate	PHI days	Comments
Early Blight and Late Blight	TPTH-triphenyltin hydroxide 30	SuperTin 4L: 4- 6 floz, SuperTin 80 WP: rate dependent on method of application, see label, Agri Tin 80WP: 2.5-3.75 oz dry oz/acre, rate dependent on method of application	7 and 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
	Zoxamide 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
	Chlorothalonil M5	Orondis Opti , 0.6 pts/acre then 1.125 pts/acre	7	Do not apply more than 15 pints of Orondis Opti B (11.25 lb ai) per acre during each growing season.
	Metiram M3	Polyram , 1.5-2.0 lb	14	No more than 14 lb/ season-do not feed to livestock
	Zoxamide 22 + Chlorothalonil M5	Zing! , 32-34 fl oz/acre	7	Apply on a preventative schedule. Use the maximum labeled rate at row fill. Do not make more than 2 sequential applications before alternating with a fungicide that has a different mode of action. Do not make more than 8 applications or apply more than 1.52 lb zoxamide and 8.88 lb chlorothalonil per acre per season. Excellent for late blight, can be used in place of standard protectants when disease pressure is high. Foliar applications of these products can be more effective in reducing the tuber blight phase of late blight than standard protectants.
	Penthiopyrad 7	Vertisan , 10-24 oz	7	Early blight only: No more than two consecutive applications and no more than 72 fl oz/season/A
Late Blight only	Cymoxanil 27	Curzate , 3.2 fl oz/acre	14	Do not use alone, mix with FRAC M3, M5, 30 protective fungicide
	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
	Ametoctradin 45 + Dimethomorph 15	Zampro , 11-14 oz	4	Maximum 42 oz per season
	Propamocarb hydroxide 28	Previcur Flex , 0.7-1.2 pt	14	Tank mix with M class fungicide. No more than 6 oz/season
	Zoxamide 22 + Chlorothalonil M5	Zing! , 32-34 fl oz/acre	7	Apply on a preventative schedule. Use the maximum labeled rate at row fill. Do not make more than 2 sequential applications before alternating with a fungicide that has a different mode of action. Do not make more than 8 applications or apply more than 1.52 lb zoxamide and 8.88 lb chlorothalonil per acre per season. Excellent for late blight, can be used in place of standard protectants when disease pressure is high. Foliar applications of these products can be more effective in reducing the tuber blight phase of late blight than standard protectants.
	Fluazinam 29	Omega , 5.5 fl oz	14	Tank mix with M class fungicide. No more than 3.5 pt/season
	Mandipropanid 40	Revus , 5.5-7.0 fl oz	14	Do not apply more than 28 fl oz/A/season

Disease	Active Ingredient FRAC Group	Product/ Rate	PHI days	Comments
Rhizoctonia stem canker and black scurf - infurrow	Azoxystrobin 11	Quadris , 0.4-0.8 fl oz/1000 row ft		Apply in-furrow at planting. Will also control Silver Scurf and Black dot. See seed treatment label for Dynasty
	Azoxystrobin 11+ Benzovindiflupyr 7	Elatus , 0.34-0.5 oz/1,000 ft		Apply in-furrow at planting. Nore more than 9.5 oz/acre banded. See label. Also effective against Black Dot
Seed Treatments Please See the 2016 Seed Treatment Quick Reference Guide	PCNB 14	Blocker 10G , 1.65 lb/1000 row ft		Apply in-furrow over the seed piece at planting in 8.5 inch band
	PCNB 14	Blocker 4F , 5.2 to 10.4 fl oz/1,000 ft row		Apply in-furrow for control of common scab. Do not spray a PCNB within 12 months of previous application. See label.
	Pyraclostrobin 11	Headline 4-8 fl oz/1000 row ft		Apply in-furrow at planting
	Flutolanil 7	Moncut 70-F , 0.71-1.1lb		Apply in-furrow over the seed piece at planting in 4-8 inch band- Use a minimum of 3 gal/a water
	Penthiopyrad 7	Vertisan , 0.7- 1.6 fl oz/1000 row ft		max rate/A=24 oz
	Fluapyroxad 7+ Pyraclostrobin 11	Priaxor , 0.48-0.6 fl oz/1000 row ft		No more than 24 fl oz or Priaxor may be applied per season
Pythium leak and Pink Rot	Mefanoxam 4	Ridomil Gold EC , 0.42 oz/1000 row ft, Ultra Flourish 0.84 fl oz/1000 row ft		Use a minimum of 3 gal/a water in 6-8 inch band over seed piece. Apply at planting with Quadris=Quadris Ridomil Gold (0.82 fl oz/1000 ft row)
	Mefenaxam 4 + Chlorothalonil M5	Ridomil Gold Bravo , 2.5 pts/acre	14	At total of 3 applications at 14 day intervals starting at flowering
	Mefanoxam 4 + mancozeb M3	Ridomil Gold MZ , 2.5 lbs/acre	3	At total of 3 applications at 14 day intervals starting at flowering
	Cyazofamid 21	Ranman , 0.42 fl oz/1000 row ft (in-furrow), 2.75 fl oz at layby	0	Use full label rate
	Phosphorous acid P7	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
White Mold	Boscalid 7	Endura , 5.5-10 oz	30	1-2 applications staring at 1st flower. Can be used to replace early blight spray
	Fluazinam 29	Omega , 5.5-8.0 fl oz	14	1-2 applications staring at 1st flower. Must combine with M class fungicide to control early blight. This is a very good late blight fungicide. Tank mix with Top MP, chlorothalonil, mancozeb to control early blight
	<i>Bacillus mycooides</i> strain J	Life Gard WG , 1-4.5 fl oz /acre.	0	NOP and OMRI Certified, may be applied up to 5 times per crop cycle. Apply in an alternating or tank mix program with labeled fungicides as part of a disease management program. Mix only with fungicides having label instructions that do not prohibit such mixtures. See label for specific rates.
	Fluopyram 7+ pyrimethanil 9	Luna Tranquility , 11.2 fl oz	7	1-2 applications staring at 1st flower. Can be used to replace early blight spray
	Iprodione 2	Rovral 50 WP 4F : 2 pts/acre, Nevado : 2 pts/acre	14	2 applications staring at 1st flower.

Disease	Active Ingredient (FRAC Group)	Product/Rate	PHI days	Comments
White Mold	Thiophanate-methyl 1	Topsin M 75 WP , 1-1.5 lb/A or 20-30 oz of 4.5 FL	21	Make first application at row closure with subsequent applications 7-14 days later
	Penthiopyrad 7	Vertisan , 14-24 fl oz	7	Disease suppression only, Treat at 100% bloom, again 14 later, no more than 72 fl oz./acre/year
	<i>Coniothyrium minitans</i>	Contans , 1-4 lbs/acre	0	Apply in fall (preferred) or spring- incorporate lightly
	Metconazole M3	Quash , 4.0 oz/acre	1	No more than 4 applications per season, no more than 16 oz, no more than 2 sequential applications
Fusarium Dry rot-storage	<i>Pseudomonas syringae</i>	Biosave	0	Apply with 1-2 qt/ton of water. Avoid bruising Note ~ 50% of isolates in MT are resistant to thiabendazole (Mertect). However combinations of BioSave with 0.42 oz/ton Mertect 340F have given the best results.
Scab	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 greater than 80% field holding capacity from tuber set through bulking. Use resistant varieties where possible. Integrated management is critical			
Powdery Mildew	Difenoconazole 3	Top MP , 5.5-7 fl oz/acre		Apply 7-14 day interval, no more than two consecutive applications
Silver Scurf	Azoxystrobin 11+ Benzovindiflupyr 7	Elatus , 0.34-0.5 oz/1,000 ft		Apply in-furrow at planting. Nore more than 9.5 oz/acre banded. See label. Also effective against Black Dot

PESTICIDE USE: Pesticide usage suggestions provided in MSU Extension materials are intended to serve only as a guide and are published for educational purposes. If any suggestions conflict with a product label, follow the product label instructions. Read and follow all product labels carefully.

Disclaimer: This is not an endorsement of any of the products listed here. Many other products exist. Please consult product labels for rates, proper intervals, and recommendations.

2017 Potato Seed Piece and In- Furrow Treatment Guide		
Active Ingredient IRAC/ FRAC Group	Product/Rate	Comments
Imidacloprid 4	Admire Pro , 0.17-0.35 fl oz/cwt	Apply as diluted spray for the pest suppression of aphids, Colorado potato beetle, flea beetles, leafhoppers, potato psyllids, and wireworms.
Clothianidin 4	Belay , 4.0-6.0 fl oz/acre	Apply in-furrow for the pest suppression of aphids, Colorado potato beetle, flea beetles, leafhoppers, potato psyllids, and wireworms.
Pentachloronitrobenzene (PCNB) 14	Blocker 10 G , 1.65 lbs/1,000 row ft	Apply in-furrow with 8.5" band. See label. PHI=45 days For the control of Stem Canker and Black Scurf.
Fludioxonil 12 + Thiamethoxam 4	Cruiser Maxx Potato , 0.19-0.27 fl oz/cwt	Rate dependent on seeding rate, see label.
Cymoxanil 27 + mancozeb M3	Curzate , 0.25-1 fl oz/cwt	Apply as slurry or concentrated mist for control of late blight. Excellent where seed borne late blight is suspected-use with maneb or mancozeb.
Mancozeb M3	Dithane F-45 , 1.6-2.5 oz/cwt	Apply as a slurry for control of late blight, Fusarium, Common scab, Rhizoctonia shoot blight and Silver scurf.
Azoxystrobin 11	Dynasty , 0.10-3.75 per 100 lbs of seed	Apply as slurry for the suppression: Black Scurf, Black Dot, Stem Canker, Protection: Silver Scurf. Excellent for seed-borne Rhizoctonia, Silver Scurf, and Black dot. Some soil activity, not as good as in-furrow Quadris. <i>Note- Still labeled, but no longer sold for potato.</i>
Azoxystrobin 11	Equation , 5.8-8.7 fl oz/acre	Apply in-furrow for the control of Black scurf, Silver scurf, and Black dot. See label.
Penflufen 7 + Prothioconazole 3	Ernesto Silver , 0.31 fl oz/cwt	Apply as diluted spray/slurry for the suppression of Rhizoctonia diseases and dry rot. Add mancozeb for better Fusarium control.
thiophanate-methyl 1, mancozeb M3, and cymoxanil 27	Evolve , 0.75 lbs/100 lbs	Apply as dust to cut or single drop seed for the suppression of late blight. Do not attempt to rescue seed. Also for the suppression of Dry rot, Black scurf, and Silver scurf.
Pyraclostrobin 11	Headline EC , 0.4-0.73 fl oz/1,000 ft row	Apply in-furrow for the control of Rhizoctonia diseases.
Pyraclostrobin 11	Headline SC , 0.4-0.73 fl oz/1,000 ft row	Apply in-furrow for the control of Rhizoctonia diseases.
Mancozeb M3	Koverall , 1.25 lb/50 gal water	Apply as slurry, for the suppression of Dry rot, Common scab, Silver scurf. Reduces the spread of late blight. Seed dip.

2017 Potato Seed Piece and In-Furrow Treatment Guide cont.

Active Ingredient (FRAC Group)	Product/Rate	Comments
Maneb/ mancozeb M3	Many products , rate varies	Good for seed borne scab. Good fungicide resistance management partner for fludioxonil and cymoxanil.
Mancozeb M3	Manzate Flowable , 1 qt/50 gal	Apply as slurry, for the suppression of Dry rot, Common scab, Silver scurf. Reduces the spread of late blight. Seed dip.
Mancozeb M3	Manzate Prostick , 1.25 lbs/50 gal water	Apply as dust, for the suppression of Dry rot, Common scab, Silver scurf. Reduces the spread of late blight. Seed dip.
Fludioxonil 12	Maxim , 8.0 fl oz/cwt	Apply as dust to cut or single drop seed for suppression of Fusarium, Stem canker, Black scurf, and Silver scurf.
Fludioxonil 12	Maxim MZ , 0.5 lb/cwt	Apply as dust to cut or single drop seed. Excellent control of Fusarium seed piece decay, Scab, Silver scurf, Seed-borne late blight.
Fludioxonil 12	Maxim 4S , 0.04-0.08 fl oz/cwt	Apply liquid to cut or single drop seed for suppression of Fusarium, Stem canker, Black scurf, and Silver scurf. ***DO NOT USE UNLESS MANCOZEB OR MANEB IS ADDED*** Resistance has been reported. As a seed producing state we do not want to ship Fusarium resistant to this important fungicide.
Flutolanil 7	Moncut 70 DF , 0.79-1.18 fl oz/1,000 row ft	Apply in-furrow, see label for row spacing.
Manozeb M3 +Flutolanil 7	Moncoat MZ , 0.75-1 lb/cwt	Apply as dust. Excellent seed piece treatment will provide control of Fusarium and Rhizoctonia seed piece decay, Scab and Silver scurf.
Fluazinam 29	Omega 500 F , 1.5-3.0 pints/acre	Apply in-furrow for the suppression of powdery scab. See label.
Mancozeb M3	Penncozeb 80 WP , 1.25 lbs/50 gal water	Apply as slurry, for the suppression of Dry rot, Common scab, Silver scurf. Reduces the spread of late blight. Seed dip.
Mancozeb M3	PSP , 1 lb/cwt	Apply as dust, for the suppression of Dry rot, Common scab, Silver scurf. Reduces the spread of late blight. Seed dip.
Mancozeb M3	PSP+bark , 1 lb/cwt	Apply as dust, for the suppression of Dry rot, Common scab, Silver scurf. Reduces the spread of late blight. Seed dip.
Fluxapyroxad 7 + Pyraclostrobin 11	Priaxor , 0.48-0.6 fl oz/1,000 row ft	Apply in-furrow for the suppression of Rhizoctonia diseases.

2016 Potato Seed Piece and In-Furrow Treatment Guide cont.

Active Ingredient (FRAC Group)	Product/Rate	Comments
Azoxystrobin 11	Quadris , 0.4-0.6 fl oz/1,000 row ft	Apply in-furrow for the control of black scurf and silver scurf.
Azyoxystrobin 11 + Mefenoxam M3	Quadris Ridimil Gold , 0.82 fl oz/ 1,000 row ft	Apply in-furrow for the control of Rhizoctonia diseases, pythium leak, and pink rot.
Cyazofamid 21	Ranman 400 SC , 1.42 fl oz/1,000 row ft (Lay by: 2.75 fl oz/acre in 20 gal spray solution)	Apply in-furrow of control of pink rot apply at lay-by for suppression of late blight, pink rot, and Pythium. Use rotational modes of action. See label.
Mefenoxam M3	Ridimil Gold SL , 0.82 fl oz/1000 row ft	Apply in-furrow or with dry fertilizer. For post-harvest control of pink rot and Pythium leak.
Mancozeb M3	Roper DF Rainshield , 1.25 lbs/50 gal water	Apply as slurry, for the suppression of : dry rot, common scab, silver scurf. Reduces the spread of late blight. Seed dip.
Azoxystrobin 11	Satorim , 0.4-0.6 fl oz/1,000 row ft	Apply in-furrow for the control of black scurf and silver scurf.
<i>Bacillus subtilis</i>	Serenade Soil , 2-6 qts/acre	Apply in-furrow for use against Rhizoctonia, Pythium, Fusarium, Verticillium, Phytophthora, and Erwinia spp. Be mindful of tank mix, as these are living organisms. See label.
Fludioxonil 12	Spirato 40S , 0.5 lb/cwt	Apply as slurry to cut or single drop seed for suppression of Fusarium, stem canker, black scurf, and silver scurf.
Thiophanate-methyl 1	ST-Methyl 540 FS , 0.5-0.7 fl oz/cwt	Apply as a slurry for the suppression of Black scurf, stem and stolon canker, silver scurf, and dry rot. See label.
<i>Trichoderma harzianum</i>	T-22 , 0.5-3.0 oz/cwt	Biological, Apply as a slurry or in-furrow. See label.

2017 Potato Seed Piece and In-Furrow Treatment Guide cont.

Active Ingredient (FRAC Group)	Product/ Rate	Comments
Imidacloprid 4, Thiophanate-methyl 1, and mancozeb M3	Tops MZ Gaucho , 0.75 lb/100 lb	Apply as dust to cut or single drop seed for the suppression of late blight. Do not attempt to rescue seed. Also for the suppression of Colorado potato beetle, flea beetle, potato leaf-hopper, psyllids, wireworms, dry rot, black scurf, and silver scurf. Good seed treatment for seed-borne, but not soil-borne Rhizoctonia and scab. Due to resistance, it may not be effective for Fusarium or Silver Scurf.
Azoxystrobin 11	Quadris , 0.4-0.6 fl oz/1,000 row ft	Apply in-furrow for the control of black scurf and silver scurf.
Azyoxystrobin 11 + Mefenoxam 4	Quadris Ridimil Gold , 0.82 fl lz/ 1,000 row ft	Apply in-furrow for the control of Rhizoctonia diseases, pythium leak, and pink rot.

Information on fungicide controls and their effectiveness for control of early blight, late blight, Pythium leak, Phytophthora pink rot, and white mold

E= Excellent control, G=Good control, F=Fair control, P=Poor control, N= no control

	Type	Active Ingredient	Name	Late Blight	Early Blight	Pythium Leak	Pink rot	White Mold
Fungicide	Protective	Chlorothalonil	Bravo 720	G	G	N	N	P
			Bravo Ultrex	G	G	N	N	P
			Bravo Weather Stik	G	G	N	N	P
			Bravo weather Stik Zn	G	G	N	N	P
			Bravo Zn	G	G	N	N	P
			Echo 720	G	G	N	N	P
			Echo 90 DF	G	G	N	N	P
			Echo Zn	G	G	N	N	P
		Dithiocarbamate	Dithane 75DF	G	G	N	N	N
			Dithane Rainshield NT	G	G	N	N	N
			Maneb 75 DF	G	G	N	N	N
			Maneb plus Zinc	G	G	N	N	N
			Manzate Flowable	G	G	N	N	N
			Manzate Pro-Stik	G	G	N	N	N
			Pencozeb 75DF	G	G	N	N	N
		Triphenyltin hydroxide	Polyram 80DF	G	G	N	N	N
			Super-Tin 80 WP, 4L	E	E	N	N	N
		Benzamide	Agri Tin 80WP	E	E	N	N	N
Gavel 75 DF	E		G	N	N	N		

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

E= Excellent control, G=Good control, F=Fair control, P=Poor control, N= no control

Fungicide	Type	Active Ingredient	Name	Late Blight	Early Blight	Pythium Leak	Pink rot	White Mold
		Systemic/ translaminar	QoI, Strobilurin, Group 11	Gem	F-G	E	N	N
	Headline			F-G	E	N	N	N
	Tanos			E	E	N	N	N
	Reason 500SC			E	E	N	N	N
	Quadris			E	E	N	N	N
	Quadris Opti			F-G	E	N	N	N
	Evito 480 SC			P-F	E	N	N	N
	Phenyl Amide		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
	Carboxamid-7		Endura	N	N	N	N	N
			Luna Tranquility	N	N	N	N	N
			Vertisan	N	G-E	N	N	P
			Priaxor	F-G	E	N	N	E
	Various		Curzate DF	E	N	N	N	N
			Forum	E	P	N	N	N
			Omega 500F	E	P	N	N	G-E
			ScalaSC	N	G	N	N	N
			Previcur Flex	E	P	N	N	N
			Quash	N	G	N	N	G
			Ranman	E	N	N	E	N
			RevusTop	E	E	N	N	N
			Revus	E	N	N	N	N
	Phosphorus Acid Compounds		Crop-Phite	P	N	N	N	N
			Fosphite	P	N	N	N	N
			Phostrol	P	N	N	N	N
			Resist 57	P	N	N	N	N
			Topaz	P	N	N	N	N

Disclaimer: This data was generated from previously undertaken field research. This does not constitute a recommendation of any of these products over another. These products were ranked by their performance in the field under the conditions in which plants were grown. Many other sources exist evaluating these products and many others for their efficacy in treating early blight, late blight, Pythium leak, pink rot, and white mold. Please read labels carefully for the desired disease control guidelines.

2017 Late Blight Fungicides for Control compared at highest label rate Quick Reference Guide									
<i>For more information please see the 2016 Montana Seed Potato Late Blight Quick Reference Guide</i>									
E= Excellent control, G= Good control, F= Fair control, P= Poor control, N= no control, U= unknown									
Fungicide	Effectiveness				Mode of action			Rain fastness	Type of fungicide
	<i>Leaf Blight</i>	<i>New growth</i>	<i>Stem blight</i>	<i>Tuber Blight</i>	<i>Protect^{ant}</i>	<i>Curati^{ve}</i>	<i>Anti-sporulant</i>		
Chlorothalonil, many products	G	N	P	N	G	N	N	G	Protective, Contact
Mancozeb	G	N	P	N	G	N	N	F	Protective, Contact
Maneb	G	N	P	N	G	N	N	F	Protective, Contact
metiram	G	N	P	N	G	N	N	F	Protective, Contact
Curzate	G	U	F	N	G	E	P	G	Translaminar
Forum	G	U	F	F	G	P	G	G	Translaminar
Gavel	E	N	P	F	E	N	N	G	Protective, Contact
Omega	E	N	P	G	E	N	N	G	Protective, Contact
Previcur-Flex	G	G	G	N	G	G	G	E	Systemic
Phosporus acid Several products	P	P	P	G	P	N	U	G	N/A
Ranman	E	N	P	E	E	N	N	E	Protective, Contact
Tanos	G	U	F	N	G	E	P	G	Translaminar
Revus Top	E	U	F	G	E	P	F	E	Translaminar, protective, contact
TPTH SuperTin, Agri Tin	E	N	E	E	G	N	E	F	Protective, Contact
Headline	G-E	P-F	F	N	G	G	P	G-E	Translaminar
Gem	G-E	P-F	F	N	G	G	P	G-E	Translaminar
Quadris	G-E	P-F	F	N	G	G	P	G-E	Translaminar
Reason	G-E	P-F	F	N	G	G	P	G-E	Translaminar

The 2016 Montana Seed Potato Late Blight Quick Reference Guide is available in print by request and online at both msuextension.org/pspp and montanaspud.org . For a print copy, please send an email to jessica.rupp@montana.edu and include your name, address, and the number of copies you would like to receive.

2017 Disinfectants for Potato Handling and Storage Equipment			
Type	Active ingredient	Products	Comments
Chlorine generating products			
Note: Chlorine has significant human inhalation problems-follow safety precautions!			
Bleach	Sodium hypochlorite	Many products available. Rate will depend on product. Concentrations will vary from 3.25- 12%	Strong oxidizer (corrosive), rapidly inactivated by soil or organic matter, no residual activity. Water pH must be 4-8.
Calcium hypochlorite	Calcium hypochlorite	Many products available. Rate will depend on product label.	Strong oxidizer (corrosive), rapidly inactivated by soil or organic matter, no residual activity. Water pH must be 4-8. Can be applied directly to potatoes.
Chlorine dioxide	Chlorine dioxide	Oxine Sanitizer, SNIPEr, EnviroCON, Clorodisys, CDG Solution 3000, and Purogene	Less corrosive than bleach, no residual activity, water pH not as critical.
Non- chlorine gene rating products			
Quaternary Ammonium products	Quaternary Ammonium, benzalkonium chloride, n-alkyl dimethyl benzyl ammonium chloride, N,N,-didecyl-N,N-dimethyl ammonium chloride, etc.	De-Bac, Virex, Roccal-D, AFBC, Breakthru, Micro Q64, Micro Q128, Pro-San, and many others.	Only slightly corrosive, relatively safe for humans when diluted, some residual activity, much less affected by organic matter or soil. Water pH not critical.
Hydrogen peroxide/ Peroxyacetic acid products	Hydrogen dioxide (hydrogen peroxide)	StorOx, Oxidate, Jet Oxide, Jet Ag, SaniDate 12.0	Can be applied directly to potatoes, no residual. Low corrosiveness. With use of heat JetAg can be used as fumigant in air system.
Iodine, Iodophores	Iodine, povidone iodine	Code Blue Iodine disinfectant and many others. Look for iodine in label name	Corrosive, will stain treated areas, some residual activity. Less affected by organic matter or water pH than bleach.
Phenol-glutaraldehyde	Phenol- glutaraldehyde	Sporocidin, Hospiseptic Disinfectant Wex-cide, Birex, etc- look for Phenol in name	Warning: oral poison!
Formaldehyde	Formaldehyde	Many products available.	Potential human carcinogen! Follow OSHA directions regarding exposure
Copper quinolinolate	Copper 8 quinolinolate	Many products available. Purchase as generic chemical. ISK Biotech PQ-57, PQ-80	Good residual activity. May cause some staining.
<p>The first step in disinfecting surfaces contaminated with potato residues and potential pathogens is to remove soil and potato residues by washing with soapy water and scrubbing to remove heavy deposits of potato residue. This is an important step since many disinfectants are inactivated by soil or organic matter and bacteria can live in the heavier residues protected from disinfectants. The second step is to disinfect with a labeled disinfectant. It is important to keep all surfaces wet with the disinfectant solution for 10-15 minutes and to use the highest labeled rate of the disinfectant chemical.</p>			

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