



2020 Montana Seed Potato Disease Management Guide

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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](#). For more information, please visit <http://pspp.msuextension.org/> or <http://montanaspud.org/>. Please check these websites periodically for weather station updates, new information, alerts, and new factsheets. 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 contact Nina at 406-994-3150 or Uta McKelvy at 406-580-6106.

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Website: <http://pspp.msuextension.org/>
MSU's Seed Potato Certification Website: <http://montanaspud.org/>

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Disease	Active Ingredient (FRAC Group)	Product/Rate	PHI days	Comments
Aerial Stem Rot	Copper hydroxide M1	See product labels. Use at highest label rate. See table on disinfectants.		Use with/without Mancozeb following hail event.
	Copper Hydroxide M1 + Copper Oxychloride M1	Badge X2 , 1-4 lbs/acre; Previsto 1-3 qts/acre.	0	Maximum 89.3 lbs/acre per season of Badge X2 Apply at 4 lbs/ acre when disease is more severe. Under conditions of severe disease control with Badge X2 will be improved by tank mixing with other compatible fungicides. Maximum 331 qts/acre per season of Previsto .
	Cymoxanil 27+ Famoxadone 11	Tanos , 8 fl oz/acre/ application. See product label.	14	Disease suppression. 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	Copper quinolate	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.
	Formaldehyde			
	Hydrogen peroxide			
	Iodine compounds			
	Peroxyacetic acid			
	Phenol			
	Quaternary ammonium compounds			
Sodium/ calcium hypochlorite				
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 separate 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 separately - 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			

Disease	Active Ingredient (FRAC Group)	Product/Rate	PHI days	Comments
Black Dot	Pre-emergence			
	Penthiopyrad 7	Vertisan: Apply in-furrow or banded 0.16-0.24 fl oz/1000 row ft	n/a	max rate/A=24 oz
	Fluapyroxad 7+ Pyraclostrobin 11	Priaxor: Apply in-furrow 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
	Azoxystrobin 11	Quadris, A-Zox 25SC: Apply in-furrow 0.4-0.80 fl oz /1000 row ft	n/a	Plant disease-free seed, several products: Quadris Ridomil Gold SL,
	Fluoxastrobin 11	Evito 480SC, in-furrow 0.16-0.24 fl oz/ 1000 row ft; Afterschock, 0.16-0.24 fl oz/1000 ft row	7	Max rate = 0.72 lbs a.i./acre per year. Refer to label for specific application instructions and row width-dependent rates.
	Post-emergence			
	Difenoconazole 3	Top MP, 5.5-7 fl oz/acre	14	Use no more than 2 consecutive sprays, rotate to another mode of action. Max rate = 28 fl. oz./A
	Difenconazole 3 + Azoxystrobin 11	Quadris Top, 8-14 fl oz/acre	14	Max rate = 55.3 fl oz/acre per year (0.46 lbs Difenconazole a.i./acre per year, 2.0 lbs Azoxystrobin a.i./acre per year). Use sufficient water volume for good coverage. No more than two sequential applications before rotating MOA. No more than 4 applications per year.
	Difenconazole 3 + Mandiproamide 40	Revus Top, 5.5-7.0 fl oz/acre	14	Max rate = 28 fl oz/acre per year. The addition of a spreading/penetrating type adjuvant such as a non-ionic surfactant or crop oil concentrate or blend is recommended when applying by ground or air. Apply in 7-10 day intervals. No more than 2 sequential applications before rotating to another MOA.
	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
	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, 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
	Fluopyram 7 + Pyrimethanil 9	Luna Tranquility, 8-11.2 fl oz/acre	7	Max rate = 54.7 fl oz/acre per year. Do not make more than 2 sequential applications of product or other group 7 or group 9 fungicide before rotation to another MOA.
	Azoxystrobin 11+ Benzovindiflupyr 7	Elatus, 0.34-0.5 oz/1,000 ft row	n/a	Apply in-furrow at planting. No more than 9.5 oz/acre banded. See label.
	Azoxystrobin 11	Quadris Flowable, A-zox 25SC, Arius 250: 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 + Mancozeb M3	Dexter Max, 1.6-2.1 lbs/acre	14	Max rate = 16 lbs/acre per season (11.2 lbs Mancozeb a.i.; 0.8 lbs/ Azoxystrobin a.i.)	

Disease	Active Ingredient (FRAC Group)	Product/Rate	PHI days	Comments
Black Dot	Post-emergence			
	Azoxystrobin 11+ Chlorothalonil M5	Quadris Opti , 1.6 pts/acre; Arius ADV , 20-25.5 fl oz/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.
	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
	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 lbs zoxamide and 8.88 lbs chlorothalonil per acre per season.
	Cymoxanil 27 + Chlorothalonil M5	Cymbol Advance , 32 fl oz/acre	14	Max rate = 17.5 pts product/acre per year. Apply by ground, air, or chemigation. Read label for detailed instructions.
	Tea Tree Oil 46	Timorex Act , 13-35 fl oz/acre; Timorex Gold , 7-42 fl oz/acre	2	Do not apply more than 0.89 lbs ai/acre per season (= 120 fl oz Timorex Act/acre/season; 106 fl oz Timorex Gold/acre/season).
	Mancozeb M3	Manzate Prostick , 1-2 lbs/acre	3	Do not exceed more than 11.2 lb ai/season
	Mancozeb M3 + Chlorothalonil M5	Elixir , 1.8-2.4 lbs/acre	14	Max rate = 18lbs/acre per season.
	Chlorothalonil M5	Bravo Weatherstik , 0.75–1.5 pts/acre; Bravo ZN , 1.125, then 1.5-2.25 pt/acre; Echo ZN , 1, then 1.5-2.125 pts/acre; Equis DF , 0.7, then 0.9-1.36 lb/acre; Equis 720 SST , 0.75, then 1-1.5 pt/acre; Initiate ZN , 1.125, then 1.5-2.25 pt/acre; Oranil , 0.75 then 1-1.5 pts/acre.	7	Many formulations. Follow labels for specific rates and spray intervals. Max rate = 11.25 lbs a.i./acre per year.
Chlorothalonil M5 + Oxathiapiprolin U15	Orondis Opti , 1.75-2.5 pt/acre	7	Max. rate/acre = 2.5 pts. No more than 10 pt/acre per season. No more than 2 sequential applications before rotating to another MOA.	

Disease	Active Ingredient (FRAC Group)	Product/Rate	PHI days	Comments
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	Iprodione M3	Meteor , 1-2 pts/acre	14	Early blight control only. Apply in minimum of 10 gal water/acre. Do not make more than 4 applications per season. Do not irrigate for 24h after application.
	Difenconazole 3 + Azoxystrobin 11	Quadris Top , 8-14 fl oz/acre	14	Max rate = 55.3 fl oz/acre per year (0.46 lbs Difenconazole a.i./acre per year, 2.0 lbs Azoxystrobin a.i./acre per year). Use sufficient water volume for good coverage. No more than two sequential applications before rotating MOA. No more than 4 applications per year.
	Mefentrifluconazole 3	Provysol , 2-4 fl oz/acre		Currently for potatoes used domestically or exported to Mexico only.
	Metaconazole 3	Quash , Early Blight only: 2-4 fl oz/acre	1	No more than 2 consecutive applications. No more than 16 oz/A/season
	Mandiproamide 40+ Difenconazole 3	Revus Top , 5.5-7.0 fl oz/acre	14	Use primarily for Late blight. No more than 2 consecutive applications. Max rate = 28 fl oz/acre per season. Apply in 7-10 day intervals.
	Difenconazole 3	Top MP , 5.5-7 fl oz/acre	14	No more than 2 consecutive applications. Max rate = 28 fl oz/acre per season Maybe tank mixed with Omega for late blight
	Mefanoxam 4 + Chlorothalonil M5	Ridomil Gold Bravo SC , 1.75-2.5 pt/acre	14	Do not exceed equivalent of 11.25 lb chlorothalonil a.i./acre per year or 0.188 lbs Mefanoxam a.i./acre per year.
	Mefanoxam 4 + Macozeb M3	Ridomil Gold MZ WG , 2.5 lbs/acre.	14	Max rate = 10 lbs product/acre per year. No more than 4 applications per season.
	Fluopyroxad 7+ Pyraclostrobin 11	Priaxor , 4-8 fl oz/acre	1	No more than two consecutive applications and no more than 3 applications (4-8 oz/A) or 24 oz/season
	Boscalid 7	Endura , 3.5-4.5 fl oz/acre	30	Early Blight only: No more than 2 sequential applications, no more than 4 applications/season.
	Fluopyram 7 + Pyrimethanil 9	Luna Tranquility , 8-11.2 fl oz/acre	7	Early Blight only: Do not make more than 2 sequential applications of product or other group 7 or group 9 fungicide before rotation to another MOA. Max rate = 54.7 fl oz/acre per year.
	Penthiopyrad 7	Vertisan , 10-24 fl oz/acre	7	Early blight only: No more than two consecutive applications and no more than 72 fl oz/season/A
	Pyrimethanil 9	Scala SC , 7 fl oz	7	Early Blight only: Does not control late blight –use in combination with a class M, 7 or 30 material
	Azoxystrobin 11	Quadris Flowable, Arius 250, A-Zox 25SC , 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.

Disease	Active Ingredient (FRAC Group)	Product/Rate	PHI days	Comments
Early Blight and Late Blight - Continued	Azoxystrobin 11 + Mancozeb M3	Dexter Max , 1.6-2.1 lbs/acre	14	Max rate = 16 lbs/acre per season (11.2 lbs Mancozeb a.i.; 0.8 lbs/ Azoxystrobin a.i.)
	Azoxystrobin 11 + Chlorothalonil M5	Quadris Opti , 1.6 pt/acre; Arius ADV , 20-25.5 fl oz/acre	14	Alternate away from Group 11 fungicides to manage resistance. Use no more than 3 gal/a per season
	Famoxadone 11 + Cymoxanil 27	Tanos , Early blight: 6 fl oz/acre, Late blight: 6-8 fl oz/acre	14	Mix with M5 group fungicide, consult label
	Fenamidone 11	Reason 500SC , 5.5-8.2 fl oz/acre	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/acre; Aftershock : Early blight: 2.0- 3.8 fl oz, Late blight 3.8 fl oz	7	Do not exceed 22.8 fl oz/acre per season. Alternate every application of FRAC 11 fungicide with an application of a different MOA.
	Pyraclostrobin 11	Headline , Early blight: 6-9 fl oz/acre, Late blight: 6-12 fl oz/acre	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
	Trifloxystrobin 11	Gem 500SC 2.9-3.8 fl oz	7	Use highest rate for late blight. Do not exceed 48 oz (23 fl oz-Gem 500SC)/ season.
	Polyoxin D Zinc Salt 19	Ph-D , Early Blight only 6.2 oz/acre in furrow or foliar		Early blight only; Do not apply more than 6 applications of products containing any polyoxin as the active ingredient (4.2 oz ai/ acre) per season.
	Polyoxin D 19	OSO 5% , 6.5-13 fl oz/acre	0	Suppression of Late Blight. Max rate = 4.2 oz a.i./acre per season (equals 6 applications at highest rate).
	Zoxamide 22+ Mancozeb M3	Gavel 75DF , 1.5-2.0 lb/acre	3	Do not exceed 12 lbs/season primarily for late blight. Note field workers should be advised that this fungicide is dermal and oral sensitizer.
	Zoxamide 22 + Chlorothalonil M5	Zing! , Early Blight 24-34 fl oz/acre, Late Blight 30-34 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 lbs zoxamide and 8.88 lbs 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.
Cymoxanil 27 + Chlorothalonil M5	Cymbol Advance , 32 fl oz/acre	14	Max rate = 17.5 pts product/acre per year. Apply by ground, air, or chemigation. Read label for detailed instructions.	

Disease	Active Ingredient (FRAC Group)	Product/Rate	PHI days	Comments
Early Blight and Late Blight - Continued	Propamocarb hydroxide 28	Previcur Flex , 0.7-1.2 pt/acre	14	Tank mix with M class fungicide (Chlorothalonil, Maneb, Mancozeb). No more than 6 oz/season.
	TPTH-triphenyltin hydroxide 30	SuperTin 80 WP , rate dependent on method of application, see label; Agri Tin 80WP , 2.5-3.75 dry oz/acre, rate dependent on method of application	7, 21	Do not use more than 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
	<i>Bacillus mycoides</i> isolate J BM2	LifeGard 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.
	<i>Bacillus subtilis</i> strain IAB/BS03 BM2	Aviv , see label, 10-30fl oz/100 gal water.	n/a	In furrow: Direct spray into the seed furrow just before seeds are covered. Soil drench: Apply during or shortly after transplant to reduce transplant shock and suppress soilborne diseases and improve root growth. Multiple drench applications can be made on a 10-14 day interval.
	<i>Bacillus amyloliquefaciens</i> strain D747 BM2	Double nickel LC , 1-2 qts/acre	n/a	See label for application instructions.
	<i>Streptomyces lydicus</i> BM2	Actinovate , 3-12 oz/acre		Foliar application. Use with spreader/sticker for best results.
	Copper Octanoate M1	Cueva , 0.5-2 gal in 30-100 gal water/acre	0	Early blight control, late blight suppression only. Max rate = 159 gal/acre per year.
	Copper Hydroxide M1 + Copper Oxychloride M1	Previsto , 1-3 qt/acre; Badge X2 , 1-4 lb/acre.	0	Maximum 331 quarts/ acre per season of Previsto . Maximum 89.3 lbs/ acre per season of Badge X2 . Apply at 4 lbs/ acre when disease is more severe. Under conditions of severe disease control with Badge X2 will be improved by tank mixing with other compatible fungicides.
	Maneb M3	Maneb 80 WP - 1.5 -2.0 lb Manex 4F 1.2- 1.5qt	3	Do not exceed more than 11.2 lbs a.i./acre per season
	Metiram M3	Polyram 80 DF , 1.5-2.0 lbs/acre	14	No more than 14 lbs/acre per season.

Disease	Active Ingredient (FRAC Group)	Product/Rate	PHI days	Comments
Early Blight and Late Blight - Continued	Mancozeb M3	Dithane F45 Rainshield , 0.4-1.6 qt/acre; Koverall , 1.5-2.0 lb/acre; Manzate Prostick , 1-2 lb/acre; Manzate Max , 0.4-1.6 qts/acre; Penncozeb 75DF , 0.5- 2 lb/acre; Penncozeb 80WP , 0.5- 2 lb/acre	14	Do not exceed more than 11.2 lbs ai/ acre per season. See product-specific label for further instructions.
	Mancozeb M3 + Chlorothalonil M5	Elixir , 1.8-2.4 lbs/acre	14	Max rate = 18lbs/acre per season.
	Chlorothalonil M5	Bravo Weatherstik , 0.75, then 1-1.5 pts/acre; Bravo ZN , 1.125, then 1.5-2.25 pt/acre; Bravo Ultrex , 0.7, then 0.9-1.36 lb/acre; Echo ZN , 1.125, then 1.5-2.25 pt/acre; Echo 720 , 0.75, then 1-1.5 pt/acre; Echo 90DF , 0.625, then 0.875-2.25 lb/acre; Equis DF , 0.7, then 0.9-1.36 lb/acre; Equis 720 SST , 0.75, then 1-1.5 pt/acre; Initiate ZN , 1.125, then 1.5-2.25 pt/acre; Initiate 720 , 0.75, then 1-1.5 pt/acre; Oranil , 0.75 then 1-1.5 pts/acre.	7	Many formulations; follow labels for specific rates and spray intervals. Max rate = 11.25 lbs a.i./acre per year.
	Oxathiapiprolin U15 + Chlorothalonil M5	Orondis Opti , 1.75-2.5 pts/acre	7	Do not apply more than 15 pints of Orondis Opti B (11.25 lbs a.i.) per acre during each growing season.
	Laminarin P4	Vacciplant , 14-22 fl oz/acre	0	At water volumes of less than 70 gal/acre, apply product at 14 lf oz/acre. At water volumes above 70 gal/acre, apply product at 0.15 % v/v. Repeat applications at 7-14 day intervals.
	Oxathiapiprolin U15 + Chlorothalonil M5	Orondis Opti , 1.75-2.5 pts/acre	7	Do not apply more than 15 pints of Orondis Opti B (11.25 lb a.i.) per acre during each growing season.
	Laminarin P4	Vacciplant , 14-22 fl oz/acre	0	At water volumes of less than 70 gal/acre, apply product at 14 lf oz/acre. At water volumes above 70 gal/acre, apply product at 0.15 % v/v. Repeat applications at 7-14 day intervals.

Disease	Active Ingredient (FRAC Group)	Product/Rate	PHI days	Comments
Late Blight only	Mandipropanid 40 + Difenconazole 3	Revus Top , 5.5-7.0 fl oz/acre	14	Max rate = 28 fl oz/acre per year. The addition of a spreading/penetrating type adjuvant such as a non-ionic surfactant or crop oil concentrate or blend is recommended when applying by ground or air. Apply in 7-10 day intervals. No more than 2 sequential applications before rotating to another MOA.
	Ametoctradin 45 + Dimethomorph 15	Zampro , 11-14 oz	4	Maximum 42 oz per season
	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
	Cyazofamid 21	Ranman 400SC , 1.4-2.75 fl oz/acre	7	No more than 27.5 fl oz/season. Note for crops not on label 30 day limit before planting
	Cymoxanil 27	Curzate 60DF , Cymbol , 3.2 fl oz/acre	14	Do not use alone, mix with FRAC M3, M5, 30 protective fungicide
	Fluazinam 29	Omega Top MP , 5.5 fl oz/acre	14	Tank mix with M class fungicide. No more than 3.5 pts/season
Rhizoctonia stem canker and black scurf- in furrow	Benzovindiflupyr 7 + Azoxystrobin 11	Elatus , 0.34-0.5 oz/1000 ft row		Apply in-furrow at planting. No more than 9.5 oz/acre banded. See label. Also effective against Black Dot
	Flutalonil 7	Moncut SC , 16-25 fl oz/acre		Use a minimum of 3 gal/acre. See label for row width-dependent product rates. Do not apply through chemigation.
	Penflufen 7	EverGol Prime , 0.5-0.57 fl oz/1000 ft row		Apply 0.4-0.57 fl oz/ 1000 row ft in furrow if in addition to seed piece treatment.
	Azoxystrobin 11	Quadris , 0.4-0.8 fl oz/1000 ft row		Apply in-furrow at planting. Will also control Silver Scurf and Black dot. See seed treatment label for Dynasty.
	Fluoxastrobin 11	Evito 480 SC , 0.16-0.24 fl oz/1000 ft row; Afterschock , 0.16-0.24 fl oz/1000 ft row	7	Black scurf control. Max rate = 0.72 lbs a.i./acre per year. Refer to label for specific application instructions and row width dependent rates.
	PCNB 14	Blocker 4F , 5.2-10.4 fl oz/1000 ft row	28	Apply in-furrow over the seed piece at planting in 8.5 inch band.
	Polyoxin D Zinc 19	OSO 5% SC , 6.5-13 fl oz/acre; Ph-D , 6.2 oz/ acre	0	Max rate = 4.2 oz a.i./acre per season (equals 6 applications at highest rate). Apply as banded spray or in-furrow at planting, either just before placement of seed pieces or over seed pieces before covering with soil. See label instructions.
	<i>Bacillus amyloliquefaciens</i> strain D747 BM2	Double Nickel LC , 1-2 qt/acre	n/a	See label for detailed application instructions.

Disease	Active Ingredient (FRAC Group)	Product/Rate	PHI days	Comments
Seed Treatments <i>Please See the 2020 Seed Treatment Quick Reference Guide</i>	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
	Flutolanil 7 + Mancozeb M3	Moncoat MZ , 0.75-1 lb/100lbs of cut seed pieces		
	Penthiopyrad 7	Vertisan , 0.7-1.6 fl oz/1000 ft row		max rate/A=24 oz
	Pyraclostrobin 11	Headline , 4-8 fl oz/1000 ft row		Apply in-furrow at planting.
Pythium leak and Pink Rot	Mefanoxam 4	Ridomil Fold SL , 0.42 fl 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).
	Mefanoxam 4 + Chlorothalonil M5	Ridomil Gold Bravo , 2.5 pts/acre	14	At total of 3 applications at 14 day intervals starting at flowering. Do not exceed equivalent of 11.25 lb chlorothalonil a.i./ acre per year or 0.188 lb Mefanoxam a.i./acre per year.
	Mefanoxam 4 + Mancozeb M3	Ridomil Gold MZ WG , 2.5 lbs/acre	14	At total of 3 applications at 14 day intervals starting at flowering. Max rate = 10 lbs product/acre per year.
	Cyazofamid 21	Ranman 400SC , 0.42 fl oz/1000 row ft in furrow, 2.75 fl oz layby	0	Use full label rate
	Ehtaboxam 22	Elumin , 8 fl oz/acre	n/a	Apply in furrow with 5-10 gal/acre, site-dress with 20-40 gal/acre. Do not make more than 2 applications per year. Max rate = 16 fl oz/acre per year.
	<i>Bacillus amyloliquefaciens</i> strain D747 BM2	Double Nickel LC , 1-2 qt/acre	n/a	See label for detailed application instructions.
	<i>Bacillus subtilis</i> strain IAB/BS03 BM2	Aviv , 10-30 fl oz/ 100 gal water at 5-15 gallons/acre in furrow; soil drench 10-30 fl oz/ 100 gal water		In furrow: Direct spray into the seed furrow just before seeds are covered. Soil drench: Apply during or shortly after transplant to reduce transplant shock and suppress soilborne diseases and improve root growth. Multiple drench applications can be made on a 10-14 day interval.
	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	Thiophanate-methyl 1	T-Methyl 4.5 F Fungicide , 1-1.5 lb/acre or 20-30 fl oz/acre; Topsin 4.5FL , 20-30 fl oz/acre; Topsin M WSB , 1-1.5 lbs/acre	21	Max rate = 2.8 lbs a.i./acre per season. Make first application at row closure with subsequent applications 7-14 days later. May be tank mixed with other fungicides labeled for early and late blight control, e.g. Penncozeb.

Disease	Active Ingredient (FRAC Group)	Product/Rate	PHI days	Comments
White Mold - continued	Iprodione 2	Rovral 4 Flowable , 2 pt/acre; Meteor , 2 pts/acre	14	2 applications starting at 1st flower. Do not apply by air. Thorough coverage is essential for good control. Apply in minimum of 10 gal water/acre. Do not make more than 4 applications per season. Do not irrigate for 24h after application.
	Boscalid 7	Endura , 5.5-10 fl oz/acre	30	1-2 applications starting at 1st flower. Can be used to replace early blight spray
	Fluopyram 7 + Pyrimethanil 9	Luna Tranquility , 11.2 fl oz/acre	7	1-2 applications starting at 1st flower. Can be used to replace early blight spray. Do not make more than 2 sequential applications of product or other group 7 or group 9 fungicide before rotation to another MOA. Max rate = 54.7 fl oz/acre per year.
	Penthiopyrad 7	Vertisan , 14-24 fl oz/acre	7	Disease suppression only, Treat at 100% bloom, again 14 later, no more than 72 fl oz./acre/year
	Polyoxin D Zinc 19	OSO 5% SC , 6.5-13 fl oz/acre	0	Max rate = 4.2 oz a.i./acre per season (equals 6 applications at highest rate). Apply in 30-50 gal water/acre as a directed spray towards soil surface, lower leaves, and stems. May also be applied through overhead sprinkler irrigation.
	Fluazinam 29	Omega Top MP , 5.5-8 fl oz/acre	14	1-2 applications starting 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
	Tea Tree Oil 46	Timorex Gold , 7-41 fl oz/acre; Timorex Act , 13-35 fl oz/acre	2	Do not apply more than 0.89 lb ai/acre per season (= 120 fl oz Timorex Act/acre/season; 106 fl oz Timorex Gold/acre/season).
	<i>Bacillus mycoides</i> strain J BM2	LifeGard 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.
	<i>Bacillus amyloliquefaciens</i> strain D747 BM2	Double Nickel LC , 1-2 qt/acre	n/a	See label for detailed application instructions.
	<i>Bacillus subtilis</i> strain IAB/BS03	Aviv , 10-30 fl oz/100 gal water, for low volume application 15-25 fl oz/100 gal		In furrow: Direct spray into the seed furrow just before seeds are covered. Soil drench: Apply during or shortly after transplant to reduce transplant shock and suppress soilborne diseases and improve root growth. Multiple drench applications can be made on a 10-14 day interval.
	<i>Coniothyrium minitans</i> BM2	Contans , 1-4 lbs/acre	0	Apply in fall (preferred) or spring- incorporate lightly
	Metconazole M3	Quash , 4 fl oz/acre	1	No more than 4 applications per season, no more than 16 oz, no more than 2 sequential applications
	Laminarin P4	Vacciplant , 14-22 fl oz/acre	0	At water volumes of less than 70 gal/acre, apply product at 14 fl oz/acre. At water volumes above 70 gal/acre, apply product at 0.15 % v/v. Repeat applications at 7-14 day intervals.

Disease	Active Ingredient (FRAC Group)	Product/Rate	PHI days	Comments
Fusarium Dry rot - storage	<i>Pseudomonas syringae</i> BM2	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 that 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	Difenconazole 3	Top MP , 5.5-7 fl oz/acre	14	Apply 7-14 day interval, no more than two consecutive applications before rotation to different MOA. Max rate = 28 fl oz/acre per year.
	Difenconazole 3 + Azoxystrobin 11	Quadris Top , 8-14 fl oz/acre	14	Max rate = 55.3 fl oz/acre per year (0.46 lbs Difenconazole a.i./acre per year, 2.0 lbs Azoxystrobin a.i./acre per year). Use sufficient water volume for good coverage. No more than two sequential applications before rotating MOA. No more than 4 applications per year.
	Difenconazole 3 + Mandiproamide 40	Revus Top , 5.5-7.0 fl oz/acre	14	Max rate = 28 fl oz/acre per year. The addition of a spreading/penetrating type adjuvant such as a non-ionic surfactant or crop oil concentrate or blend is recommended when applying by ground or air. Apply in 7-10 day intervals. No more than 2 sequential applications before rotating to another MOA.
	Fluopyram 7 + Pyrimethanil 9	Luna Tranquility , 8-11.2 fl oz/acre	7	1-2 applications starting at 1st flower. Can be used to replace early blight spray. Do not make more than 2 sequential applications of product or other group 7 or group 9 fungicide before rotation to another MOA. Max rate = 54.7 fl oz/acre per year.
	Penthiopyrad 7	Vertisan , 10-24 fl oz/acre	7	Disease suppression only, Treat at 100% bloom, again 14 later, no more than 72 fl oz./acre/year
	Azoxystrobin 11 + Mancozeb M3	Dexter Max , 1.6-2.1 lbs/acre	14	Suppression only ; Max rate = 16 lbs/acre per season (11.2 lbs Mancozeb a.i.; 0.8 lbs/ Azoxystrobin a.i.)
	Tea Tree Oil 46	Timorex Gold , 7-41 fl oz/acre; Timorex Act , 13-35 fl oz/acre	2	Do not apply more than 0.89 lb ai/acre per season (= 120 fl oz Timorex Act/acre/season; 106 fl oz Timorex Gold/acre/season).
	<i>Bacillus subtilis</i> strain IAB/BS03 BM2	Aviv , 10-30 fl oz/100 gal water, for low volume application 15-25 fl oz/100 gal		In furrow: Direct spray into the seed furrow just before seeds are covered. Soil drench: Apply during or shortly after transplant to reduce transplant shock and suppress soilborne diseases and improve root growth. Multiple drench applications can be made on a 10-14 day interval.
	<i>Streptomyces lydicus</i> BM2	Actinovate , 3-12 oz/acre		Foliar application. Use with spreader/sticker for best results.
	Copper Hydrocide M1 + Copper Oxychloride M1	Badge X2 , 1-4 lbs/acre	0	Maximum 89.3 lbs/ acre per season. Apply at 4 lbs/ acre when disease is more severe. Under conditions of severe disease, control with Badge X2 will be improved by tank mixing with other compatible fungicides.

Disease	Active Ingredient (FRAC Group)	Product/Rate	PHI days	Comments
Powdery Mildew - continued	Sulfur M2	Microthiol Disperss , 5-10 lbs/acre	n/a	No max rate listed. Do not use within two weeks of an oil spray treatment. Do not use in combination with spreader/stickers. Product application will provide sulfur needed for plants nutrient requirements and should be considered for use in total nutrient applications.
	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
	Laminarin P4	Vacciplant , 14-22 fl oz/acre	0	At water volumes of less than 70 gal/acre, apply product at 14 fl oz/acre. At water volumes above 70 gal/acre, apply product at 0.15 % v/v. Repeat applications at 7-14 day intervals.
Silver Scurf	Azoxystrobin 11 + Benzovindiflupyr 7	Elatus , 0.34-0.5 fl oz/ 1000 ft row		Make an in-furrow application at planting. Apply the spray in a narrow band over the seed piece. Do not apply more than 9.5 oz/A as a banded application. Refer to instructions in Application Section to calculate total oz per acre when applying in a band. Also effective against Black Dot.
	Fluoxastrobin 11	Evito 480 SC , 0.16-0.24 fl oz/ 1000 ft row; Afterschock , 0.16-0.24 fl oz/1000 ft row	7	In-furrow or banded. Max rate = 0.72 lb a.i./acre per year. Refer to label for specific application instructions and row width dependent rates.

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.

2020 Potato Seed Piece and In-Furrow Treatment Guide

Active Ingredient IRAC/FRAC Group	Product/Rate	Comments
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.
Thiophanate-methyl 1 + Mancozeb M3 + Cymoxanil 27	Evolve , 0.75 lbs/cwt	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.
Thiophanate-methyl 1 + Mancozeb M3 + Imidacloprid 4	Tops MZ Gaucho , 0.75 lb/cwt	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 soilborne Rhizoctonia and scab. Due to resistance, it may not be effective for Fusarium or Silver Scurf
Penflufen 7 + Prothioconazole 3	Emesto Silver , 0.13 fl oz/cwt	Apply as diluted spray/slurry for the suppression of Rhizoctonia diseases and dry rot. Add mancozeb for better Fusarium control. No more than 2.5 fl oz/ cwt
Flutolanil 7	Moncut 70 DF , 0.71- 1.11 lbs/acre	For control of Black Scurf. Apply in-furrow, see label for row spacing-dependent product rates.
Flutolanil 7	Moncut SC , 16-25 lf oz/acre	For control of Black Scurf. Apply in-furrow, see label for row spacing-dependent product rates.
Flutolanil 7 + Mancozeb M3	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, Black and Silver scurf.
Azoxystrobin 11	Arius 250 , 0.4-0.6 fl oz/1,000 ft row	Control of Black Dot, Black and Silver Scurf. In-furrow application for seedling disease control at planting. Apply spray directed at furrow prior to seeds being covered. Banded application for control of soilborne diseases that occur later in the season. Apply banded applications as soil-directed spray around plants and lower stems. Refer to product labels for row-width dependent product rates.
Azoxystrobin 11	A-Zox 25SC , 0.25-1.5 fl oz/cwt	
Azoxystrobin 11	Dynasty , 0.10-3.75 fl oz/ cwt	Apply as slurry for the suppression: Black Scurf, Black Dot, Stem Canker, Protection: Silver Scurf. Excellent for seedborne 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.
Azoxystrobin 11	Quadris , 0.4-0.8 fl oz/1,000 ft row	Apply in-furrow for the control of black scurf and silver scurf.
Azoxystrobin 11	Satori , 0.4-0.8 fl oz/1,000 row ft	Apply banded or in-furrow for the control of black dot, black scurf and silver scurf. Refer to label for specific instructions.
Azyoxystrobin 11 + Mefenoxam 4	Quadris Ridomil Gold , 0.82 fl oz/ 1,000 ft row	Apply in-furrow for the control of Rhizoctonia diseases, Pythium leak, and pink rot.
Fenamidone 11	Reason 500SC , 0.15 fl oz/cwt	For control of seed-borne late blight. Good coverage of seed pieces is required for optimal control.
Fluoxastrobin 11	Evito 480 SC , 0.11- 0.24 fl oz/1000 row ft	Apply in-furrow or banded for control of soil/seedling-borne diseases. Controls back scurf, silver scurf, black dot. Refer to label for specific application instructions.

2020 Potato Seed Piece and In-Furrow Treatment Guide – continued

Active Ingredient IRAC/FRAC Group	Product/Rate	Comments
Pyraclostrobin 11	Headline EC, Headline SC , 0.4-0.73 fl oz/1,000 ft row	Apply in-furrow for the control of Rhizoctonia diseases.
Pyraclostrobin 11 + Fluxapyroxad 7	Priaxor , 0.48-0.6 fl oz/1,000 row ft	Apply in-furrow for the suppression of Rhizoctonia diseases.
Fludioxonil 12	Maxim 4FS , 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.
Fludioxonil 12	Maxim PSP , 0.5 lb/cwt	Apply as dust 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***
Fludioxonil 12	Spirato 480 FS , 0.08-0.16 fl oz/cwt	Apply as slurry to cut or single drop seed for suppression of Fusarium, stem canker, black scurf, and silver scurf. Labelled rate of mancozeb seed treatment dust must be applied to seed tubers after the SPIRATO 480 FS treatment. If the mancozeb dust is not used, an in-furrow application of a labeled Strobilurin fungicide must be applied over the SPIRATO 480 FS treated seed tubers.
Fludioxonil 12 + Mancozeb M3	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 + Thiamethoxam 4	Cruiser Maxx Potato , 0.19-0.27 fl oz/cwt	Rate dependent on seeding rate, see label.
Pentachloronitrobenzene (PCNB) 14	Blocker 4F , 5.2-10.4 lbs/1,000 ft row	Apply in-furrow with 8.5" band. See label. PHI=45 days. For the control of Stem Canker and Black Scurf.
Cyazofamid 21	Ranman 400 SC , 1.42 fl oz/1,000 ft row (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.
Cymoxanil 27	Cymbol , 0.25-1 fl oz/cwt	Suppression of Late Blight. Apply by thoroughly dipping seed pieces in concentrated slurry or by mist seed treating equipment. Use only in combination with labeled rate of protectant fungicide registered for use as seed treatments in potato.
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.
Fluazinam 29	Omega 500 F , 24 to 48 fl oz/ acre in-furrow	Apply in-furrow for the suppression of powdery scab. See label.
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.
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.

2020 Potato Seed Piece and In-Furrow Treatment Guide – continued

Active Ingredient IRAC/FRAC Group	Product/Rate	Comments
Mancozeb M3	Manzate Flowable , 1.6-2.5 fl oz/cwt	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.
Mancozeb M3	Nubark Mancozeb AS , 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	Penncozeb 75 DF , 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	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.
Mancozeb M3/ Maneb	Many products , rate varies	Good for seed borne scab. Good fungicide resistance management partner for fludioxonil and cymoxanil.
Mefenoxam M3	Ridomil Gold SL , 3.2 fl oz/acre	Apply in-furrow or with dry fertilizer. For post-harvest control of pink rot and Pythium leak.
<i>Bacillus amyloliquefaciens</i> strain D747 BM2	Double Nickel LC , 0.5-4.5 qts/acre	For control of Black Scurf, Pythium, Rhizoctonia, and Fusarium seedling diseases. Apply in-furrow directly over seed just before covering with soil. Refer to label for row width-dependent rates.
<i>Bacillus amyloliquefaciens</i> strain D747 BM2 + Bifenthrin 3A	Ethos XB , 12.75-25.5 fl oz/acre	Suppression of “Damping off” seedling blights, root or crown diseases caused by Pythium, Rhizoctonia, Fusarium, Phytophthora. May be applied as soil incorporated broadcast, directed bed spray or a T-band spray into the planting furrow.
<i>Streptomyces lydicus</i> BM2	Actinovate , 2-6 oz/cwt.	Apply as seed treatment or in furrow. For control of Fusarium Dry Rot.
<i>Trichoderma harzianum</i> BM2	RootShield WP , 0.03-0.2 lb/cwt, in furrow 16-32 oz/acre	Biological, Apply as a slurry or in-furrow. See label.
Clothianidin 4A <i>Insecticide</i>	Belay , 4.0-6.0 fl oz/cwt	Apply in-furrow for the pest suppression of aphids, Colorado potato beetle, flea beetles, leafhoppers, potato psyllids, and wireworms. Can be applied with compatible fungicides. If using inert dusts or dust-based fungicides, apply Belay first.
Clothianidin 4A <i>Insecticide</i>	Belay , 9-12 fl oz/acre	For control of aphids, Colorado potato beetle, leaf beetles, potato psyllids. Broadcast by ground pre-plant or at planting. Refer to label for specific application rates and methods.
Imidacloprid 4A <i>Insecticide</i>	Admire Pro, Midash Forte , 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. Apply as diluted, fine spray over the cut or whole tubers.
Gibberellic Acid	ProGibb LV Plus , 0.1-0.2 fl oz/100 gal water	To stimulate uniform sprouting to aid in maximum production, more uniform development, fewer late maturing plants, and to break dormancy of newly harvested potatoes that have not had a full rest period.

Information on fungicide controls and their effectiveness for control of early blight, late blight, Pythium leak, Phytophthora pink rot, and white mold; Updated 2018

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
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			Super-Tin 80 WP, 4L	E	E	N	N	N
			Agri Tin 80WP	E	E	N	N	N
Benzamide			Gavel 75 DF	E	G	N	N	N
Systemic/translaminar		QoI, Strobilurin, Group 11	Gem	F-G	E	N	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
			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		

Information on fungicide controls and their effectiveness for control of early blight, late blight, Pythium leak, Phytophthora pink rot, and white mold; Updated 2018								
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	Systemic/ translaminar	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>Protectant</i>	<i>Curative</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, AgriTin	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 generating products			
Quaternary Ammonium products	Quaternary Ammonium, benzalkkonium 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>			