Delaware Cooperative Extension

UNIVERSITY OF DELAWARE | DSU DELAWARE STATE UNIVERSITY

This is a section from the

2024/2025
Mid-Atlantic Commercial Vegetable Production Recommendations

The recommendations are **NOT** for home gardener use.

The full recommendations are available online at:
https://www.udel.edu/academics/colleges/canr/cooperative-extension/sustainable-production/commercial-crops/vegetable-crops/midatlantic-vegetable-recommendations/

Printed copies of the recommendations are available for purchase at the New Castle, Kent and Sussex County Extension Offices in Delaware.

This publication will be revised biennially. In January 2025, a Critical Update with important updates for this publication will be communicated through the above website.

These recommendations were prepared and reviewed by individuals from Cornell University, University of Delaware, Delaware State University, University of Maryland, Penn State, Rutgers University, Virginia Tech, and West Virginia University with the purpose of providing up to date information for commercial vegetable growers in the Mid-Atlantic states of **Delaware, Maryland, New Jersey, Pennsylvania, Virginia,** and **West Virginia**.

Disclaimer

- The label is a legally-binding contract between the pesticide user and the manufacturer.
- The user MUST follow all rates and restrictions as per label directions.
- The use of any pesticide inconsistent with the label directions is a violation of Federal law.

F. Commodity Recommendations

Pesticide Use Disclaimer

THE LABEL IS THE LAW

A pesticide applicator is legally bound by the labeling found on and with the pesticide container in their possession. Before using a pesticide, check and always follow the labeling distributed with the product at the point of sale for legally enforceable rates and use restrictions and precautions.
Although labels are available on the Internet from electronic label services such as Proagrica's CDMS (*https://www.cdms.net/*), Greenbook (*https://www.greenbook.net*), or Agworld DBX powered by Agrian (*https://www.agrian.com/labelcenter/results.cfm)* the information contained in these electronic labels may not be identical to the labeling distributed with the product. **Please be advised that these electronic label services provide use disclaimers, and in some cases legally binding *User Agreements* assigning ALL liability to user of service. (**See section D 3.1. Labels and Labeling for more detail.)

Guide to the Recommended Pesticide Tables in the Following Crop Sections:

1. Pesticides are listed by **group number or code based on chemical structure and mechanism of action**, as classified by the Herbicide Resistance Action Committee (**HRAC**, *https://hracglobal.com*) for herbicides, the Insecticide Resistance Action Committee (**IRAC**, *https://irac-online.org*) for insecticides, and the Fungicide Resistance Action Committee (**FRAC,** *https://www.frac.info/*) for fungicides. **In this guide, if the group number or code is in bold font, there are resistance concerns for the product.**
2. **Restricted use pesticides** are marked with a * in the Tables. These products may only be used by certified and/or licensed pesticide applicators, and when stated on the label, those making applications under their direct supervision. Some labels may restrict use solely to certified and/or licensed applicators. (See section D 3.2.1 Restricted Use Classification Statement for more detail).
3. **In addition to the pesticide products listed in the Commodity Recommendations below, other formulations or brands with the same active ingredient(s) may be commercially available. ALWAYS CHECK THE LABELING ON THE PRODUCT CONTAINER ITSELF:**
   a) to ensure a pesticide is labeled for the same intended use,
   b) to ensure the pesticide is labeled for the desired crop,
   c) for differences in application rates and % active ingredient(s), and
   d) additional restrictions.
4. All pesticide recommendations contained in this document are prescribed for spray applications to a **broadcast area of 1 acre** (43,560 square feet). **Adjust the rate accordingly for banded applications** (See section E 1.3. Calibrating Granular Applicators) **or for chemigation** (check labels for amounts per 1,000 feet).
5. Check the physical product label for and do not exceed the maximum amount of pesticide *per application* and the maximum number of applications *per year*.
6. **Bee Toxicity Rating (Bee TR)**: N=nontoxic; L=minimum impact on bees; M=moderately toxic, can be used if dosage, timing, and method of application are correct, but should NOT be applied directly to the crop if bees are present; H=highly toxic, severe losses expected, -- = data not available.
7. In accordance with the USDA National Organic Program, the Organic Materials Research Institute (OMRI) maintains a directory of all products that OMRI has determined are allowed for use in organic production, processing, and handling. These products are catalogued online in the **OMRI Products List** (see *https://www.omri.org/omri-lists*).

Potatoes

Recommended Varieties

When selecting varieties, consider market preferences, variety adaptation to local conditions, specific field problems and the susceptibility-tolerance to stress disorders. Use certified, disease-free "seed" (tuber or cut piece used for planting) of good quality from reputable source to maximize yield and quality. Depending on variety, production area and market, the crop take 90 to 160 days to mature and harvest.

Maturity Group	Varieties[1,2]	Table Stock[3]	Chipping[3]	Yield[3]	Spacing (in.)
Early	Andover	+++	+++	+	9-10
	Dark Red Norland D	++	No	+	8-10
	Envol	+++	No	++	8-10
	Michigan Purple (purple skin)	++	No	++	8-10
	Superior (S resistant, VW susceptible)	+++	+	++	8-12
	Vivaldi (yellow flesh)	+++	No	++	8-10
Midseason	Atlantic[4]	No	+++	+++	7- 9
	Chieftain (red skin)	++	No	++	7- 9
	Dakota Crisp	++	+++	+++	8-10
	Electra (pale yellow flesh) (S resistant)	++	No	+++	9-10
	Eva	++	++	++	8-10
	Harley Blackwell	++	+++	++	9-12
	King Harry (for organic production)	++	--	++	8-10
	Kueka Gold (pale yellow flesh)	++	+	+++	9-10
	NorDonna (red skin)	++	No	++	9-12
	Norkotah Russet	++	No	+	9-12
	Peter Wilcox (purple skin/yellow flesh)	++	No	++	8-10
	Purple Majesty (purple skin/purple flesh)	++	++	++	9-12
	Reba[5]	+++	++	++	7- 9
	Sebec	+	+++	++	8-10
	Yukon Gold[5] (yellow flesh)	+++	No	++	8-10
Late	Gold Rush	+++	No	++	8-10
	Katahdin (LR resistant)	++	No	+++	8-10
	Kennebec (VW susceptible, LB tolerant) (not for eastern VA)	++	No	+++	7-10
	Lehigh (yellow flesh)	+++	++	+++	8-10
	Marcy	++	+++	+++	7- 9
	Snowden (for chips only)	No	+++	++	8-10

[1]**Listed alphabetically within maturity group**. [2]LR=Leaf Roll, LB=Leaf Blight, S=Scab, VW=Verticillium Wilt. [3]+=fair, ++= good, +++= excellent. [4]Tubers are extremely susceptible to internal necrosis and hollow heart. [5]Tubers are susceptible to hollow heart during cool growing seasons. Apply one-third of the N at planting and sidedress the remainder when plants are 4-6 inches tall to help reduce hollow heart.

Recommended Nutrients Based on Soil Tests

In addition to using the table below, check the suggestions on rate, timing, and placement of nutrients in your soil test report and Chapter B Soil and Nutrient Management. Your state's soil test report recommendations and/or your farm's nutrient management plan supersede the recommendations found below.

		Soil Phosphorus Level				Soil Potassium Level				
		Low	Med	High (Opt)	Very High	Low	Med	High (Opt)	Very High	
	N (lb/A)	P_2O_5 (lb/A)				K_2O (lb/A)				Nutrient Timing and Method
Potatoes[1,2]	150-180[3]	200	150	100	0[4]	300	200	100	0[4]	Total nutrient recommended
	50	200	150	100	0[4]	300	200	100	0[4]	Broadcast and disk-in
	100	0	0	0	0	0	0	0	0	Sidedress 4-5 weeks after planting
	0-30[3]	0	0	0	0	0	0	0	0	Adjust rate based on petiole nitrate testing at flowering

[1]Apply 1 lb/A of boron (B) with broadcast fertilizer; see also Table B-7. in Chapter B Soil and Nutrient Management. [2]Apply 20 to 30 lb/A of sulfur (S) for most soils. [3]For high yielding crop systems (>250 cwt/A), an extra split N application at flowering may be useful. [4] In VA, crop replacement values of 50 lb/A of P_2O_5 and 50 lb/A of K_2O are recommended on soils testing Very High; additionally total nitrogen should be maintained under 150 lb/A.

Plant Tissue Testing

Plant tissue testing can be a valuable tool to assess crop nutrient status during the growing season to aid with in-season fertility programs or to evaluate potential deficiencies or toxicities. Critical potato tissue test values for most recently matured leaves at first flower are: N 3-4 %, P 0.2-0.5 %, K 3-5 %, Ca 0.6-2 %, Mg 0.25-0.6% and S 0.2-0.5 %. For additional nutrients and other growth stages consult with a tissue testing laboratory or this web link at the University of Florida: *https://edis.ifas.ufl.edu/publication/ep081*.

Site Selection, Soil Preparation and Fertilization

The best soils are well-drained, deep, well aerated, sandy, and sandy loam soils high in organic matter (especially muck soils). Avoid heavy soils and soils that adhere to tubers. Ideally, the planting site should have a low to moderate slope to avoid water accumulation near the plants. Use crop rotation to decrease the incidence of soil-borne diseases. Avoid fields that have had potatoes in the past 2 years, and those with high nematode populations. Test the soil for nematodes and fertility. Soil compaction reduces the available space for water and oxygen, resulting in a substantial reduction of potato yield. Avoid field operations when the soil is too wet. Vary the depth of tillage from year to year to reduce the chances of developing a hard pan. Incorporate green manure crops and deep-rooted cover crops to help increase soil organic matter, improve soil drainage, and return considerable amounts of crop residue to the soil. Optimum soil pH is 5.5 to 6.5. All P and K can be applied before planting. Split the recommended N (See table: Recommended Nutrients Based on Soil Tests above).

Seed-Piece Treatment Use certified seed. See Disease Control below.

Planting and Spacing

The recommended planting dates are March 10 to April 5 in MD and coastal VA, March 20 to April 15 in DE, March 20 to April 25 in NJ, and March 25 to June 5 in PA. Space seed 7 to 12 inches apart in 34 or 36-inch rows. Use close spacing for large seed pieces and wider spacing for whole (B-size) seed. Use close spacing for potatoes that are to be marketed in 5 and 10-pound consumer packs, and for 'Katahdin' and 'Kennebec', which tend to produce few oversized tubers.

Irrigation

Soil moisture and irrigation management are key for the success of the crop (see Chapter C Irrigation Management). Shortage of water may reduce tuber size and increase deformation, but water excess may promote late blight and other soil-borne diseases. Overhead irrigation in combination with crop evapotranspiration estimations can be used to supply the crop irrigation requirements. The critical stage for irrigating potatoes is in early tuber formation and tuber bulking. Potatoes are extremely sensitive to both excessive and deficient water applications. An effective potato irrigation plan requires regular monitoring of the soil water content and an irrigation schedule based on quantitative measurements. Plant available soil water should be maintained above 65% to avoid yield and quality losses. The optimum range for planting is about 70-80%. Soils that are too wet may slow down soil warming and delay sprout development and emergence early in the season. Cool, wet soils can increase seed decay. Available soil water should be allowed to decrease to 60-65% at vine kill. Dry soils during vine kill will increase the chances of developing stem-end discoloration.

Harvest and Storage Considerations

Monitor environmental conditions prior to harvest to determine potential incidence of a disorder associated with adverse conditions (see Common Physiological Disorders below). Pre-harvest conditioning in potato is critical to set the skin and facilitate harvest. In early harvests, vine killing can hasten or improve skin set on relatively immature potatoes, thus reducing tuber damage during harvest, grading, packing, and shipping. Tubers stop growing after vine killing and proper skin set improves shelf life, promotes retention of potato quality during transport, and improves eye appeal. Chemical vine killing is the most common method (see Vine Killing below), but mechanical vine killing (mowing) is also used. Vines of potatoes going into storage should be completely dead at least 14-21 days before harvest. Use potato chain diggers or other means of bulk-harvest with appropriate design to reduce bruises. After harvest, healing of cuts and bruises is most rapid at 50-60°F (10-16°C) tuber temperature and 90-95% relative humidity without water condensation. This temperature should be maintained for 2-3 weeks at the beginning of the storage period. The temperature should then be lowered to 40°F (4°C) for table stock or seed potatoes.

Potatoes for processing are stored at 45-50°F (7-10°C). If a rot-producing agent such as field frost, late blight, or soft rot is present, the curing period should be eliminated, air flow increased, and the temperature lowered to 45°F (7°C) as soon as possible. Monitor the storage daily and, if the rot continues, sell the crop immediately.

Common Physiological Disorders

Disorders that are associated with adverse environmental conditions or cultural practices are listed below.

Disorder	Primary Cause	Occurrence	Market Effect
Blackheart	low oxygen, wet soil	bulking, storage	quality, poor processing
Brown center and hollow heart	rapid growth after stress	early to mid-bulking	quality, poor processing
Chaining	hot soil	mid-bulking	yield (size)
Chilling, Freezing	low temperature	harvest, storage	quality, yield prone to rots
Deformation	growth stops and go	bulking	quality
Greening	Light	bulking, storage	quality
Growth crack	wet/dry soil	bulking	quality
Heat necrosis	heat, acid soil (low Ca)	harvest	quality, yield, poor processing
Heat and hair sprouting	hot soil	late bulking, early storage	quality, yield, poor processing
Internal sprouting	piling, sprout inhibition	storage	quality, poor seed
Jelly End, Glassy End	fast vine death, low moisture	harvest	poor processing
Swollen lenticel	wet soil	bulking, harvest	storage rots
Vascular discoloration	fast vine death, low moisture	harvest	poor processing

Air Pollution

Symptoms appear as tiny spots of brown tissue on the upper surface of leaves and a bronzing of the lower surfaces. Some varieties (*e.g.*, Snowden) are particularly sensitive.

Vine Killing

Vine desiccation facilitates harvesting by reducing potato and weed foliage, and to set the skin when done 2 to 3 weeks before harvest. Decisions as to when to kill the vines are based on market, demand for a given size, and the need for non-skinned tubers.

Group	Product Name (*=Restricted Use)	Product Rate	Active Ingredient	Active Ingredient Rate	PHI (d)	REI (h)
10	Rely 280 2.34L, Scout 2.34L, Interline 2.34L	21 fl oz/A	**glufosinate**	0.38 lb/A	9	12
-Apply at the beginning of natural vine senescence in a single application. Cover vines thoroughly. -**Do not** apply to potatoes grown for seed. **Do not** plant treated areas with wheat, barley, and other small grains until 30 or more days after application. Refer to label for rotational restrictions. The presence of heavy or dense vines may require an application of another desiccation product (*i.e.*, Reglone). Rainfastness is 4 h. **Do not** apply more than 1 application per harvest.						
22	Reglone 2SL	1 to 2 pt/A	**diquat**	0.25 to 0.5 lb/A	7	24
-Add a non-ionic surfactant 0.5% v/v (2 qt/100 gal). Ground application in a minimum of 20 gal/A of water. -**Do not** apply to drought stressed potatoes. If a second application is necessary, allow at least 5 days between applications. -Rainfastness is 30 min. Maximum application of Reglone per season is 4 pt/A						

Other Labeled Products These products are labeled but limited local data is available; and/or are labeled but not recommended in our region due to potential crop injury concerns.

Group	Product Name (*=Restricted Use)	Active Ingredient
14	Aim	**carfentrazone**
14	Vida	**pyraflufen**
22	Generic paraquat*	**paraquat**
--	Defol 5	**sodium chlorate**

Sprout Inhibitors

Group	Product Name (*=Restricted Use)	Product Rate	Active Ingredient	Active Ingredient Rate	PHI (d)	REI (h)
--	Sprout Nip 3EC	Apply at 1% emulsion	**chlorpropham**	0.01 lb ai/1100 lb potatoes	--	--
-Refer to label for respirator and other PPE requirements. **Do not** use on seed potatoes. -Use to treat potatoes after storage and washing; use only after bruises and cuts have healed (normally a minimum of 2 weeks) -Use at 1% emulsion by diluting 1 gal of Sprout Nip 3EC to 35 gal of water. -Apply at a rate of 1 qt of 1% emulsion per 20 bags of potatoes (100 lb/bag). Only one application is allowed. -Spray uniformly across rollers moving the potatoes.						
--	MH-30	5 lb/A	**maleic hydrazide**	0.01 lb ai/1100 lb potatoes	--	12
-Apply in minimum of 30 gallons of water per acre. Apply 2 to 3 weeks past full bloom. Applying too early will result in undersized tubers.						

Weed Control

THE LABEL IS THE LAW-see the Pesticide Use Disclaimer on the first page of Chapter F.

Recommended Herbicides

1. Identify the weeds in each field and select recommended herbicides. More information is available in the "Herbicide Effectiveness on Common Weeds in Vegetables" (Table E-3) in Chapter E Pest Management.

2. Minimize herbicide resistance development. Identify the herbicide mode of action group number and follow recommended good management practices; **bolded group numbers in tables below are herbicides at higher risk for selecting resistant weed populations.** Include non-chemical weed control whenever possible.

1. Non-Selective or Burndown

Group	Product Name (*=Restricted Use)	Product Rate	Active Ingredient	Active Ingredient Rate	PHI (d)	REI (h)
9	Roundup PowerMax 4.5L "Generic" glyphosate 3L	16 to 32 fl oz/A 24 to 48 fl oz/A	**glyphosate**	0.75 to 1.10 lb acid equivalent/A	--	4
-Apply prior to planting. Some glyphosate formulations may require an adjuvant, refer to label. -Glyphosate controls many perennial weeds as well as annuals if applied when the weed is actively growing and has reached the stage of growth listed on the label. Repeat applications are allowed, with maximum application of 5.3 qt/A per year.						
22	Gramoxone SL 2.0* Gramoxone SL 3.0*	1 to 2 pt/A 0.7 to 1.3 pt/A	**paraquat**	0.25 to 0.5 lb/A	--	24
-Apply up to ground cracking, before potato has emerged. Always include an adjuvant (nonionic surfactant or crop oil concentrate). -Tank mix with appropriate herbicides for residual weed control. Paraquat may not control established grasses. Spray coverage is essential for optimum control. -Rainfastness 30 min. -A maximum of 3 applications per year are allowed. -***Restricted-use pesticide***. Only certified applicators, who successfully complete the paraquat-specific training, can mix, load, or apply paraquat. Application of paraquat "under the direct supervision" of a certified applicator is no longer allowed. Required training link (*https://campus.extension.org/enrol/index.php?id=2201*); certified applicators must repeat training every three years.						

2. Soil-Applied (Preemergence/Drag-Off)

Group	Product Name (*=Restricted Use)	Product Rate	Active Ingredient	Active Ingredient Rate	PHI (d)	REI (h)
2	Matrix 25DF or Solida 25DF	1.0 to 1.5 oz/A	**rimsulfuron**	0.0156 to 0.023 lb/A	60	4
-Apply immediately after hilling or drag-off. -Apply with nonionic surfactant at 0.25% v/v (1.0 qt/100 gal of spray solution) if weeds are emerged at the time of application. -Controls many weeds including foxtail species, pigweed species, wild mustard, and wild radish. Suppresses common lambsquarters, common ragweed, jimsonweed, morningglory species, and yellow nutsedge. Tank mix with other residual products to improve spectrum of weed control. Control may be reduced if grasses are large or if hot, dry weather or drought conditions occur. -Yellow nutsedge, wild onion, or broadleaf weeds will **not** be controlled. -Repeated applications may be needed to control certain perennial grasses. -Temporary chlorosis may occur to potatoes under stress from drought, cold temperatures, high temperatures, or extreme temperature variations. -**Do not** tank mix with or apply within 1 week before or after any pesticide unless labeled. The risk of crop injury may be increased, or reduced control of grasses may result. Matrix is an ALS inhibiting herbicide and resistant weed populations are common in the region. **Do not** use Group 2 herbicides repeatedly in the same field. -Maximum for Matrix: 2.5 oz/A per year.						
3	Prowl H2O 3.8CS Prowl 3.3 EC	1.5 to 3.0 pt/A 1.8 to 3.6 pt/A	**pendimethalin**	0.71 to 1.43 lb/A	--	24
-Apply preemergence after planting, but before potatoes and weeds emerge, or after drag-off. -Activity of Prowl H2O is improved by incorporation. Apply preemergence incorporated after planting but before potatoes and weeds emerge. Where drag-off is practiced, apply and incorporate before, at, or after drag-off, but before potatoes and weeds emerge. -Ensure incorporation equipment does not damage seed pieces or elongating sprouts. -Prowl H2O controls certain broadleaf weeds and annual grasses. Does not control yellow nutsedge. -Use lower rates on coarse-textured soils with < 3% organic matter and higher rates on medium- and fine-textured soil with > 3% organic matter. Tank mix with appropriate postemergence herbicides if weeds are emerged at time of application. Tank mix with other residual herbicides such as Lorox or Metribuzin to improve broadleaf control. -Application to 'White Rose' variety during or followed by cool and/or wet conditions may result in crop injury. -A maximum of 1 application per season is allowed.						
3	Sonalan HFP 3EC	1.3 to 2.67 pt/A	**ethalfluralin**	0.49 to 1.0 lb/A	--	24
-Apply after planting but before potato emergence. -Use lower rates on coarse-textured soils and higher rates on medium- and fine-textured soil. -Must be incorporated for maximum effectiveness. Rainfall or irrigation (0.5 to 1 inch) is sufficient for incorporation. If rainfall or irrigation does not occur within 2 days of application, mechanical incorporation in the top 2 to 3 inches of soil is recommended. Ensure incorporation equipment does not						

2. Soil-Applied (Preemergence/Drag-Off) Sonalan - continued next page

2. Soil-Applied (Preemergence/Drag-Off) Sonalan - continued

damage seed pieces or elongating sprouts. -Sonalan controls certain broadleaf weeds and annual grasses. Does not control yellow nutsedge, and only provides suppression of eastern black nightshade. -Maximum application is 2.67 pt/A/season.						
5	Metribuzin 75DF Metribuzin 4L	0.33 to 0.66 lb/A 0.5 to 1 pt/A	**metribuzin**	0.25 to 0.5 lb/A	60	12
-Apply just prior to emergence or after drag-off. Metribuzin primarily controls broadleaf weeds and is weak on grasses. -Tank mix with Dual Magnum or Prowl H2O or use in addition to Eptam for preemergence annual grass control. -Pre-mixes of Dual Magnum and metribuzin are sold under the trade names Boundary and Moccasin MTZ. -Metribuzin has some postemergence activity. To get consistent control, apply metribuzin before weeds are 1 inch tall. -Tank mix with appropriate postemergence herbicides if weeds are emerged at time of application. -Preemergence application to 'Atlantic' and 'Norland' or to any early maturing, smooth, white- or red-skinned potato varieties, may cause crop injury, especially under adverse weather conditions and when higher labeled rates are used. -'Atlantic', 'Bellchip', 'Centennial', 'Chipbell', and 'Shepody' are sensitive to metribuzin and may be injured by preemergence applications under adverse weather conditions on coarse soils, under high soil pH, with higher rates, and with mechanical incorporation. -Maximum for metribuzin 75DF: May be applied once preemergence and once postemergence. **Do not** exceed 1.33 lb/A per season of metribuzin 75DF or 2 pt/A of metribuzin 4L.						
7	Lorox 50DF Linex 4L	0.8 to 2.0 lb/A 0.75 to 2 pt/A	**linuron**	0.4 to 1.0 lb/A	--	24
-Apply just prior to emergence or after drag-off. -Primarily controls broadleaf weeds and is weak on grasses. Tank mix with Dual Magnum for preemergence annual grass control. -Use lower rates on coarse-textured soil low in organic matter and higher rates on medium- or fine-textured soils with greater organic matter. Linuron has some postemergence activity. To get consistent control, apply just before or when weed seedlings emerge. If weeds are emerged add a nonionic surfactant at 0.5% v/v (2 qt/100 gal spray solution). -Maximum for Lorox: 3 lb/A per year. Maximum for Linex: 3 pt/A per year.						
8	Eptam 7E	3.4 to 5.1 pt/A	**EPTC**	3.0 to 4.5 lb/A	30	12
-Apply at one of the following timings: 1) just before planting and disking. For plantings before April 1, Eptam may reduce early vigor and yields slightly; 2) just after drag-off and incorporate with 1 or 2 cultivations by a spike-tooth harrow or similar piece of equipment; and 3) just before first or second cultivation. -Eptam controls annual grasses, yellow nutsedge, and a few broadleaf weeds. Tank mix with Lorox or metribuzin to improve broadleaf weed control. Maximum for Eptam: 14 pt/A per season.						
14	Reflex 2SL	0.75 to 1.0 pt/A	**fomesafen**	0.188 to 0.25 lb/A	70	24
-Apply after planting but before potato emergence. **Do not** apply preplant incorporated nor apply to emerged potatoes or severe injury will occur. Reflex primarily controls broadleaf weeds and is weak on grasses. -Tank mix with Dual Magnum, Prowl H2O, or use in addition to Eptam for preemergence annual grass control. The Reflex rate labeled for potato is lower than for other crops due to crop safety concerns. -Reflex has postemergence activity. To get consistent control, apply before weeds reach 4 inches. -Potato varieties vary in response to Reflex. Determine crop tolerance before using. -Maximum for Reflex 2SL: 1 pt/A per season on potatoes. Maximum fomesafen for all crops: NJ and most of PA 0.313 lb ai/A in alternate years; DE, MD, VA, and parts of PA 0.375 lb ai/A in alternate years.						
15	Dual Magnum 7.62E	1.0 to 2.0 pt/A	***s*-metolachlor**	0.96 to 1.91 lb/A	60	24
-Apply preplant incorporated, postplant incorporated up to drag-off, preemergence, delayed preemergence, or after drag-off prior to emergence of potatoes and weeds. If incorporate, use appropriate equipment to evenly distribute the herbicide into the top 2 to 3 inches of soil. Ensure incorporation equipment does not damage seed pieces or elongating sprouts. -Dual Magnum controls most annual grasses (except Texas panicum), small seeded broadleaf weeds, and suppresses yellow nutsedge. -Tank mix with Lorox or metribuzin for additional broadleaf weed control. -Pre-mixes of Dual Magnum and metribuzin are sold under the trade name Boundary or Moccasin MTZ. -If cool, wet soil conditions occur after application, *s*-metolachlor may delay maturity and/or reduce yield of 'Superior' and other early maturing potato varieties. **Do not** use on muck or peat soils. **Do not** apply both a preemergence and an incorporated treatment. -Maximum for Dual Magnum: 3.6 pt/A per crop season.						
15	Outlook 6E	12 to 21 fl oz/A	**dimethenamid**	0.56 to 0.98 lb/A	40	12
-Apply preemergence after planting or dragoff, but before potatoes and weeds emerge. -Apply as a single application. -Application under cold conditions may cause delayed emergence or early season stunting. -Outlook controls annual grasses and broadleaves such as pigweed, lambsquarters, nightshade, common ragweed etc. Suppresses yellow nutsedge. -Use lower rates on coarse-textured soils with < 3% organic matter and higher rates on medium- and fine-textured soil with > 3% organic matter. Tank mix with appropriate postemergence herbicides if weeds are emerged at time of application. Tank mix with other residual herbicides such as Lorox or Metribuzin to improve broadleaf control.						

3. Postemergence

Group	Product Name (*=Restricted Use)	Product Rate	Active Ingredient	Active Ingredient Rate	PHI (d)	REI (h)
1	Shadow 3EC Select 2EC Select Max 0.97EC	4 to 10.67 fl oz/A 6 to 8 fl oz/A 9 to 32 fl oz/A	**clethodim**	0.07 to 0.242 lb/A	30	24
	Poast 1.5EC	1.0 to 2.5 pt/A	**sethoxydim**	0.2 to 0.47 lb/A	30	12

3. Postemergence (Shadow, Select, Select Max, Poast) - continued next page

3. Postemergence (Shadow, Select, Select Max, Poast) - continued

-**Select 2EC**: use crop oil concentrate (COC) at 1% v/v (1 gal/100 gal of spray solution). **Select Max**: use nonionic surfactant (NIS) at 0.25% v/v (1 qt/100 gal of spray solution). **Shadow 3EC**: use crop oil concentrate (COC) at 1% v/v (1 gal/100 gal of spray solution) for large or stressed grasses; use nonionic surfactant (NIS) at 0.25% v/v (1 qt/100 gal of spray solution) when crop safety is a concern. **Poast**: use COC at 1.0% v/v. -**The use of COC may increase the risk of crop injury when hot or humid conditions prevail**. To reduce the risk of crop injury, omit additives or switch to NIS when grasses are small and soil moisture is adequate. -Use lower labeled rates for annual grass control and higher labeled rates for perennial grass control. -Yellow nutsedge, wild onion, wild garlic, and broadleaf weeds will **not** be controlled. Controls many annual and certain perennial grasses, including annual bluegrass, but Poast is preferred for goosegrass control. For best results, treat annual grasses when they are actively growing and before tillers are present. Control may be reduced if grasses are large or under hot or dry weather conditions. -Repeated applications may be necessary to control certain perennial grasses. If repeat applications are necessary, allow 14 days between applications. Rainfastness is 1 h. -**Do not** tank mix with or apply within 2 to 3 days of any other pesticide, unless labeled, as this may increase the risk of crop injury or reduce the control of grasses. -**Do not** apply more than 8 fl oz/A of Select in a single application and **do not** exceed 2 pt/A for the season; **do not** apply more than 32 fl oz/A of Select Max in a single application and **do not** exceed 4 pt/A for the season. **-Do not** apply more than 10.67 fl oz/A of Shadow 3EC in a single application and **do not** exceed 21.33 fl oz/A for the season -**Do not** apply more than 2.5 pt/A Poast in a single application and **do not** exceed 5 pt/A for the season.						
2	Matrix 25DF or Solida 25DF	1.0 to 1.5 oz/A	**rimsulfuron**	0.0156 to 0.023 lb/A	60	4
-Apply early postemergence; typically weeds at 1 inch tall or less; crop stage is not defined on label. -Apply with nonionic surfactant at 0.25% v/v (1.0 qt/100 gal of spray solution). -Controls many small weeds including foxtail species, pigweed species, wild mustard, and wild radish. Suppresses common lambsquarters, common ragweed, jimsonweed, morningglory species, and yellow nutsedge. -Temporary chlorosis may occur to potatoes under stress from drought, cold or high temperatures, or extreme temperature variations. -Matrix provides both residual and postemergence control of susceptible weed species. Matrix is an ALS inhibiting herbicide and resistant weed populations are common in the region. **Do not** use Group 2 herbicides repeatedly in the same field. -Rainfastness is 4 h. -Maximum for Matrix: 2.5 oz/A per year.						
5	Metribuzin 75DF Metribuzin 4L	0.33 to 0.66 lb/A 0.5 to 1 pt/A	**metribuzin**	0.25 to 0.50 lb/A	60	12
-Apply just prior to emergence or after drag-off. Metribuzin primarily controls broadleaf weeds and is weak on grasses. -Tank mix with Dual Magnum or Prowl H2O or use in addition to Eptam for preemergence annual grass control. -Metribuzin has some postemergence activity. To get consistent control, apply metribuzin before weeds are 1 inch tall. -Tank mix with appropriate postemergence herbicides if weeds are emerged at time of application. -Postemergence application can used only on russet or white-skinned varieties that are not early maturing. **Do not** use on red-skinned or early maturing, smooth, white-skinned varieties. -Potato varieties vary in sensitivity to metribuzin. Determine tolerance on a trial basis before using on field scale. 'Atlantic', 'Bellchip', 'Centennial', 'Chipbell', and 'Shepody' are sensitive to metribuzin. Avoid postemergence applications to these varieties. -Apply only if there have been at least three successive sunny days prior to application. May cause some chlorosis or minor necrosis. -Maximum for metribuzin 75DF: 0.66 lb/A postemergence or metribuzin 4L: 1 pt/A. May be applied once preemergence and once postemergence. -**Do not** exceed 1.33 lb/A per season of metribuzin 75DF or 2 pt/A per season of metribuzin 4L. -Rainfastness is 6 h.						

4. Other Labeled Herbicides These products are labeled but limited local data are available; and/or are labeled but not recommended in our region due to potential crop injury concerns.

Group	Product Name (*=Restricted Use)	Active Ingredient
2	League	**imazosulfuron**
3	Treflan	**trifluralin**
14	Chateau	**flumioxazin**
15	Zidua SC	**pyroxasulfone**

Insect Control

THE LABEL IS THE LAW-see the Pesticide Use Disclaimer on the first page of Chapter F.

Recommended Insecticides

Soil Pests

Wireworms

See also section E 3.1. Soil Pests - Detection and Control.

(continued next page)

Wireworms - continued

Apply one of the following formulations:						
Group	**Product Name (*=Restricted Use)**	**Product Rate**	**Active Ingredient(s)**	**PHI (d)**	**REI (h)**	**Bee TR**
Preplant Application: Broadcast and incorporate just before planting.						
1B	Mocap EC*	2/3 to 1.0 gal/A (broadcast), 4.4 fl oz/1000 row ft (banded)	ethoprop	AP	48	H
3A	Brigade 2EC*, others	9.6 to 19.2 fl oz/A	bifenthrin	21	12	H
3A	Capture LFR*	12.75 to 25.5 fl oz/A	bifenthrin	n/a	12	H
Planting Application						
1B	Mocap EC*	2/3 to 1.0 gal/A (broadcast), 4.4 fl oz/1000 row ft (banded)	ethoprop	AP	48	H
1B	Thimet 20G*	Light or sandy soil: 8.5-11.3 oz/1000 ft Heavy or clay soil: 13-17.3 oz/1000 ft	phorate	90	48	H
2B	Regent 4SC*	2.9 to 3.2 fl oz/A (see label for rate based on row spacing)	fipronil	90	0	H
3A	Brigade 2EC*, others	9.6 to 19.2 fl oz/A	bifenthrin	21	12	H
3A	Capture LFR*	12.75 to 25.5 fl oz/A	bifenthrin	n/a	12	H
3A	Ethos XB*	12.75 to 25.5 fl oz/A	bifenthrin + *Bacillus amyloliquefaciens*	n/a	12	H
3A+4A	Brigadier*	16.0 to 25.6 fl oz/A	bifenthrin +imidacloprid	21	12	H
30	Nurizma	0.08 to 0.16 fl oz/ 1000 row ft	broflanilide	AP	12	H
Lay-by Application						
1B	Thimet 20G*	8.5 to 11.3 oz/1000 ft	phorate	90	48	H
3A	Brigade 2EC*, others	3.2 to 9.6 fl oz/A	bifenthrin	21	12	H
3A	Capture LFR*	12.75 to 25.5 fl oz/A	bifenthrin	n/a	12	H
3A	Ethos XB*	12.75 to 25.5 fl oz/A	bifenthrin + *Bacillus amyloliquefaciens*	n/a	12	H
Systemic Foliar Application at Flowering						
23	Movento	4.0 to 5.0 fl oz/A	spirotetramat	7	24	L
23	Movento HC	2.0 to 2.5 fl oz/A	spirotetramat	7	24	L

Above-ground Pests

Aphids

Insecticide treatments are recommended when aphid counts exceed 2 per leaf prior to bloom, 4 per leaf during bloom, and 10 per leaf within 2 weeks of vine kill. Apply one of the following formulations:

Group	Product Name (*=Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
1A	Lannate LV*	1.5 to 3.0 pt/A	methomyl	6	48	H
1B	Dimethoate 400	0.5 to 1.0 pt/A	dimethoate	0	48	H
3A	Pyrethroid insecticides registered for use on Potatoes: see table at the end of Insect Control.					
4A	Neonicotinoid insecticides registered for use on Potatoes: see table at the end of Insect Control.					
4D	Sivanto Prime or 200SL	7.0 to 14.0 fl oz/A	flupyradifurone – **foliar**	7	4	M
4C	Transform WG	0.75 to 1.5 oz/A	sulfoxaflor	7	24	H
4C + 3A	Ridgeback*	4.5 to 13.8 fl oz/A	sulfoxaflor + bifenthrin	21	24	H
7C + 23	Senstar (broad mite only)	8.0 to 10.0 fl oz/A	pyriproxyfen + spirotetramat	7	24	L
9B	Fulfill 50WDG	2.75 to 5.5 oz/A	pymetrozine	14	12	L
21A	Torac	14.0 to 2.01 fl oz/A	tolfenpyrad	21	12	H
23	Movento	4.0 to 5.0 fl oz/A	spirotetramat	7	24	L
23	Movento HC	2.0 to 2.5 fl oz/A	spirotetramat	7	24	L
28 + 6	Minecto Pro*	10.0 fl oz/A	cyantraniliprole + abamectin	14	12	H
29	Beleaf 50SG	2.0 to 2.8 oz/A	flonicamid	7	12	L

Colorado Potato Beetles (CPB) – Preplant or Planting Application

Pesticide Resistance Management:

Do not rely exclusively on the neonicotinoid class of insecticides (Class 4: Actara, Assail, Cruiser, Gaucho, imidacloprid, Leverage 360, Platinum, Scorpion, or Venom) for CPB control. It is important to use all available effective pest management strategies, including crop rotation, pest scouting, treatment thresholds, and alternative

(different class) insecticides, such as abamectin (Agri-Mek), Blackhawk, Coragen, Entrust, Radiant, Rimon, Verimark, Voliam Xpress, or Vydate.

For rotated fields adjacent to CBP overwintering sites or to previous year's potato fields, most of the colonizing adults can be killed by treating only a strip of rows along the field edge where the invasion front is expected. Fields should still be monitored for beetles and other insect pests throughout the season.

DO NOT use foliar applications of any neonicotinoid insecticide (clothianidin, imidacloprid, thiamethoxam, dinotefuron, acetamiprid) in fields previously treated with seed-treatment or at-planting neonicotinoids.

Apply one of the following formulations. PREPLANT OR PLANTING APPLICATION						
Group	**Product Name (*=Restricted Use)**	**Product Rate**	**Active Ingredient(s)**	**PHI (d)**	**REI (h)**	**Bee TR**
4A	Neonicotinoid insecticides registered for use on Potatoes: see table at the end of Insect Control.					
28	Verimark	6.75 to 13.5 fl oz/A	cyantraniliprole	AP	4	H

Colorado Potato Beetles - Postemergence Application

Rotation to non-solanaceous crops (crops other than potato, tomato, eggplant, and pepper) is extremely important in reducing CPB problems. Avoid applying late-season sprays to prevent the buildup of insecticide-resistant beetles.

Beginning at plant emergence, sample fields weekly for CPB to determine the need to spray. Select at least 10 sites per field along a V- or W-shaped path throughout the field. At each site, select 1 stem from each of 5 adjacent plants and count and record all adults, large larvae (larger than half-grown), and small larvae (smaller than half-grown). If more than 50 adults or 75 large larvae or 200 small larvae are counted per 50 stems, treatment is recommended. Yield loss because of CPB feeding depends on the age of the potato plant. 'Superior' variety (short season) cannot compensate for early season defoliation by overwintered beetles, but during the last 30 days of the season, 'Superior' can withstand up to 50% defoliation without yield loss.

Note: Several of these insecticides may no longer be effective in certain areas due to CPB resistance. Check with your county Extension agent for most effective control.

Apply one of the following formulations. POSTEMERGENCE APPLICATION						
Group	**Product Name (*=Restricted Use)**	**Product Rate**	**Active Ingredient(s)**	**PHI (d)**	**REI (h)**	**Bee TR**
1B	Imidan 70W	1.33 lb/A	phosmet	7	120	H
3A	Pyrethroid insecticides registered for use on Potatoes: see table at the end of Insect Control.					
4A	Neonicotinoid insecticides registered for use on Potatoes: see table at the end of Insect Control.					
4D	Sivanto Prime or 200SL	10.5 to 14.0 fl oz/A	flupyradifurone	7	4	M
5	Blackhawk 36WG	1.7 to 3.3 oz/A	spinosad	7	4	M
5	Radiant SC	4.5 to 8.0 fl oz/A	spinetoram	7	4	M
6	Agri-Mek SC*	1.75 to 3.5 fl oz/A	abamectin	14	12	H
11A	Trident (OMRI)	3.0 to 6.0 qt/A	*Bacillus thuringiensis tenebrionis*	0	4	L
15	Rimon 0.83EC	6.0 to 12.0 fl oz/A	novaluron	14	12	M
17	Trigard 75WSP	2.66 to 5.32 oz/A	cyromazine	17	12	H
21A	Torac	14 to 21 fl oz/A	tolfenpyrad	21	12	H
22	Avaunt 30WDG, Avaunt eVo	3.5 to 6.0 oz/A	indoxacarb	7	12	H
28	Coragen 1.67SC Coragen eVo	3.5 to 5 fl oz/A 1.2 to 2.5 fl oz/A	chlorantraniliprole **- foliar**	14	4	L
28	Exirel	5.0 to 13.5 fl oz/A	cyantraniliprole	7	12	H
28	Vantacor	1.2 to 2.5 fl oz/A	chlorantraniliprole **- foliar**	14	4	L
28 + 3	Elevest*	5.6 to 9.8 fl oz/A	bifenthrin + chlorantraniliprole	21	12	H
28 + 6	Minecto Pro*	5.5 to 10.0 fl oz/A	cyantraniliprole + abamectin	14	12	H
UN	Azatin O, Aza-Direct, Ecozin, Neemix (OMRI)	Refer to individual labels for rates	azadirachtin	0	4	L
UN+3A	Azera (OMRI)	2.0 to 35 pt/A	azadirachtin + pyrethrins	0	12	H

Cutworms See also section E 3.1. Soil Pests - Detection and Control.

Present during July and August. Especially troublesome to tubers where soil cracking occurs. Variegated cutworms feed on lower leaves and petioles, and protective sprays should be applied if numbers exceed 6 worms per plant or foliar loss is more than 10%. Black cutworms are largely underground feeders but will occasionally feed on leaves.

Apply one of the following formulations. Note: No materials are effective if larvae do not feed above ground (foliar and systemic insecticides are ineffective). Several spray applications may be required for control.

Cutworms - continued

Group	Product Name (*=Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
1A	Lannate LV*	1.5 pt/A	methomyl	6	48	H
1A	Sevin XLR Plus	1.0 to 2.0 qt/A	carbaryl	7	12	H
3A	Pyrethroid insecticides registered for use on Potatoes: see table at the end of Insect Control.					

European Corn Borers (ECB)

Proper timing of ECB sprays is critical. Apply the first spray when 10% of the stems have entry holes in fresh market varieties or 25% in processing varieties. Make 2 to 3 applications on a 5-10-day schedule. Consult your county Extension agent and/or area pest management newsletter.

Apply one of the following formulations:						
Group	**Product Name (*=Restricted Use)**	**Product Rate**	**Active Ingredient(s)**	**PHI (d)**	**REI (h)**	**Bee TR**
3A	Pyrethroid insecticides registered for use on Potatoes: see table at the end of Insect Control.					
4A	Neonicotinoid insecticides registered for use on Potatoes: see table at the end of Insect Control.					
5	Blackhawk 36WG	1.7 to 3.3 oz/A	spinosad	7	4	M
5	Radiant SC	6.0 to 8.0 fl oz/A	spinetoram	7	4	M
15	Rimon 0.83EC	6.0 to 12.0 fl oz/A	novaluron	14	12	M
22	Avaunt 30WDG, Avaunt eVo	3.5 to 6.0 oz/A	indoxacarb	7	12	H
28	Coragen 1.67SC Coragen eVo	3.5 to 7.5 fl oz/A 1.2 to 2.5 fl oz/A	chlorantraniliprole - **foliar**	14	4	L
28	Exirel	7.0 to 13.5 fl oz/A	cyantraniliprole	7	12	H
28	Verimark	10.0 to 13.5 fl oz/A	cyantraniliprole	AP	4	H
28	Vantacor	1.2 to 2.5 fl oz/A	chlorantraniliprole - **foliar**	14	4	L
28 + 3	Elevest*	5.6 to 9.8 fl oz/A	bifenthrin + chlorantraniliprole	21	12	H
28 + 6	Minecto Pro*	5.5 to 10.0 fl oz/A	cyantraniliprole + abamectin	14	12	H

Flea Beetles

Apply one of the following formulations:						
Group	**Product Name (*=Restricted Use)**	**Product Rate**	**Active Ingredient(s)**	**PHI (d)**	**REI (h)**	**Bee TR**
1A	Lannate LV*	1.5 pt/A	methomyl	6	48	H
1B	Imidan 70W	1.33 lb/A	phosmet	7	120	H
3A	Pyrethroid insecticides registered for use on Potatoes: see table at the end of Insect Control.					
4A	Neonicotinoid insecticides registered for use on Potatoes: see table at the end of Insect Control.					

Potato Leafhoppers

Monitor fields for the buildup of leafhoppers from early June until early August. Treatment is suggested if leafhopper counts exceed 1 adult per sweep or 1 nymph per 10 leaves.

Apply one of the following formulations:						
Group	**Product Name (*=Restricted Use)**	**Product Rate**	**Active Ingredient(s)**	**PHI (d)**	**REI (h)**	**Bee TR**
1A	Lannate LV*	1.5 to 3.0 pt/A	methomyl	6	48	H
1A	Sevin XLR Plus	0.5 to 1 qt/A	carbaryl	7	12	H
1B	Dimethoate 400	0.5 to 1.0 pt/A	dimethoate	0	48	H
1B	Imidan 70W	1.33 lb/A	phosmet	7	120	H
3A	Pyrethroid insecticides registered for use on Potatoes: see table at the end of Insect Control.					
4A	Neonicotinoid insecticides registered for use on Potatoes: see table at the end of Insect Control.					
4C	Transform WG	1.5 to 2.75 oz/A	sulfoxaflor	7	24	H
4D	Sivanto Prime or 200SL	7 to 10.5 fl oz/A	flupyradifurone	7	4	M
21A	Portal	2.0 pt/A	fenpyroximate	7	12	L
21A	Torac	14 to 21 fl oz/A	olfenpyrad	21	12	H

Potato Tuberworms

Treat for tuberworms when foliage injury is first noted; 4 to 5 applications at 7 to 14 day intervals may be needed. Tuberworms are primarily a problem on the fall crop. Because moths are actively flying at dusk, sprays are most effective when applied early evening. *(continued next page)*

Potato Tuberworms - continued

Apply one of the following formulations:						
Group	**Product Name (*=Restricted Use)**	**Product Rate**	**Active Ingredient(s)**	**PHI (d)**	**REI (h)**	**Bee TR**
1A	Lannate LV*	1.5 to 3.0 pt/A	methomyl	6	48	H
3A	Pyrethroid insecticides registered for use on Potatoes: see table at the end of Insect Control.					
4A	Neonicotinoid insecticides registered for use on Potatoes: see table at the end of Insect Control.					
15	Rimon 0.83EC	6.0 to 12.0 fl oz/A	novaluron	14	12	M
28	Coragen 1.67SC Coragen eVo	3.5 to 7.5 fl oz/A 1.2 to 2.5 fl oz/A	chlorantraniliprole - **foliar**	14	4	L
28	Vantacor	1.2 to 2.5 fl oz/A	chlorantraniliprole - **foliar**	14	4	L
28 + 3	Elevest*	5.6 to 9.8 fl oz/A	bifenthrin + chlorantraniliprole	21	12	H
28 + 6	Minecto Pro*	5.5 to 10.0 fl oz/A	cyantraniliprole + abamectin	14	12	H

Group 3A Pyrethroid Insecticides Registered for Use on Potatoes

Apply one of the following formulations (check if the product label lists the insect you intend to spray; the label is the law):

Product Name (*=Restricted Use)	**Product Rate**	**Active Ingredient(s)**	**PHI (d)**	**REI (h)**	**Bee TR**
Asana XL*	2.9 to 9.6 fl oz/A	esfenvalerate	7	12	H
Baythroid XL*	0.8 to 2.8 fl oz/A	beta-cyfluthrin	0	12	H
Brigade 2EC*, others	2.1 to 19.2 fl oz/A	bifenthrin	21	12	H
Hero*	2.6 to 10.3 fl oz/A	zeta-cypermethrin + bifenthrin	21	12	H
Lambda-Cy 1EC*, others	1.92 to 3.84 fl oz/A	lambda-cyhalothrin	7	24	H
Mustang Maxx*	1.28 to 4.0 fl oz/A	zeta-cypermethrin	1	12	H
Permethrin 3.2EC*, others	4.0 to 8.0 fl oz/A	permethrin	14	12	H
Tombstone*	0.8 to 2.8 fl oz/A	cyfluthrin	0	12	H
Warrior II*	0.96 to 1.92 fl oz/A	lambda-cyhalothrin	7	24	H
Combo products containing a pyrethroid					
Besiege*	5.0 to 9.0 fl oz/A	lambda-cyhalothrin + chlorantraniliprole (Group 28)	14	24	H
Brigadier*	16.0 to 25.6 fl oz/A	bifenthrin + imidacloprid (Group 4A) - **soil**	21	12	H
Brigadier*	3.8 to 6.14 fl oz/A	bifenthrin + imidacloprid (Group 4A) - **foliar**	21	12	H
Elevest*	3.9 to 9.6 fl oz/A	bifenthrin + chlorantraniliprole (Group 28)	21	12	H
Endigo ZC*	3.5 to 4.5 fl oz/A	lambda-cyhalothrin + thiamethoxam (Group 4A)	14	24	H
Endigo ZCX*	3.0 to 3.5 fl oz/A	lambda-cyhalothrin + thiamethoxam (Group 4A)	14	24	H
Ethos XB*	12.75 to 25.5 fl oz/A	bifenthrin + *Bacillus amyloliquefaciens* - **soil**	n/a	12	H
Leverage 360*	2.8 fl oz/A	beta-cyfluthrin + imidacloprid (Group 4A)	7	12	H
Ridgeback*	4.5 to 13.8 fl oz/A	bifenthrin + sulfoxaflor (Group 4C)	21	24	H
Savoy EC*	3.6 to 9.6 fl oz/A	bifenthrin + acetamiprid (Group 4A)	21	12	H

Group 4A Neonicotinoid Insecticides Registered for Use on Potatoes

Apply one of the following formulations (check if the product label lists the insect you intend to spray; the label is the law):

Product Name (*=Restricted Use)	**Product Rate**	**Active Ingredient(s)**	**PHI (d)**	**REI (h)**	**Bee TR**
Admire Pro	5.7 to 8.7 fl oz/A	imidacloprid - **soil**	AP	12	H
Admire Pro	1.3 fl oz/A	imidacloprid - **foliar**	7	12	H
Assail 30SG	1.5 to 4.0 oz/A	acetamiprid	7	12	M
Belay	9.0 to 12.0 fl oz/A	chlothianidin - **soil**	AP	12	H
Belay	2.0 to 3.0 fl oz/A	chlothianidin - **foliar**	14	12	H
Actara 25WDG	1.5 to 3.0 oz/A	thiamethoxam	14	12	H
Platinum 75SG	1.66 to 2.67 oz/A	thiamethoxam	AP	12	H
Scorpion 35SL	11.5 to 13.25 fl oz/A	dinotefuran - **soil**	AP	12	H
Scorpion 35SL	2.0 to 2.75 fl oz/A	dinotefuran - **foliar**	7	12	H
Venom 70SG	6.5 to 7.5 oz/A	dinotefuran - **soil**	AP	12	H
Venom 70SG	1.0 to 1.5 oz/A	dinotefuran - **foliar**	7	12	H
Combo products containing a neonicotinoid					
Brigadier*	16.0 to 25.6 fl oz/A	imidacloprid + bifenthrin (Group 3A) - **soil**	21	12	H
Brigadier*	3.8 to 6.14 fl oz/A	imidacloprid + bifenthrin (Group 3A) - **foliar**	21	12	H
Endigo ZC*	3.5 to 4.5 fl oz/A	thiamethoxam + lambda-cyhalothrin (Group 3A)	14	24	H
Endigo ZCX*	3.0 to 3.5 fl oz/A	thiamethoxam + lambda-cyhalothrin (Group 3A)	14	24	H

Group 4A Neonicotinoid Insecticides Registered for Use on Potatoes - continued next page

Group 4A Neonicotinoid Insecticides Registered for Use on Potatoes - continued

Leverage 360*	2.8 fl oz/A	imidacloprid + beta-cyfluthrin (Group 3A)	7	12	H
Savoy EC*	3.6 to 9.6 fl oz/A	acetamiprid + bifenthrin (Group 3A)	21	12	H
Voliam Flexi	4.0 oz/A	thiamethoxam + chlorantraniliprole (Group 28)	14	12	H

Disease Control

THE LABEL IS THE LAW-see the Pesticide Use Disclaimer on the first page of Chapter F.

Recommended Fungicides

Nematodes

See sections E 1.5. Soil Fumigation and E 1.6. Nematode Control (including "Nonchemical Management of Nematodes" - certain mustard green cover crops planted in the fall and incorporated prior to planting may offer nematode suppression). Use fumigants listed in section E 1.5., or one of the following:

Code	Product Name (*=Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
1A	Vydate CL-V 3.77L*	34.0 to 68.0 fl oz/A in at least 20 gal/A pre-plant in-furrow treatment. See label.	oxamyl	AP	48	H
1B	Mocap 6F*	4.4 fl oz/1000 ft row in 12-inch band over the row at planting. See label.	ethoprop	AP	48	H
7	Velum Prime 4.16SC	6.5 to 6.84 fl oz/A, see label	fluopyram	7	12	--

Seed-Piece Treatment

Use certified seed. Keep seed at 65-70°F (18-21°C) for 2-3 weeks before planting to encourage rapid emergence. Plant seed pieces immediately after cutting or store under conditions suitable for rapid healing of the cut surfaces (60-70°F, 16-21°C plus high humidity). Dust seed pieces with fungicides immediately after cutting. Some fungicide seed-piece treatments are formulated with fir or alder bark. Bark formulations have been effective treatments.

Apply one of the following formulations:						
Code	**Product Name (*=Restricted Use)**	**Product Rate**	**Active Ingredient(s)**	**PHI (d)**	**REI (h)**	**Bee TR**
For *Fusarium* spp.:						
M04	Captan 7.5D	1.0 lb/cwt	captan	--	--	N
For *Fusarium* spp. and *Rhizoctonia* spp.:						
7 + M03	MonCoat MZ 7.5D[1]	0.75 to 1.0 lb/cwt	flutolanil + mancozeb	--	--	N
12+M03	Maxim MZ[1]	0.5 lb/cwt	fludioxonil + mancozeb	--	--	L

[1]Seed-piece fungicides that contain Early Blight Disease Control (EBDC) fungicides or cymoxanil also provide protection against seedborne late blight infections.

Bacterial and Fungal Diseases

Bacterial Soft Rot

Prevent wounding and make certain the tubers are dry before packing. Free chlorine wash maintained at 25 ppm chlorine or use of a fresh chlorine rinse maintained at 50 ppm chlorine may help reduce soft rot.

Common Scab

Potato scab is caused by a soil-inhabiting fungus (*Streptomyces scabies*). The disease is suppressed in acid soils and the optimum soil pH for growing scab susceptible varieties is about 5.0 to 5.2. Scab resistant varieties may be grown at pH 5.5 to 6.2. If lime is needed, apply after potato harvest and before subsequent crops grown in rotation. Plant scab-free seed potatoes. Use resistant varieties and rotate with small grains, corn, or alfalfa. Avoid rotations using red clover. Maintain adequate soil moisture during and after tuber set. Avoid heavy application of manures.

Dickeya dianthicola and *Pectobacterium* spp.

In 2015, *Dickeya dianthicola* was introduced to the Mid-Atlantic region. *Dickeya* and related *Pectobacterium* species are transmitted via infested seed pieces and is thought to have limited or no survival ability in our soils. Growers should purchase certified seed that has been properly inspected and determined free of these pathogens. Growers are reminded to practice sound sanitation practices when handling seed pieces (particularly those not tested for *Dickeya* or *Pectobacterium*) to prevent contamination of other potato seed lots.

Early Blight

Begin preventative sprays and continue every 7-10 d according to a disease forecasting system where available. If late blight is a threat, then begin sprays when plants are 8 inches tall.

Code	Product Name (*=Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
Rotate and TANK-MIX one of the following protectant fungicides:						
M03	mancozeb 75DF	1.5 to 2.0 lb/A	mancozeb	0	12	N
M03	Polyram 80DF	2.0 lb/A	metiram	14	24	N
M05	chlorothalonil 6F	1.0 to 1.5 pt/A	chlorothalonil	0	12	N
M05+22	Zing! 4.9SC	32.0 to 34.0 fl oz/A	chlorothalonil + zoxamide	7	12	N
30	Super Tin 4L*	3.0 to 6.0 fl oz/A	triphenyltin hydroxide	7	48	--
WITH one of the following pre-mix fungicides:						
49+M05	Orondis Opti	1.75 to 2.5 pt/A	oxathiapiprolin + chlorothalonil	7	12	--
M05+11	Quadris Opti 5.5SC	1.6 pt/A	chlorothalonil + azoxystrobin	14	12	N
3 + 11	Quadris Top 1.67SC	8.0 to 14.0 fl oz/A	difenoconazole + azoxystrobin	0	12	--
3 + 40	Revus Top 4.16SC	5.5 to 7.0 fl oz/A	difenoconazole + mandipropamid	1	12	M
7 + 3	Luna Pro 3.34SC	10.0 fl oz	fluopyram + prothioconazole	14	12	--
7 + 9	Luna Tranquility 4.16SC	8.0 to 11.2 fl oz/A	fluopyram + pyrimethanil	7	12	--
7 + 11	Priaxor 4.17SC	4.0 to 8.0 fl oz/A	fluxapyroxad + pyraclostrobin	7	12	N
11 + 27	Tanos 50DF	6.0 oz/A	famoxadone + cymoxanil	3	12	--
OR tank mix a protectant fungicide with one of the following single-active ingredient fungicides:						
3	Quash 50WDG	2.5 to 4.0 oz/A	metconazole	1	12	--
7	Endura 70W	2.5 to 4.5 oz/A	boscalid	0	12	--
11	azoxystrobin 2.08F	6.0 to 15.5 fl oz/A	azoxystrobin	0	4	N
11	Flint Extra 500SC	3.0 to 3.8 fl oz/A	trifloxystrobin (**Do not apply near Concord grapes**, see label)	7	12	N
11	Headline 2.09EC	6.0 to 9.0 fl oz/A	pyraclostrobin	3	12	N
11	Reason 500SC	5.5 to 8.2 fl oz/A	fenamidone	14	12	--

Late Blight

Begin fungicide applications when plants are 6 inches tall and repeat every 7 d or apply fungicides according to a disease forecasting system such as BLITECAST or WISDOM. Monitor for progress of the disease by following local Extension reports or visiting the following website (*http://www.usablight.org/*). When a field contains new late blight infections and harvest is near, vines should be destroyed immediately to help prevent tuber infection.

Code	Product Name (*=Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
One of the following protective fungicides should be applied early in the season PRIOR to occurrence of any disease in the region:						
M03	mancozeb 75DF[1]	1.5 to 2.0 lb/A[1]	mancozeb	0	12	N
M03	Polyram 80DF[1]	2.0 lb/A[1]	metiram	14	24	N
M03+22	Gavel 75DF	1.5 to2.0 lb/A	mancozeb + zoxamide	5	48	--
M05	chlorothalonil 6F	1.0 to 1.5 pt/A	chlorothalonil	0	12	N
M05+22	Zing! 4.9SC	34.0 fl oz/A	chlorothalonil + zoxamide	7	12	N
Once late blight is detected in your area, rotate and tank mix one of the following fungicides with a protectant fungicide listed above. Apply on a 7-day schedule as long as conditions are favorable for disease development.						
3 + 40	Revus Top 4.16SC	5.5 to 7.0 fl oz/A	difenoconazole + mandipropamid	1	12	M
11+ 27	Tanos 50DF	6.0 to 8.0 oz/A	famoxadone + cymoxanil	3	12	--
21	Ranman 400SC	1.40 to 2.75 fl oz/A	cyazofamid	0	12	L
27	Curzate 60DF	3.2 oz/A	cymoxanil	3	12	N
28	Previcur Flex 6F	1.2 pt/A	propamocarb HCl	5	12	N
29	Omega 500F	5.5 fl oz/A	fluazinam	14	48	N
30	Super Tin 4L*	3.0 to 6.0 fl oz/A	triphenyltin hydroxide	7	48	--
40	Forum 4.17SC	4.0 to 6.0 fl oz/A	dimethomorph	4	12	N
45 + 40	Zampro	11.0 to 14.0 fl oz/A	ametoctradin + dimethomorph	4	12	--
49+M05	Orondis Opti	1.75 to 2.5 pt/A	oxathiapiprolin + chlorothalonil	7	12	--
49 + 40	Orondis Ultra 2.33SC	5.5 to 8.0 fl oz/A	oxathiapiprolin + mandipropamid	14	4	--

[1]**DO NOT** apply more than a combined total of 15.0 lb/A of mancozeb 75DF or Polyram 80DF per crop

Leak (*Pythium*) and Pink Rot (*Phytophthora*)

Leak usually enters the tubers through bruises occurring in conjunction with the harvesting of immature tubers during hot weather. Pink Rot generally occurs in poorly drained areas. Rotate field out of potatoes for at least 2 yr.

Code	Product Name (*=Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
Apply one of the following fungicides in a 6-8 inch band directly over the seed-piece prior to row closure:						
4	Ridomil Gold 4SL	0.42 fl oz/1000 ft row	mefenoxam	AP	48	N
4	Ultra Flourish 2E	0.84 fl oz/1000 ft row	mefenoxam	AP	48	N
21	Ranman 400SC	0.42 fl oz/1000 ft row (see label)	cyazofamid	AP	12	L
22	Elumin	8 fl oz/A (see label)	ethaboxam	AP	12	--
49 + 4	Orondis Gold	27.8 fl oz/A	oxathiapiprolin + mefenoxam	AP	48	--
33	Phostrol	3.75 to 10.0 fl oz/A (see label)	Mono- and dibasic sodium, potassium, and ammonium salts of phosphorous acid	AP	4	--
As an alternative, apply one of the following fungicides with as much water as possible for ground applications and a minimum of 5 gal/A for aerial applications. Apply at flowering and 14 d later. If the field has a history of Pink Rot or leak a third application might be warranted 14 d after that. Be sure to get some coverage of the soil surrounding plants for root uptake to occur.						
4 + M01	Ridomil Gold Copper 65WP	2.0 lb/A	mefenoxam + copper	14	48	N
4 + M03	Ridomil Gold MZ 68WP	2.5 lb/A	mefenoxam + mancozeb	14	48	N
4 + M05	Ridomil Gold Bravo 76WP	2.0 lb/A	mefenoxam + chlorothalonil	14	48	N

Rhizoctonia stem canker and black scurf

Code	Product Name (*=Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
Apply one of the following formulations as an in-furrow spray at planting:						
7	Moncot 70DF	0.79 to 1.18 oz/1000 ft row	flutolanil	AP	12	N
7 + 11	Elatus 45WG	0.34 to 0.50 oz/1000 ft row	benzovindiflupyr + azoxystrobin	AP	12	N
11	azoxystrobin 2.08F	0.4 to 0.6 fl oz/1000 ft row	azoxystrobin	AP	4	N
11	Aftershock	0.16 to 0.24 fl oz/1000 ft row	fluoxastrobin	AP	7	--

Verticillium Wilt

Select fields with a low incidence of wilt. Use resistant varieties where possible. Do not plant tomato, eggplant, or pepper in rotation with potato. The use of Sudangrass in rotation with potato may reduce nematode levels. The use of Mocap will reduce lesion nematode levels in the soil, resulting in less Verticillium Wilt.

Code	Product Name (*=Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
Apply one of the following through center pivot irrigation in the fall to fallow fields for suppression of Verticillium and lesion nematode:						
--	K-Pam HL*	30 to 60 gal/A	potassium N-methyldithiocarbamate	AP	48	N
--	Vapam HL*	37.5 to 70 gal/A	metam-sodium	AP	48	N

White Mold

Code	Product Name (*=Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
Apply one of the following immediately prior to row closing and repeat 28 d later with a different FRAC code:						
1	Topsin M WSB	1.0 to 1.5 lb/A	thiophanate-methyl	14	12	N
2	iprodione 4F	2.0 pt/A	iprodione	14	24	N
7	Endura 70W	5.5 to 10.0 oz/A	boscalid	0	12	--
29	Omega 500F	5.5 to 8.0 fl oz/A	fluazinam	14	48	N

Viruses

Numerous seed-borne viruses can occur in potato including potato leafroll, potato virus S, potato virus M, and several strains of potato virus Y. There has been an increase in occurrence of the potato virus YN strain in the region. Control these seed borne viruses by obtaining virus-free certified or foundation seed.

If you are having a medical emergency after using pesticides, always call 911 immediately.

POISON Help®
1-800-222-1222

In Case of an Accident

- Remove the person from exposure
- Get away from the treated or contaminated area immediately
- Remove contaminated clothing
- Wash with soap and clean water
- Call a physician and/or the National Poison Control Center (1-800-222-1222). Your call will be routed to your State Poison Control Center.
- Have the pesticide label with you!
- Be prepared to give the EPA registration number to the responding center/agency