

**2015 Field Crop  
Insect Management Guide  
For Use in 2015 Only**



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## POTATO INSECTS

Other resources available through NDSU Extension Service:

Publications: E1001 Potato Leafhopper Biology and Control  
EB No. 26 Potato Production and Pest Management in North Dakota and Minnesota

## APHIDS

Aphids are major pests of seed potatoes because they transmit viruses which lead to rejection of the seed lot. For this reason, seed producers must keep aphid numbers lower than what can be tolerated on table stock. The most common aphid found on potato is the green peach aphid, an important vector of potato leaf roll virus (PLRV). Many aphids can transmit potato virus Y (PVY). Control measures are targeted specifically against aphids to keep virus spread to a minimum in seed production; control is not as common in normal commercial production.

### Thresholds

**Seed Stock:** To prevent the spread of PLRV, treat when aphid populations reach levels of 10 aphids per 100 leaves. Insecticides will not effectively prevent the spread of PVY.

**Table Stock:** To prevent a yield loss from direct feeding by aphids, treat when aphid densities reach 30 aphids per 100 leaves. Sample only middle to lower leaves; aphids will rarely be found on young leaves.

## CABBAGE LOOPER

Many different defoliating insects can be found on potatoes. Potatoes are relatively tolerant of some defoliation, especially if the attack is not sustained. The cabbage looper is a light green caterpillar with white or pale yellow stripes down the side. They have only three pair of fleshy prolegs, causing them to loop when moving forward.

**Threshold:** Normal populations seldom reach economically significant levels in North Dakota.

## COLORADO POTATO BEETLE

This beetle is the most common and destructive leaf feeding pest of potato. Both adults and larvae feed on foliage. The adult is 3/8 inch long, with oval body and a yellow-brown color with 5 black stripes on each wing cover. The larvae are 1/8 to 3/8 inch long, brick red to light orange in color. Eggs are laid on the underside of leaves in clusters of 10 to 30 and are orange colored when ready to hatch. In North Dakota, overwintered beetles emerge from May to June. The first-generation larvae are present in the fields from June through July. Beetles from these larvae appear in fields in July, feeding and laying eggs for a second generation. One of the greatest concerns with management programs for beetles is resistance to insecticides. The best way to manage the development of resistance in an insect population is the reduced use of compounds, limiting the selection of surviving (resistant) individuals. In North Dakota, resistance to the pyrethroid insecticides has been documented and the use of these compounds should be limited to one application per season. If control failures occur following the application of any product, switching to a different class of insecticides is recommended.

**Threshold:** The current recommendation is that spraying be initiated at first egg hatch. Best results have been achieved by flagging the first egg masses that can be located, monitoring these daily, and spraying at 15 to 30% hatch. If the insecticide used is effective but not persistent, a second application should be made 5 to 10 days later. With this approach, the first-generation beetle larvae should be controlled with one or two applications.

## POTATO LEAFHOPPER

Direct feeding damage to foliage is the primary concern with leafhoppers. The potato leafhopper migrates north in the spring, arriving before potatoes emerge. Leafhoppers develop in alfalfa first, moving to potatoes later.

Leafhopper adults are wedge-shaped, 1/8 inch long, and lime green to yellow green in color. The nymphs resemble the adults but are wingless. When disturbed, the nymphs move across the leaf in a sideways fashion.

Damage by leafhoppers is referred to as hopper-burn. Foliage becomes dwarfed, crinkled, and curled. Small triangular brown areas appear at the tips of leaves, gradually spreading around the entire leaf margin. Immature leafhoppers are more destructive than the adults, and generally more numerous than adults.

**Threshold:** Sample 35 leaves in each of 5 locations in a field. Pluck leaves from the plants and inspect the underside of the leaf for the presence of nymphs. Treatments are recommended when potato leafhoppers (PLH) can be found at:

<b>Seedling Stage (two true leaves)</b>
<b>Adults:</b> 0.5 adult PLH per sweep or 2 per row foot
<b>Nymphs:</b> Nymphs PLH usually not present at seedling stage
<b>3<sup>rd</sup> Trifoliate to Bud Stage</b>
<b>Adults:</b> 1 adult PLH per sweep or 5 PLH per row foot
<b>Nymphs:</b> 1 nymph PLH per leaflet (10/10 leaflets)

## FLEA BEETLE

Flea beetles are small, dull black beetles, about 1/16 inch long, with hind legs adapted for jumping. The adults overwinter in the soil, emerging in the spring to begin feeding on young foliage. Newly emerged plants are most vulnerable. When abundant, flea beetles shot-hole the foliage with numerous small round holes. Severely damaged leaves do not recover.

**Threshold:** Thresholds for this pest are not well-defined. Past recommendations have suggested treatment when 10% of the leaf area is lost due to flea beetle feeding. Early season weed control and removal of crop debris make fields less attractive to flea beetles.

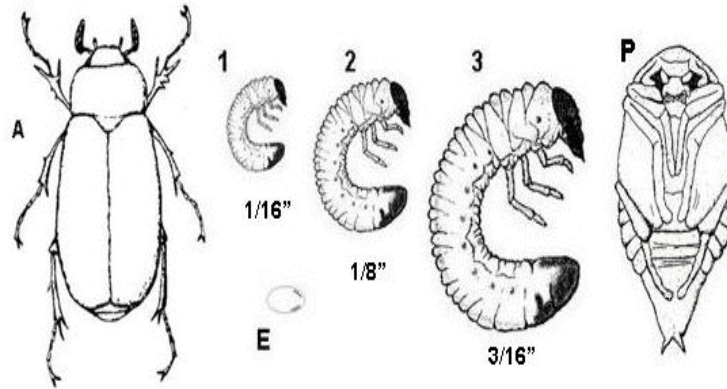
## VARIEGATED CUTWORM

The variegated cutworm is an occasional pest of potato in the region. These larvae are about 2 inches long when full grown. Their color ranges from black to light greenish-yellow or tan. They have a distinctive row of pale yellow spots down the middle of their backs. The variegated cutworm is a climbing cutworm, feeding in the plant canopy at night. Variegated cutworm have been responsible for below-ground feeding that damages tubers. The variegated cutworm overwinters in states to the south of North Dakota, making annual predictions of problems difficult. Moths migrate to the region during the spring and summer months. There are multiple generations of this cutworm, numbering two to three, depending on environmental conditions.

**Threshold:** Treatments would be justified when 4 or more worms per square foot are present.

## WHITE GRUBS

White grubs that are destructive to field crops in North Dakota have a three-year life cycle. In southeast North Dakota, the most common white grub pest occurs in continuous cropping situations at sites where willow and cottonwood trees are present. In other areas of the state, white grubs are most likely to be found when rotation from grassland, pasture, or grassy weed sites occur. Most root feeding occurs in the second year of the life cycle. In most cases, the number of second-year grubs will only be great enough to justify control once every three years.



**Life stages of *Phyllophaga implicita*:** A - adult June beetle; E - egg; grub stages with their head width in inches, 1 - first; 2 - second; 3 - third; and P - pupa.

**Thresholds:** Treatment is recommended when sampling indicates an average of one or more white grubs per square foot are found. The following sampling procedure provides treatment decisions based on this guideline.

**Soil sampling:** Fields need to be sampled to determine grub abundance and aid in determining if control is necessary. Sampling in late summer or early fall, before a freeze, provides a more reliable estimate of populations than spring sampling just before planting. Larvae are typically present in the upper 6 inches of soil until a killing frost occurs in the fall. Take soil samples, 1 square foot in size to a depth of 8 inches. Begin taking samples 45 yards from shelterbelts. A total of 30 samples per field, randomly spaced along the shelterbelts, are necessary. If at least a single grub is found in less than 40% of the samples, treatment may be required only out 20 yards from the tree line. If 40% to 60% of the samples are infested, treatment is needed to this distance and maybe as far as 65 yards. If greater than 60% of the samples are infested, treatment may be needed out to 90 yards from the tree line.

## WIREWORMS

Wireworms are most likely to be problems when crops follow pasture or grassland. Infestations often are found in coarse textured soils (sandy loam) where moisture is abundant, perhaps in low spots of fields.

**Thresholds:** There is no easy way to estimate wireworm infestations. Two methods are currently used.

**Soil Sampling:** Sample 20, well spaced, 1 square foot sites to a depth of 4 to 6 inches for every 40 acres being planted. If an average of 1 wireworm per square foot is found, treatment would be justified.

**Solar Baiting:** In September, establish bait stations for 2 to 3 weeks before freeze. Place bait stations randomly through the field, but representing all areas of the field. There should be 10 - 12 stations per 40 acre field. Place one cup wheat and one cup shelled corn in a 4- to 6-inch deep hole. Cover grain with soil and then an 18-inch square piece of clear plastic. Dig up the grain. If an average of one or more wireworm larvae is found per station, treatment would be justified.

## INSECTICIDES REGISTERED FOR USE IN POTATO

INSECTICIDE	PRODUCT PER ACRE	PHI	Aphids	Cabbage Looper	Colorado Potato Beetle	Flea Beetles	Potato Leafhopper	Potato Psyllid	Variegated Cutworm	White Grubs	Wireworms
<b>abamectin</b> ABBA 0.15EC Agri-Mek 0.15EC Epi-Mek 0.15EC Nufarm Abamectin 0.15EC Reaper 0.15EC Temprano Timectin 0.15EC <i>RUP</i>	8 - 16 fl oz	14 days Do not allow livestock to graze or feed treated foliage to livestock			●			●			
<b>abamectin</b> Agri-Mek SC <i>RUP</i>	1.75 - 3.5 fl oz	14 days			●			●			
<b>acetamiprid</b> Assail 30SG Assail 70WP	1.5 - 4 oz 0.6 - 1.7 oz	7 days	●		●	●	●				
<b>avermectin + bifenthrin</b> Athena <i>RUP</i>	7 - 17 fl oz	21 days	●	●	●	●	●	●	●		
<b>Bacillus thuringiensis</b> Biobit HP Dipel DF Dipel ES Xentari DF	0.5 - 1 lb 0.5 - 1 lb 1 - 2 pts 0.5 - 1.5 lbs	None		‡					‡		
<b>beta-cyfluthrin</b> Baythroid XL <i>RUP</i>	0.8 - 2.8 fl oz	None for tubers 14 days for grazing if more than 5.6 fl oz per acre is applied	†	●	●	●	●	●	●		
<b>beta-cyfluthrin + imidacloprid</b> Leverage 360 <i>RUP</i>	2.8 fl oz	7 days	●	●	●	●	●	●	●		
<b>bifenthrin</b> Bifenture EC Brigade 2EC Fanfare 2EC Sniper Tundra EC <i>RUP</i>	At Plant, In-furrow or T-band: 19.2 fl oz  Lay-by: 3.2 - 9.6fl oz	21 days								●	●
<b>bifenthrin</b> Bifenture EC Brigade 2EC Fanfare 2EC Sniper Tundra EC <i>RUP</i>	Foliar Application: 2.1 - 6.4 fl oz	21 days				●					
<b>bifenthrin</b> Capture LFR <i>RUP</i>	At Plant In-furrow, T-band or Lay-by: 12.75 - 25.5 fl oz	35 days								●	●
<b>bifenthrin + imidacloprid</b> Brigadier Skyraider Swagger <i>RUP</i>	At Plant: 16 - 25.6 fl oz 19.2 fl oz 32 - 51.2 fl oz	21 days	●		●	●	●	●		●	●

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<b>bifenthrin + imidacloprid</b> Brigadier Skyraider Swagger <i>RUP</i>	Foliar Application: 3.8 - 6.14 fl oz 2.1 - 6 fl oz 7.6 - 12.28 fl oz	21 days	●	●	●	●	●	●			
<b>bifenthrin + zeta-cypermethrin</b> Hero <i>RUP</i>	2.6 - 10.3 fl oz	21 days	●	●	●	●	●		●		
<b>carbaryl</b> Sevin 4F Sevin 80S Sevin XLR Plus	0.5 - 2 qts 0.625 - 2.5 lbs 0.5 - 2 qts	7 days			●	●	●		●		
<b>chlorantraniliprole</b> Coragen	3.5 - 5 fl oz	14 days		●	●						
<b>chlorantraniliprole + lambda-cyhalothrin</b> Besiege <i>RUP</i>	5 - 9 fl oz	14 days	●	●	●	●	●	●	●		
<b>chlorantraniliprole + lambda-cyhalothrin</b> Voliam Xpress <i>RUP</i>	5 - 9 fl oz	14 days	●	●	●	●	●	●	●		
<b>chlorantraniliprole + thiamethoxam</b> Voliam Flexi	4 oz	14 days	●	●	●	●	●				
<b>clothianidin</b> Belay	In-furrow or Side-dress Application: 9 - 12 fl oz	None	●		●	●	●	†		●	●
<b>clothianidin</b> Belay	Foliar Application: 2 - 3 fl oz	14 days	●		●	●	●				
<b>clothianidin</b> Belay 50 WDG	1 - 1.5 fl oz	14 days	●		●		●				
<b>cyfluthrin</b> Renounce 20WP Tombstone Tombstone Helios <i>RUP</i>	1 - 3.5 oz 0.8 - 2.8 fl oz 0.8 - 2.8 fl oz	0 days for tubers 14 days for grazing	†	●	●	●	●	●	●		
<b>deltamethrin</b> Battalion 0.2EC Delta Gold <i>RUP</i>	7.7 - 17.9 fl oz 1 - 2.4 fl oz	3 days Do not graze livestock on vines	†	●	●	●	●		●		
<b>dimethoate</b> Digon 400 Dimate 4E Dimethoate 4E Dimethoate 4EC Dimethoate 400	0.5 - 1 pt	14 days	●				●				
<b>dinotefuran</b> Scorpion 35SL	Soil Application: 11 - 13 fl oz  Foliar Application: 2 - 2.75 fl oz	7 days	†		●	●	●	●			

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<b>dinotefuran</b> Venom 20SG	Soil Application: 1.4 - 1.65 lbs  Foliar Application: 0.33 lb	7 days	†		●	●	●	●			
<b>dinotefuran</b> Venom	Soil Application: 6.5 - 7.5 oz  Foliar Application: 1 - 1.5 oz	14 days			●	●	●				
<b>esfenvalerate</b> Adjourn Asana XL  <i>RUP</i>	2.9 - 9.6 fl oz	7 days	●	●	●	●	●	●	●		
<b>fipronil</b> Regent 4SC  <i>RUP</i>	At Plant In-furrow: 0.184 - 0.22 fl oz per 1,000 row-feet depending on row spacing	90 days									●
<b>flonicamid</b> Beleaf 50G	2 - 2.8 oz	7 days	●								
<b>imidacloprid</b> Impulse 1.6FL Pasada 1.6F Prey 1.6 Sherpa	Foliar Application: 3.8 fl oz	7 days	●		●	●	●	●			
<b>imidacloprid</b> ADAMA Alias 2F Advise 2FL AmTide Imidacloprid 2F Macho 2FL Malice 2F Montana 2F Nuprid 2SC Widow	In-furrow, Side-dress or Banded Application: 0.9 - 1.3 fl oz per 1,000 row- feet	None	●		●	●	●	●			●
<b>imidacloprid</b> ADAMA Alias 2F Advise 2FL AmTide Imidacloprid 2F Macho 2FL Malice 2F Montana 2F Nuprid 2SC Widow	Seed Piece Treatment: 0.4 - 0.8 fl oz per cwt	None	●		●	●	●	●			●
<b>imidacloprid</b> Advise 2FL AmTide Imidacloprid 2F Macho 2FL Montana 2F Nuprid 2SC	Foliar Application: 3 fl oz	7 days	●		●	●	●	●			

<b>INSECTICIDE</b>	<b>PRODUCT PER ACRE</b>	<b>PHI</b>	<b>Aphids</b>	<b>Cabbage Looper</b>	<b>Colorado Potato Beetle</b>	<b>Flea Beetles</b>	<b>Potato Leafhopper</b>	<b>Potato Psyllid</b>	<b>Variegated Cutworm</b>	<b>White Grubs</b>	<b>Wireworms</b>
<b>imidacloprid</b> ADAMA Alias 4F Montana 4F Nuprid 4F Max Wrangler	In-furrow, Side-dress or Banded Application: 0.45 - 0.65 fl oz per 1,000 row-feet	None	●		●	●	●	●			●
<b>imidacloprid</b> ADAMA Alias 4F Montana 4F Nuprid 4F Max Wrangler	Seed Piece Treatment: 0.2 - 0.4 fl oz per cwt	None	●		●	●	●	●			●
<b>imidacloprid</b> ADAMA Alias 4F Montana 4F Nuprid 4F Max	Foliar Application: 1.5 fl oz	7 days	●		●	●	●	●			
<b>imidacloprid</b> Admire Pro Nuprid 4.6F Pro	In-furrow, Side-dress or Banded Application: 5.7 - 8.7 fl oz per acre	None	●		●	●	●	●			●
<b>imidacloprid</b> Admire Pro Nuprid 4.6F Pro	Seed Piece Treatment: 0.17 - 0.35 fl oz per cwt	None	●		●	●	●	●			●
<b>imidacloprid</b> Admire Pro	Foliar Application: 1.3 fl oz	None	●		●	●	●	●			
<b>imidacloprid</b> Malice 75WSP	1 oz	7 days	●		●	●	●	●			
<b>indoxacarb</b> Avaunt	2.5 - 6 oz	7 days		●	●						
<b>lambda-cyhalothrin</b> Grizzly Z Lambda-Cy EC LambdaStar Lambda-T Lamcap Nufarm Lambda Cyhalothrin 1EC Province Silencer Silencer VC Taiga Z Warrior II <i>RUP</i>	1.92 - 3.84 fl oz 1.92 - 3.84 fl oz 1.92 - 3.84 fl oz 1.92 - 3.84 fl oz 1.92 - 3.84 fl oz 1.92 - 3.84 fl oz 1.92 - 3.84 fl oz 1.92 - 3.84 fl oz 1.92 - 3.84 fl oz 1.92 - 3.84 fl oz 0.96 - 1.92 fl oz	7 days	●	●	●	●	●	●	●		
<b>lambda-cyhalothrin + thiamethoxam</b> Endigo ZC <i>RUP</i>	3.5 - 4.5 fl oz	14 days	●	●	●	●	●	●	●		
<b>malathion</b> Cheminova Malathion 57% Malathion 5 Malathion 57EC	1.5 - 2 pts 1 pt 1 - 1.5 pts	None	●				●				
<b>methomyl</b> Lannate LV <i>RUP</i>	1.5 - 3 pts	6 days	●	●		●	●		●		
<b>novaluron</b> Rimon 0.83EC	6 - 12 fl oz	14 days		●	●						
<b>oxamyl</b> Vydate C-LV <i>RUP</i>	8.5 - 34 fl oz	7 days	●		●	●	●				

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<b>oxamyl</b> Vydate L <i>RUP</i>	In-furrow: 1 - 2 gal  Foliar Application: 1 - 4 pts	7 days	●		●	●	●				
<b>permethrin</b> Ambush 25W Ambush Arctic 3.2EC PermaStar Permethrin 3.2EC Perm-UP 3.2EC Perm-UP 25DF Pounce 3.2EC <i>RUP</i>	3.2 - 12.8 oz 3.2 - 12.8 fl oz 4 - 8 fl oz 4 - 8 fl oz 4 - 8 fl oz 4 - 8 fl oz 6.4 - 12.8 oz 4 - 8 fl oz	14 days	●	●	●	●	●	●	●		
<b>phorate</b> Phorate 20G Thimet 20G SmartBox Thimet 20G Lock n Load <i>RUP</i>	At Plant for Light or Sandy Soils: 8.5 - 11.3 oz per 1,000 row- feet  At Plant for Heavy or Clay Soils: 13 - 17.3 oz per 1,000 row- feet	90 days	●		●	†	●	●			●
<b>phosmet</b> Imidan 70W	1.33 lbs	7 days			●	●	●				
<b>pymetrozine</b> Fulfill	2.75 - 5.5 oz	14 days	●					†			
<b>spinetoram</b> Radiant SC	4.5 - 8 fl oz	7 days		●	●						
<b>spinosad</b> Blackhawk Entrust Spintor 2SC Success	1.7 - 3.5 oz 1 - 3 oz 3.2 - 9.6 fl oz 4.5 - 10 fl oz	7 days		●	●						
<b>spiromesifen</b> Oberon 2SC Oberon 4SC	8 - 16 fl oz 4 - 8 fl oz	7 days						●			
<b>spirotetramat</b> Movento	4 - 5 fl oz	7 days	●					●			
<b>sulfoxaflor</b> Transform WG	0.75 - 2.75 oz	7 days	●				●	●			
<b>thiamethoxam</b> Actara	1.5 - 3 fl oz	14 days	●		●	●	●				
<b>thiamethoxam</b> Cruiser 5FS	Seed Piece Treatment: 0.11 - 0.16 fl oz per cwt <b>Consult label for correct rate based on seeding rate</b>	None	●		●	●	●	●			●
<b>thiamethoxam</b> Cruiser Maxx Potato	Seed Piece Treatment: 0.19 - 0.27 fl oz per cwt <b>Consult label for correct rate based on seeding rate</b>	None	●		●	●	●	●			



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<b>thiamethoxam</b> Platinum Platinum 75SG	Soil Applications: 5 - 8 fl oz 1.66 - 2.67 fl oz <b>Consult label for soil application methods</b>	None	●		●	●	●	●			●
<b>tolfenpyrad</b> Torac	14 - 21 fl oz	14 days	●		●			●			
<b>zeta-cypermethrin</b> Mustang Maxx Mustang Maxx EC Respect Respect EC <i>RUP</i>	1.28 - 4 fl oz	1 day Do not use leaves or vines for food or feed	†	●	●	●	●		●		

*RUP* = Restricted Use Pesticide

● = Control

† = Suppression only

‡ = Control of first and second instar larvae only