

Publication 838

Vegetable Crop Protection Guide 2021

Discard old editions of this publication.

Each year a committee comprised of representatives from provincial government, industry, academia and grower organizations review the pesticides listed in the publication.

To the best knowledge of the committee, at the time of publishing, the pesticide products listed in this publication were federally registered.

The information in this publication is general information only.

The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) does not offer any warranty or guarantee, nor does it assume any liability for any crop loss, animal loss, health, safety or environmental hazard caused by the use of a pesticide mentioned in this publication.

This publication lists a number of brand names of pesticides. It is neither an endorsement of the product nor a suggestion that similar products are ineffective.

THE PESTICIDE LABEL

Consult each product label before you use a pesticide. The label provides specific information on how to use the product safely, hazards, restrictions on use, compatibility with other products, the effect of environmental conditions, etc.

The pesticide product label is a legal document. Follow all label directions.

REGISTRATION OF PESTICIDE PRODUCTS

The Pest Management Regulatory Agency (PMRA) of Health Canada registers pesticide products for use in Canada following an evaluation of scientific data to ensure that the product has value, and the human health and environmental risks associated with its proposed use are acceptable.

1. Full Registration

Pesticide registrations are normally granted for a period of 5 years, subject to renewal.

2. Emergency Registration

An emergency registration is a temporary, time-limited registration of no more than 1 year, approved to deal with serious pest

outbreaks. An emergency is generally deemed to exist when both of the following criteria are met:

- An unexpected and unmanageable pest outbreak or pest situation occurs that can cause significant health, environmental or economic problems; and
- Registered pesticides and cultural control methods or practices are insufficient to address the pest outbreak.

MAXIMUM RESIDUE LIMITS

The PMRA has established maximum residue limits (MRLs) for pesticides.

An MRL is the maximum amount of pesticide residue that may remain on food after a pesticide is applied as per label directions and which can safely be consumed. Processors or retailers may demand more restrictive limits. Growers should seek advice of their intended market to determine if more restrictive limitations apply. Keep accurate and up-to-date records on pesticide use in each crop.

SUPPLEMENTAL/ AMENDED LABELS

Supplemental/amended labels provide label directions for new approved uses for a registered pesticide that do not appear on the current label. These label directions **MUST** be followed when using the pesticide for these purposes.

Examples of when you must use a supplemental/amended label include:

- **Emergency Use Registration**
- **Minor Use Label Expansion**

You can obtain a copy of a supplemental amended label from the pesticide manufacturer or pesticide vendor, the grower association that sponsored the emergency registration or minor use, from OMAFRA crop specialists or PMRA's Pest Management Information Service.

For more information on the federal registration status, check the PMRA website at www.healthcanada.gc.ca/pmra or call 1-800-267-6315.

REGULATION OF PESTICIDES IN ONTARIO

The Ontario Ministry of Environment, Conservation and Parks (MECP) is responsible for regulating pesticide sale, use, transportation, storage and disposal in Ontario.

Ontario regulates pesticides by placing appropriate education, licensing and/or permit requirements on their use, under the *Pesticides Act* and Regulation 63/09.

All pesticides must be used in accordance with requirements under the *Pesticides Act* and Regulation 63/09, which are available on the e-laws website at ontario.ca/laws or by calling the ServiceOntario Publications Toll-Free number: 1-800-668-9938 or 416-326-5300.

CLASSIFICATION OF PESTICIDES

As of May 1, 2020, Ontario's pesticides classes have been aligned with the federal government's pesticide categories to remove duplication and reduce complexity for the sale and use of pesticides in Ontario, while ensuring continued protection of human health and the environment. MECP automatically classifies pesticides in Ontario as Class A, B, C, D or E. The Ontario pesticide classification system provides the basis for regulating the distribution, availability and use of pesticide products in Ontario. For more information on the classification of pesticides, visit the MECP website at ontario.ca/pesticides.

CERTIFICATION AND LICENSING

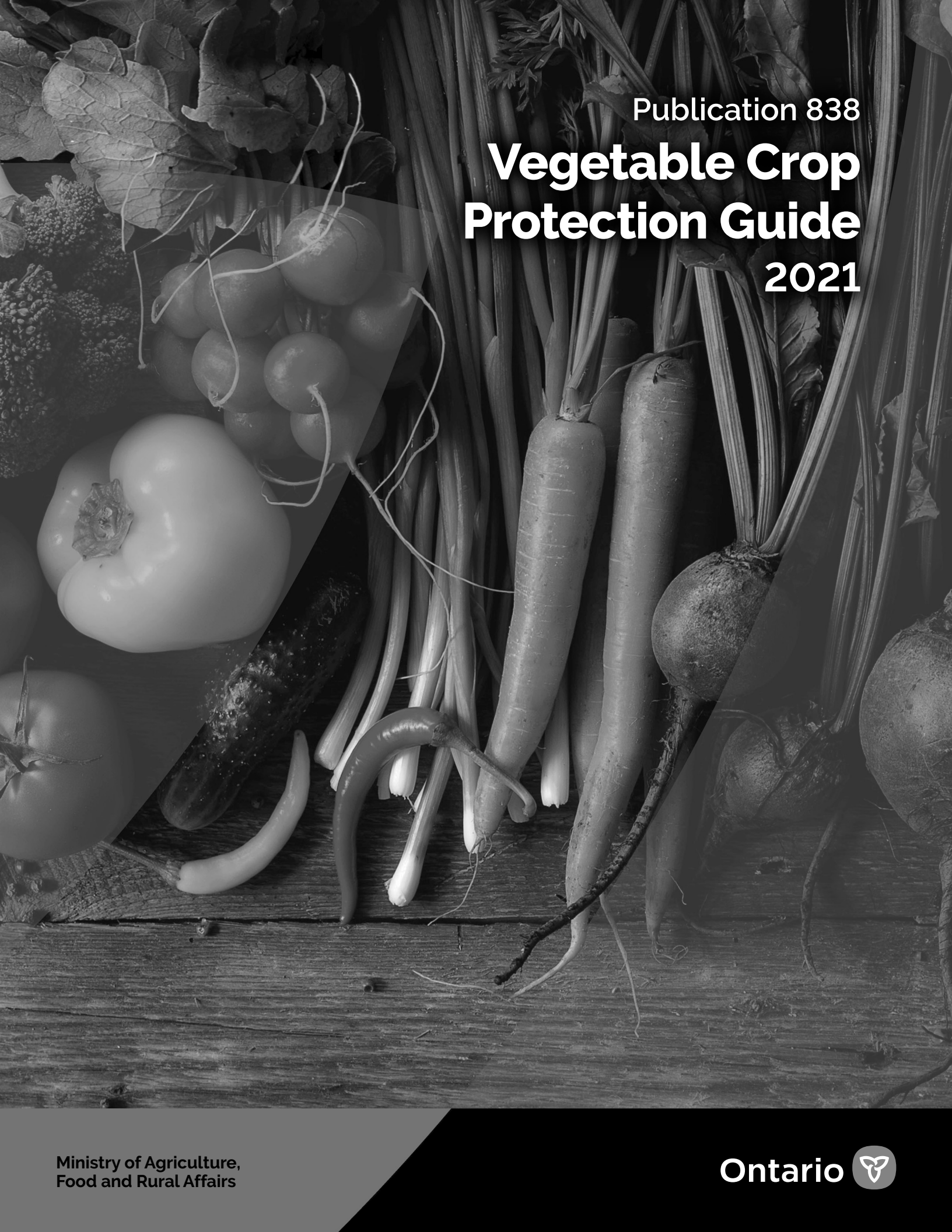
Growers and Their Assistants

For information about farmer training and certification requirements, visit the MECP website at ontario.ca/pesticides and for information on courses check the Ontario Pesticide Education Program website at www.opec.ca or call 1-800-652-8573.

Pesticide Commercial Applicators (Exterminators) and Their Assisting Technicians

For more information about exterminator licensing and technician training, visit:

- the Ontario Pesticide Training and Certification website at www.ontariopesticide.com or call 1-888-620-9999 or 519-674-1575
- the Pesticide Industry Council's Pesticide Technician Program website at www.horttrades.com/pesticide-technician or call 1-800-265-5656 or e-mail pic@hort-trades.com
- the Pesticide Industry Regulatory Council (PIRC) at www.oipma.ca.



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2021

Acknowledgements

The information contained in this publication is printed following review by the Vegetable Technical Working Group, comprised of representatives from provincial and federal governments, academia and industry.

If you need technical or business information

contact the Agricultural Information Contact Centre at

1-877-424-1300

ag.info.omafra@ontario.ca

Looking for vegetable production information on the Internet?

Check the OMAFRA website at

ontario.ca/crops

This publication contains pest control products that have been registered as of September 9, 2020, on field vegetable crops in Ontario. Any supplements to this publication will be posted on the OMAFRA website at ontario.ca/crops.

Cover images

Front cover

Collection of vegetables spread out on a wooden table.

Photo source: [Shutterstock.com](https://www.shutterstock.com)

Back cover

Collection of vegetables in a basket.

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COMING SOON!

For the 2022 growing season, you will be able to access the information currently listed in this publication through a new, digital application.

The application will replace OMAFRA's crop protection publications and provide you with information in one single location.



This one-stop tool for crop protection information will allow you to:

- ✓ customize and navigate through information based on your specific needs;
- ✓ access information when you need it to make important business decisions; and
- ✓ access information digitally, either through desktop, tablet or mobile.

Updates can be found at:
ontario.ca/crops

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Introduction

Products Listed in This Book

Products listed in this book are registered for use on field vegetable crops as of September 9, 2020 and have been reviewed by the registrants and the Vegetable Technical Working Group, comprised of representatives from provincial and federal governments, academia and industry.

Products are organized by pest for each vegetable crop. Consult each product label before you use a pest control product. Labels for registered pest control products are available at the Pest Management Regulatory Agency (PMRA) website at www.canada.ca (search “Pest Management Regulatory Agency”).

Crop Group Information

A crop group is a grouping of plant species based on botany and taxonomy (e.g., plant families), as well as on how the crops are produced. Crop groups are often further divided into smaller and more closely related subgroups. A pest control product may be registered on a subgroup, rather than the entire crop group. Crop groupings are used primarily to set maximum residue limits and establish a common pre-harvest interval (PHI) for a similar set of crops. It is important to remember that not all products have a crop group registration, and products registered on one crop are not necessarily registered on all members of its crop group. There are some crops that do not belong in a crop group. A complete list of all crops included in both original and revised crop groups can be found by searching “Residue Chemistry Crop Groups” on the Government of Canada’s website at www.canada.ca.

Levels of Control for Fungicides and Insecticides

The Efficacy Guidelines for Plant Protection Products in the *Value Guidelines for New Plant Protection Products and Label Amendments*, Pest Management Regulatory Agency, April 2016, define levels of control as follows:

Fungicides

Control: A consistent level of disease management, as defined by commercial standards and expectations in the market. In general, disease control ratings would be between 80% and 100%.

Suppression: A consistent level of disease management that is less than full control, as defined by commercial standards and expectations in the market. In general, disease control ratings would be between 60% and 80%. Suppression is defined as consistent disease reduction to a level that is not optimal but is still of commercial benefit.

Partial Suppression: A level of disease management that is less than suppression, as defined by the commercial standards and expectations in the market. This label claim will generally only be considered for non-conventional fungicides. In general, disease control ratings would be less than 60%.

Insecticides/Miticides

Control: The product, when applied in accordance with the label directions, consistently reduces pest numbers or pest damage to a commercially acceptable level.

Suppression: The product, when applied in accordance with the label directions, does not consistently reduce pest numbers or pest damage to a commercially acceptable level. Under such situations, the level of performance offered by the product should still have value in a pest management program.

Note: These guidelines are currently suggestions and are under review by the Pest Management Regulatory Agency. Currently, approved Canadian labels may also include a statement “reduction in damage from” the target pest. This is an undefined level of control less than suppression, and this statement is still under review with the Pest Management Regulatory Agency.

1. Pest Management

Integrated pest management (IPM) is an approach to managing pests that uses all available strategies to reduce pest populations below an economic injury level. IPM does not advocate a continuous pesticide spray program to eradicate pests. Instead, it promotes the integration of cultural, mechanical, biological and chemical control strategies. Using these pest control strategies can minimize the adverse effects of pesticides on the environment and maintain economic returns.

An IPM program makes management decisions based on:

- pest identification, biology and behaviour
- resistance management strategies
- beneficial organisms
- monitoring techniques
- use and timing of appropriate management tools
- stage of crop growth
- recordkeeping

More detailed information on IPM for field vegetables can be found in OMAFRA publications such as:

- *Ontario CropIPM*, ontario.ca/cropIPM
- Publication 700, *Integrated Pest Management for Onions, Carrots and Lettuce in Ontario: A handbook for growers, scouts and consultants*

Current information is also available on the OMAFRA website at ontario.ca/crops. Additional information is supplied via newsletters, meetings, field monitoring, demonstrations and pest management workshops.

For more information on available IPM programs, contact OMAFRA's Agricultural Contact Centre at 1-877-424-1300, or the nearest OMAFRA Resource Centre.

For a list of available crop consultants providing monitoring services, contact OMAFRA's Agricultural Information Contact Centre at 1-877-424-1300, or the nearest OMAFRA Resource Centre.

Pest Control Measures

Cultural and Mechanical

Integrated pest management incorporates cultural and mechanical practices to prevent or delay the development of pest outbreaks. Management tools include, but are not limited to:

- site selection
- crop rotation
- resistant/tolerant cultivars
- clean, certified seed
- sanitation
- elimination of alternative hosts
- inter-cropping
- water management (i.e., drainage, irrigation management)
- optimized plant and soil health
- barriers (i.e., row covers)
- encouraging natural enemies of crop pests

See *Pest Management for Organic Vegetable Growers*, on page 4, for more information on cultural, mechanical and biological controls.

Crop Rotation for Control of Diseases

Crop rotation can be an important practice for preventing some diseases caused by fungi, bacteria and nematodes. Rotation with non-susceptible crops for 3 years usually allows enough time for infected plant material in the soil to completely decompose. In the absence of susceptible plant material, these soil-borne pathogen organisms die off. For some soil-borne pathogens, such as phytophthora in peppers and cucurbit crops, a rotation longer than 3 years may be required.

Rotation only works when successive crops are not susceptible hosts. It is important to remember that plants in the same family (i.e., potatoes, tomatoes, peppers and eggplant) may all be susceptible to the same disease organisms. Do not rotate with plants in the same family.

Some diseases that are spread by wind or by insects may not be controlled by crop rotation. For example, some leaf blight organisms and powdery mildew fungi can blow into fields from neighbouring weeds and infested fields.

However, crop rotation will reduce the level of many disease-causing organisms that remain in the soil or on crop residue left in a field.

Chemical Controls

Chemical controls include synthetic, inorganic and biological pesticides. They kill/inhibit development of target pests and thus limit subsequent pest populations. Plant defence activators (e.g., Regalia Maxx) induce natural plant defences against crop pests, but do not directly impact the plant pathogen itself. Applications of plant defence activators to crops may “activate” the defence response of the plant, thus inhibiting infection.

Chemical controls are important tools for crop protection when used as part of an IPM program. It is important to understand the pest’s life cycle and apply chemicals at the stage when the pest is most vulnerable. Select the appropriate product for the target pests.

To control insects, monitor fields closely. Spray according to action thresholds or at critical stages of crop development.

To control disease, apply fungicides prior to disease infection and development. Use factors such as weather conditions, crop stage and (where available) disease prediction models to assist in fungicide spray timing.

Insect Control in Vegetable Crops During Bloom

Healthy pollinator populations are an essential element to many vegetable operations. Honeybees and native pollinators provide pollination services or may enter other fields looking for an alternate source of pollen or water. Some pest control products are toxic to bees and other pollinators through direct contact. Systemic insecticide products may also pose a high risk to bees and other insect pollinators. Bees can be exposed to product residues in or on flowers, leaves, pollen, nectar and/or surface water. Do not apply insecticide or allow it to drift onto blooming crops or off-site habitat if bees are foraging in or adjacent to the treatment area.

Many insecticide and miticide labels and some fungicide labels have specific precautions about applications during bloom. Some insecticide labels may include several precautionary statements. Label statements may include, but are not limited to:

- do not use on flowering crops or weeds
- do not apply to flowering crops or weeds if bees are visiting the treated area
- avoid spraying when bees are foraging (see *Precautions for Applying Insecticides*, page 3)

Please note that the information in this publication is general information only. Read each pest control product label for information on bee toxicity. See *Bee Poisoning*, on page 22, for information on preventing bee poisoning. Also, search “Protecting Pollinators during Pesticide Spraying,” at www.canada.ca/pollinators for more information.

Precautions for Applying Insecticides

This is general information only. Read each pest control product label for specific precautions regarding bees and/or other pollinators. Bees are exposed to pesticides through spray drift, or residues on/in leaves, pollen and nectar in flowering crops and weeds.

Dust generated during planting of treated seed may be harmful to bees and other pollinators:

- Alias 240SC
- Fortenza
- Poncho 600FS
- Cruiser 5FS
- Gaucho 480 FL

Bees can be exposed to product residues on flowers, leaves, pollen and/or nectar resulting from seed treatment or soil applications:

- Actara 240SC
- Fortenza
- Potato Extreme
- Verimark
- Cruiser 5FS
- Minecto Duo
- Sepresto 75WS
- Cruiser Maxx
- Poncho 600FS
- Titan ST

Do not use during crop or weed flowering period:

- Cygon 480²
- Lorsban 50W
- Pyrinex 480EC
- UP-Cyde 2.5 EC²
- Lagon 480 E²
- Movento 240SC¹
- Sevin XLR²
- Warhawk 480 EC
- Lorsban 15G
- Nufos 4E
- Sharphos
- Lorsban 4E/Lorsban
- Pyrifos 15G NT
- Ship 250²

Do not apply to flowering crops or weeds if bees are visiting the treated area:

- Actara 240SC
- Clutch 50WDG
- Harvanta 50SL
- Radiant SC
- Actara 25WG
- Concept
- Imidan 70-WP
- Silencer 120 EC
- Admire 240F
- Cormoran
- Labamba
- StorOx
- Agri-Mek 1.9% EC
- Decis 5 EC
- Lannate TNG
- Success
- Agri-Mek SC
- Delegate WG
- Malathion 85E
- Versys
- Alias 240SC
- Diazinon 50 EC
- Matador 120EC
- Voliam Xpress
- Assail 70WP
- Diazinon 500E
- Minecto Pro
- Vydate L
- Bioceres GW P
- Entrust
- Orthene 97% SG
- Xentari WG
- Closer
- Exirel

Avoid spraying when bees are foraging:

- Ambush 500EC
- Oberon¹
- Pounce 384EC
- Sivanto
- Dibrom
- OxiDate 2.0
- Rimon 10
- TwinGuard
- Mako
- Perm-UP
- Rovral

¹ Bee brood may be exposed to residues in or on pollen and nectar brought back to the hive by bees foraging on flowering crops and weeds.

² For applications on crops that are highly attractive to pollinators, DO NOT apply during the crop blooming period or during the 5-day period before the crop blooms. For applications on all other crops, avoid application during the crop blooming period. If applications must be made during the crop blooming period, restrict applications to evening when most bees are not foraging.

Natural Enemies (Beneficials)

Natural enemies are beneficial organisms, including predatory insects, parasites, pathogens and nematodes, which help suppress crop pest populations. Many beneficials occur naturally in the environment; others may be introduced to field or greenhouse production. To learn more about natural enemies in field vegetable crops, see the Great Lakes Vegetable Working Group website at www.ncipmc.org/glvwg/.

Beneficials will not completely eliminate damage by pests. However, once they are established, they can maintain pest populations at lower levels. They are also

effective at controlling indirect pests such as aphids, leafhoppers and mites. Beneficials are less effective at keeping populations of direct pests (those attacking the harvested product) at levels acceptable for commercial production. One of the advantages of beneficial insects is that their activities can prevent or delay the development of pesticide resistance.

Where possible, select chemical control products that will not harm the beneficials. Toxicity information regarding beneficial insects is available on some pest control product labels.

Pest Management for Organic Vegetable Growers

Several organic certification bodies serve Ontario farms and processors. Contact these organizations to get information on how to be certified. For more information on certification, as well as addresses and links to details of the organic regulations and standards, see the *Organic Food and Farming Certification* at ontario.ca/organic.

Pest management in organic production involves the use of numerous control strategies aimed at preventing pest problems before they appear. In organic production, pest control products should be used as a last resort, only when other management practices have not been sufficient to prevent the pest from causing economic damage to the crop.

Organic and Biopesticide Pest Control Products

Organic pest control products are pesticides that are approved for use in organic production. For organic products, both the active ingredient and all additional ingredients must be derived from natural sources (typically biological or botanical).

All organic pest control products must be registered by the PMRA for the pest and crop on which they are used, and meet the requirements of the Canadian Organic Standards and any additional requirements of the local organic certification body.

Biopesticides are products derived from natural materials such as plant extracts, bacteria and minerals. It is important to note that the definition of a biopesticide varies between organizations and countries. In Canada, biopesticides are divided into two major classes, microbial and biochemical pesticides.

Microbial pesticides contain a beneficial microorganism, such as a bacterium, fungus, virus or protozoan, as the active ingredient. They are relatively specific to their target pest. Microbial pesticides registered for use in vegetables include *Bacillus subtilis* (e.g., Serenade SOIL) and the various subspecies and strains of *Bacillus thuringiensis* (e.g., Bioprotect).

Biochemical pesticides are naturally occurring substances and/or their synthetic analogues. A synthetic analogue is a manufactured molecule that resembles a naturally occurring substance. They generally control pests by different mechanisms than conventional pesticides or by making crops unsuitable

for feeding. While many biopesticides are less toxic and pose a lower risk than conventional pesticides, some can be quite toxic.

While many biopesticides are used in organic production, it is important to be aware that not all biopesticides are organically acceptable and that not all organic products are biopesticides. In some cases, the active ingredient may be organic, but it may be formulated with other ingredients that are not acceptable for organic production (e.g., some formulations of the bacteria *Bacillus thuringiensis*). Similarly, there are organic pest control products that do not meet the definition of a biopesticide (e.g., copper is a mineral and not considered a biopesticide).

Organic Products in Conventional Production

While organic and biopesticide products are used most widely by organic producers, they can be a useful tool for conventional growers as well. Possible advantages for conventional producers include:

- lower potential for pest resistance
- providing a rotational option to help manage resistance development in other conventional products
- shorter re-entry intervals
- shorter pre-harvest intervals
- potentially lower toxicity to non-target organisms

While organic products and biopesticides can be helpful additions to IPM programs, they may not provide the same high level of control as conventional pesticides. Biopesticides are often labelled for suppression or partial suppression of pests. To improve control, combine their use with the other pest control tactics mentioned in the previous section.

Using Organic and Biopesticide Products

Although many organic and biopesticide products are formulated, packaged and applied in a very similar fashion to conventional pesticides, the active ingredients are different. They have unique, specialized modes of action that make them more susceptible to numerous biological and environmental factors.

Some of the possible challenges associated with using these products are:

- more frequent applications needed to control pests
- slower acting than conventional pesticides
- may provide suppression but not control of the pest
- more expensive than conventional pesticides
- fewer pests controlled

Resistance Management

Resistance is the ability of a pest to survive exposure to a pesticide at a rate or concentration that previously controlled it. Resistance to a pesticide develops after repeated exposure to a specific chemical or chemical family. A few naturally occurring resistant individuals survive after each application, while the susceptible portion of the population is killed. These resistant survivors multiply and gradually replace the susceptible ones. Eventually the resistant population dominates, and the pesticide loses efficacy.

There are many potential causes for pest control failures. Before assuming a population is resistant to a product, consider the following factors, which may affect the effectiveness of pest control products:

- **Product selection** — Select the appropriate product that has activity and is labelled for the specific pest(s)/crop combination. Certain pest control products may work only under specific circumstances (i.e., pests to be controlled, weather and soil conditions, timing, etc.).
- **Water volume** — See *Water Volumes*, on page 9.
- **Rate** — Ensure that pest control products are applied at the rate(s) indicated on the label.
- **Calibration and coverage** — See *Coverage*, on page 10.
- **Timing** — Some pest control products may work on specific life stages of a pest.
- **Water pH** — Some pest control products have water pH requirements.
- **Time required for knockdown of pest** — Some pest control products have delayed effects.
- **Weather conditions** — See *Air Temperature and Relative Humidity, Rainfall, and Wind Speed, Temperature Inversions and Drift*, on page 11.

Resistance to pesticides can develop very quickly. Do not use the same chemical repeatedly unless it is used in rotation with a different chemical or used in combination with other chemicals having a different mode of action.

Many chemicals with the same active ingredients are marketed under different brand names. For example, the insecticide chlorpyrifos is marketed under the brand names Lorsban, Pyrifos, Nufos, Pyrinex and Warhawk.

Different chemicals may also have the same mode of action. For example, both Assail and Admire, although different active ingredients, have the same mode of action. Using Assail after Admire is equivalent to using Assail after Assail, since resistance to both chemicals develops at the same time, even though only one may have been used repeatedly.

Certain pests are more prone to develop resistance to pesticides than others. Pests with a short life cycle and many generations per growing season are more likely to develop resistance. Pests are more likely to develop resistance to pesticides that have a single mode or site of action than to those with multiple modes of action.

See Table 1–1. *Insecticide Groups Based on Sites of Action* and Table 1–2. *Fungicide Groups Based on Mode of Action* for a list of chemical families and their modes of action.

The pest control tables in Chapter 3, *Crop Protection*, starting on page 27, list the chemical group (Group Name (Group #)) for each pest control product. Over the course of the season, rotate between products from different chemical groups.

Table 1–1. Insecticide Groups Based on Sites of Action

The classification scheme listed below is adapted from the
Insecticide Action Committee Mode of Action Classification (IRAC) 8.1 (April 2016)

Group # ¹	Primary Site of Action	Group Name ¹	Product name(s) ²
1A	acetylcholinesterase inhibitors	carbamates	Lannate TNG, Sevin XLR, Vydate L
1B		organophosphates	Cygon 480, Diazinon 500 E, Dibrom, Imidan 70-WP, Lagon 480 E, Lorsban 15G, Lorsban 4E, Lorsban 50W, Lorsban NT, Malathion 85E, Nufos 4E, Orthene 97% SG, Pyrifos 15G, Pyrinex 480 EC, Sharphos 480 EC, Thimet 20-G, Warhawk 480 EC
3A	sodium channel modulators	pyrethroids	Concept, Danitol, Decis 5 EC, Decis 100 EC, Force 3.0G, Mako, Matador 120EC, Labamba, Perm-UP, Poleci 2.5 EC, Pounce 384EC, Safer's Trounce, Ship 250 EC, Silencer 120 EC, UP-Cyde 2.5 EC, Voliam Xpress
4A	nicotinic acetylcholine receptor competitive modulators	neonicotinoids	Aceta 70 WP, Actara 240 SC, Actara 25WG, Admire 240 F, Admire 240 SPT, Alias 240 SC, Assail 70 WP, Clutch 50 WDG, Concept, Cormoran, Cruiser 5FS, Cruise Maxx Potato Express, Gaucho 480 FL, Minecto Duo, Poncho 600 FS, Sepresto 75 WS, Titan ST
4C		sulfoximines	Closer, TwinGuard
4D		butenolides	Sivanto Prime
5	nicotinic acetylcholine receptor allosteric modulators	spinosyns	Delegate WG, Entrust, Entrust 80, Scorpio Ant and Insect Bait, Success, TwinGuard
6	glutamate-gated chloride channel allosteric modulators	avermectins	Agri-Mek 1.9% EC, Agri-Mek SC, Minecto Pro
8B	non-specific inhibitors	chloropicrin	Chloropicrin 100, Pic Plus
8F		methyl isothiocyanate generators	Basamid GR, Busan 1020, Busan 1180, Busan 1236, Enfuse M 510, Vapam HL
9D	chordotonal organ TRPV channel modulators	pyropenes	Versys
11A	microbial disruptors of insect midgut membranes	<i>Bacillus thuringiensis</i>	Bioprotec 3P, Bioprotec CAF, Bioprotec PLUS, Dipel 2X DF, Thuricide HPC, XenTari WG
15	inhibitors of chitin biosynthesis affecting CHS1	benzoylureas	Rimon 10 EC
17	moulting disruptor, Dipteran	cyromazine	Citation 75WP, Governor 75WP
18	ecdysone receptor agonists	diacylhydrazines	Intrepid
20B	mitochondrial complex III electron transport inhibitors	acequinocyl	Kanemite 15 SC
20D		bifenazate	Acramite 50WS
23	inhibitors of acetyl CoA carboxylase	tetronic and tetramic acid derivatives	Movento 240 SC, Oberon Flowable
25A	mitochondrial complex II electron transport inhibitors	beta-ketonitrile derivatives	Nealta
28	ryanodine receptor modulators	diamides	Coragen, Exirel, Fortenza, Harvanta, Minecto Pro, Vayego 200 SC, Verimark, Voliam Xpress
29	chordotonal organ modulators	flonicamid	Beleaf 50SG
NC	not classified	not classified	Kopa Insecticidal Soap, Opal Insecticidal Soap, Safer's Insecticide Soap, Safer's Trounce, Sluggo Professional, Superior 70 Oil, Surround WP
UNF	fungal agents of unknown or uncertain MoA		BioCeres G WP, BioCeres F WP, BotaniGard 22WP, BotaniGard ES, Met52 EC

¹ Although sharing the same primary target site, it is possible that not all members of a single major mode of action (MoA) class have been shown to be cross-resistant. However, for the purposes of this classification system, it should be assumed that cross-resistance exists between compounds in any one sub-group.

² Some products are listed in more than one group because they contain more than one active ingredient from different groups.

Table 1–2. Fungicide Groups Based on Mode of Action

This classification scheme is based on the Fungicide Resistance Action Committee (FRAC) List, February 2019.

Group #	Mode of Action (Target Site)	Group Name	Product Name(s) ¹	Risk of Developing Resistance
1	cytoskeleton and motor protein (β-tubulin assembly)	MBC (methyl-benzimidazole carbamates)	Senator 70WP, Senator PSPT, Senator 50SC	high
2	signal transduction (MAP/Histidine-kinase)	dicarboximides	Rovral	medium to high
3	sterol biosynthesis in membranes (C14-demethylase in sterol biosynthesis)	DMI (demethylation inhibitors)	Aprovia Top, Bumper 432 EC, Caramba, Cruiser Maxx Potato Express, Dividend XL RTA, Emesto Silver, Fitness, Folicur 432F, Fungtion, Maxim D, Mettle 125 ME, Mettle 210 ME, Miravis Duo, Nova, Proline 480 SC, Propi Super, Quadris Top, Quash, Quilt, Stadium, Stratego PRO, Tilt 250E, Trivapro A, Vibrance Ultra	medium
4	nucleic acids metabolism (RNA polymerase I)	PA (phenylamides)	Allegiance FL, Apron Maxx RFC, Apron XL LS, Dividend XL RTA, Maxim XL, Ridomil Gold 1G, Ridomil Gold 480SL, Ridomil Gold MZ 68WG	high
7	respiration (complex II: succinate-dehydrogenase)	SDHI (succinate dehydrogenase inhibitors)	Aprovia, Aprovia Top, Cantus WDG, Elatus B, Emesto Silver, Excalia, Fontelis, Kenja 400SC, Lance WDG, Luna Sensation, Luna Tranquility, Miravis Duo, Miravis Prime, Pen 240, Priaxor, Pristine WG, Pro-Gro, Sercadis, Trivapro A, Velum Prime, Vertisan, Vibrance 500 FS, Vibrabce Ultra, Vitaflo 280	medium to high
9	amino acids and protein synthesis (methionine biosynthesis)	AP (anilino-pyrimidines)	Luna Tranquility, Scala SC, Switch 62.5 WG	medium
11	respiration (complex III: cytochrome bc1)	QoI (quinone outside inhibitors)	Acapela, Azoshy, Cabrio EG, Cabrio Plus, Dynasty 100FS, Elatus A, Flint, Fungtion, Headline EC, Luna Sensation, Priaxor, Pristine WG, Quadris Flowable, Quadris Top, Quilt, Reason 500SC, Stadium, Stratego PRO, Tanos 50 DF, Trivapro B	high
12	signal transduction (MAP/Histidine-kinase)	PP (phenylpyrroles)	Apron Maxx RFC, Cruiser Maxx Potato Express, Maxim 480FS, Maxim D, Maxim Liquid PSP, Maxim MZ PSP, Maxim PSP, Maxim XL, Miravis Prime, Scholar 230SC, Stadium, Switch 62.5 WG	low to medium
13	signal transduction	aza-naphthalenes	Fungtion, Quintec	medium
17	sterol biosynthesis in membranes (3-keto reductase, C4-demethylation)	hydroxyanilides	Decree 50 WDG	low to medium
19	cell wall biosynthesis (chitin synthase)	polyoxins	Diplomat 5 SC	medium
21	respiration (complex III: cytochrome bc1)	Qil (quinone inside inhibitors)	Ranman 400SC, Torrent 400SC	medium to high
22	cytoskeleton and motor protein (β-tubulin assembly)	benzamides	Gavel 75DF	low to medium
24	amino acids and protein synthesis (protein synthesis)	hexopyranosyl antibiotic	Kasumin 2L	medium
27	unknown MoA	cyanoacetamide oxime	Curzate 60 DF, Tanos 50 DF	low to medium
29	respiration (uncoupler of oxidative phosphorylation)	2,6-dinitroanilines	Allegro 500F	low
31	DNA topoisomerase type II (gyrase)	carboxylic acids	Falgro Tablet	risk in fungi unknown

¹ Some products are listed in more than one group because they contain more than one active ingredient from different groups.

Table 1–2. Fungicide Groups Based on Mode of Action

This classification scheme is based on the Fungicide Resistance Action Committee (FRAC) List, February 2019.

Group #	Mode of Action (Target Site)	Group Name	Product Name(s) ¹	Risk of Developing Resistance
40	cell wall synthesis (cellulose synthase)	CAA (carboxylic acid amides)	Acrobat 50 WP, Forum, Orondis Ultra, Orondis Ultra A, Revus, Zampro	low to medium
43	cytoskeleton and motor protein (delocalisation of spectrin-like proteins)	benzamides	Presidio	medium
45	respiration (complex III: cytochrome bc1)	QoSI (quinone outside inhibitor, stigmatellin binding type)	Zampro	medium to high
46	cell membrane disruption (proposed)	plant extract	Timorex Gold	resistance not known
49	lipid synthesis or transport/membrane integrity or function (lipid homeostasis and transfer/storage)	OSBPI (oxysterol binding protein homologue inhibition)	Orondis Ultra, Orondis Ultra B, Vibrance Ultra	medium to high
50	cytoskeleton and motor protein (β -tubulin assembly)	actin/myosin/fimbrin function	Property 300 SC, Vivando SC	medium
BM01	biologicals with multiple modes of action (multiple effects on cell wall, ion membrane transporters; chelating effects)	plant extract	Fracture	unknown
BM02	biologicals with multiple modes of action (multiple effects described)	microbial	Actinovate SP, Cease Biological, Double Nickle 55, Mycostop, Prestop, Rootshield Granules, Rootshield HC, Rootshield PLUS, Serenade Opti, Serenade SOIL, Stargus, Taegro 2, Trium P	unknown
M01	multi-site contact activity	inorganic (copper)	Copper 53W, Copper Spray, Coppercide WP, Cueva, Kocide 2000, Parasol Flowable, Parasol WG	low
M02	multi-site contact activity	inorganic (sulphur)	Cosavet DF, Microscopic Sulphur, Microthiol Disperss	low
M03	multi-site contact activity	dithiocarbamates and relatives	Cabrio Plus, Dithane F-45, Dithane Rainshield, Ferbam 76 WDG, Gavel 75DF, Granuflo-T, Manzate Pro-Stick, Maxim MZ PSP, Penncozeb 75DF Raincoat, Polyram DF, Pro-Gro, PSPT 16%, Ridomil Gold MZ 68WG, Solan MZ, Thiram 75 WP, Tuberseal, Vitaflo 280	low
M04	multi-site contact activity	phthalimides	Folpan 80 WDG, Maestro 80DF, Sharda Captan, Supra Captan 80 WDG	low
M05	multi-site contact activity	chloronitriles	Bravo ZN, Echo 720, Echo 90DF	low
NC	not classified (unknown)	diverse	Bio-Save 10 LP, Botector, Cyclone, Contans WG, MilStop, PureSpray Green Spray Oil 13E, Storox, Tivano, Vegol	resistance not known
P05	host plant defence induction (anthraquinone elicitors)	plant extract	Regalia Maxx	resistance not known
P07	host plant defence induction (phosphonates)	phosphonates	Aliette WDG, Confine Extra, Phostrol, Rampart	low

¹ Some products are listed in more than one group because they contain more than one active ingredient from different groups.

Steps to Delay the Development of Pesticide Resistance

- Follow an IPM program that makes use of a variety of different pest management strategies, including cultural, mechanical, biological and chemical options.
- Spray insecticides only when necessary. Use established thresholds where available.
- Apply fungicides preventively before disease occurs. Wherever possible, follow disease prediction models. Applying fungicides in an attempt to eradicate a disease after it has become established is rarely effective and can increase the risk of selecting for resistant populations of the pathogen.
- Rotate between products from different chemical groups. Avoid the repeated use of any one pesticide or group of pesticides.
- Follow the pesticide label. Many products make specific recommendations about the maximum number of sequential applications and the maximum number of total applications permitted in one season.
- When applying a pesticide, use the appropriate rate, timing, water volume, nozzle selection and water pH.
- Ensure the sprayer is well maintained and properly calibrated.
- Do not make decisions on tank-mixing products during loading; do so during the off-season. Before tank-mixing pest control products, ensure the following:
 - All potential tank-mix partners are registered for use on the crop in Canada and being used according to the label.
 - Tank-mixing of these products is permitted on product labels, and no product is specifically excluded on any of the other labels.
 - If more than one insecticide is included in a tank-mix, each should belong to a different insecticide group with a different mode of action. Similarly, multiple fungicides should also be from different fungicide groups.
 - All products are compatible as a tank-mix. Compatibility issues may result in problems in the tank or in reduced control or crop damage due to chemical interactions.
 - The tank-mix only includes an adjuvant when specifically required by one of the product labels, and is not incompatible with any of the others.
 - If a control failure occurs after using a registered product, do not reapply the same pesticide.
 - Keep accurate records of the type of product used during each application throughout the season.

Resistance can be costly to the grower. The development and registration of new products is expensive and time consuming. Prudent use of pesticides will help reduce the development of resistant populations and conserve the effectiveness of existing products.

Spraying Vegetable Crops

Water Volumes

When the pesticide label does not prescribe a carrier volume, the spray operator must decide the appropriate volume. Ideally, it will be enough to suspend the product in solution and distribute spray droplets evenly over the target surface(s) but not so much as to cause excess spray to run off the plants. Most insecticides/fungicides are applied in 135–450 L/ha of water. Herbicide applications range from 55–350 L/ha. There are always exceptions. The spray operator must consider a few factors when determining an appropriate volume:

- **The mode of action of the product being applied.** For example, a contact product will require a higher droplet density than a locally systemic product, which has limited translocation in plant tissues.
- **The location of the target.** For example, if the target is a mobile insect found predominately on the upper side of the leaf surface, it will be easier to spray, and lower carrier volumes will be required. However, if the target is a disease that occurs deep in the plant canopy, more carrier volume will be required to penetrate and contact the pest.
- **The row spacing, size, density and stage of development of the crop.** The more plant canopy to be protected per hectare, the more carrier volume will be required to adequately cover all surfaces.

Coverage

Coverage can be defined as the number of discrete spray droplets per target area, combined with the total area covered. For example, a single large droplet impinging on a leaf would not be as effective as 100 smaller droplets evenly distributed over the leaf surface, even though they deliver the same amount of product. Good coverage on the upper, and often lower, leaf surface is an essential component of the performance of many fungicides and insecticides.

To confirm sufficient coverage, the sprayer operator requires some form of feedback. Visually inspecting foliar “wetness” and spray residue, or waiting to see if the spray successfully controlled the pest is not sufficient. Water-and-oil sensitive paper is a tool that can be used to assess spray coverage in the field. Table 1–3. *Water-and-Oil Sensitive Paper — Recommended Droplet Density* illustrates the paper manufacturer’s recommended droplet density per square centimetre for insecticide, herbicide and fungicide applications.

Table 1–3. Water-and-Oil Sensitive Paper — Recommended Droplet Density	
Number of droplets per cm²	Application Type
20–30	insecticides
20–30	herbicides (pre-emergence)
30–40	contact herbicides (post-emergence)
50–70	fungicides

Nozzle Selection

All agricultural spray nozzle manufacturers classify the output rate and range of droplet sizes produced by each of their nozzles. This information appears in their catalogues as tables linking droplet size classification to nozzle size (output rate typically in U.S. gal/min) and spray pressures (typically in lb/in.²).

The American Society for Agricultural and Biological Engineers (ASABE) Standard S-572.1 droplet size classifications associate a colour and a code to flat fan nozzles to indicate their average droplet size (see Table 1–4. *ASABE ISO Standard Tip Colours and Symbols Denoting Volume Median Diameter for Flat Fan Nozzles*). Be aware that hollow cone nozzles are only just beginning to adopt these standards, and the manufacturer’s catalogue should be consulted to confirm droplet sizes and rates.

Table 1–4. ASABE ISO Standard Tip Colours and Symbols Denoting Volume Median Diameter for Flat Fan Nozzles

Category	Symbol	Colour Code
Extra fine	XF	purple
Very fine	VF	red
Fine	F	orange
Medium	M	yellow
Coarse	C	blue
Very coarse	VC	green
Extra coarse	XC	white
Ultra coarse	UC	black

Most fungicides and insecticides require medium or medium-to-fine spray droplets. Smaller droplets are easily carried away on the wind and/or evaporate before hitting the target, resulting in pesticide drift and poor spray coverage. Poor spray coverage is a common cause of control failures. Coarse (or larger) droplets will greatly reduce the possibility of herbicide spray drift but should be used with higher carrier volumes to increase the number of droplets required for sufficient coverage of plant surfaces for insecticides or fungicides. Be aware that coarse droplets are prone to run-off and do not cover under-leaf surfaces without air-assist.

Hollow-cone nozzles produce more droplets with a finer size than solid-cone nozzles. Hollow- and solid-cone nozzles are particularly suited to the application of wettable powders, flowables and suspensions, and may assist in penetrating dense crop canopies such as field tomato, particularly when combined with an air-assist curtain. However, excessive boom height and ambient wind will cause significant drift from these nozzles unless the sprayer is equipped with shrouds or an air-assist system to intercept drifting spray. Further, the pumps on many field sprayers may not produce sufficient pressure to properly operate cone nozzles, which typically run at 50 psi and greater.

Flat fan nozzles on approximately 50-cm centres provide uniform spray distribution across the whole boom. They are frequently used for herbicide applications but are becoming more common for fungicide and insecticide application as well. The newer, low-pressure air induction (aka Venturi) flat fan nozzles produce very coarse droplets that reduce drift significantly but, once again, may require higher carrier volumes to produce the critical droplet density required for coverage.

Air Temperature and Relative Humidity

Pesticides can cause phytotoxicity or burning of plant foliage or flowers if applied during very hot weather (temperatures above 25°C). In hot conditions, avoid midday applications, as plants will be more prone to injury. Spraying during hot conditions may also cause a large portion of the spray droplets to evaporate before they hit the target, reducing efficacy and increasing drift. For more information about weather conditions, see the OMAFRA Factsheet *How Weather Conditions Affect Spray Applications*.

During conditions of high relative humidity (greater than 80% relative humidity), the drying of the spray materials will be delayed. Slow and prolonged drying of pesticides can lead to phytotoxicity in some instances.

Synthetic pyrethroid insecticides (e.g., Mako, Decis, Pounce, Matador, etc.) break down quickly when air temperatures are above 25°C, reducing their effectiveness. If possible, apply these in the evening, when temperatures have dropped, or select a different product.

Rainfall

The decision to spray just prior to a rain or shortly after should be based on plant protection. This may be more critical when applying fungicides. Fungicides are most effective if the leaf is adequately covered prior to infection. Once they have dried, most fungicides can withstand about 2.5 cm of rainfall and still provide adequate protection.

Many pre-emergent herbicides are best applied before a rain. Moist soils allow for better distribution of the herbicide within the seed zone. Post-emergent applications are best applied after a rain or should be timed to allow adequate drying prior to rainfall.

Wind Speed, Temperature Inversions and Drift

When applying fungicides and insecticides, moderate air movement helps move the product in and around the crop. In addition, light winds will help in the drying process. Optimum air movement is 3–10 km/h.

Drift potential is affected by the interaction of boom height, droplet size and ambient wind speed. To avoid particle drift, do not spray when wind speeds are high or gusty. Spraying during periods of dead calm is not advised, because spray may remain suspended in the air until the wind changes and potentially be carried off-target.

Spraying fine droplets and/or a volatile agrichemical (e.g., 2,4-D, dicamba, etc.) when a period of weather stagnation or a strong temperature inversion is expected within 24 hr of completing the application can lead to vapour drift. This occurs when fine particles or volatilizing pesticide get trapped and concentrated in the inversion layer and move unpredictably over great distances within that layer.

For more information on preventing pesticide drift, see *Manage Drift*, on page 23, and the OMAFRA Factsheet *Pesticide Drift From Ground Applications*.

Soil Fumigation

Soil fumigants are used to control soil-borne pests of vegetables, including nematodes, weeds and plant pathogens. When using a fumigant, always follow the instructions on the label carefully regarding rates, soil/field conditions, application and sealing methods, plant back intervals and safety. Proper use of fumigants is important for safety and efficacy. Shank-injection of fumigants is preferable, as this application method reduces the volatilization of the fumigant gas, which greatly lessens the potential for the gas to drift off-target.

Prior to application, work the soil to a depth of 20–25 cm. The moisture content of the soil must be at a level that would permit good seed germination. Proper soil preparation is an important step for using fumigants, especially for metam potassium and metam sodium products.

Fumigation typically occurs either in the fall or in the spring — check product label for product-specific timings. With fall applications, work the soil several weeks before fumigation to ensure that the crop residue is well decomposed. Do not disturb the soil after sealing until the normal spring cultural operations are started. After spring fumigation, cultivate the soil thoroughly before planting to aerate and ensure that all traces of fumigant have dissipated. Ensure untreated soil is not mixed with treated soil during cultivation.

Note many fumigants require a 21-day plant-back interval or more to prevent damage to the crop. Soil temperatures affect the performance of fumigants and the length of time between application and planting. Consult each fumigant label for the appropriate soil temperature guidelines and how they impact plant-back intervals.

DO NOT apply when a temperature inversion is occurring or is predicted to occur within 48 hr after application is complete, as fumigant vapours may drift.

DO NOT apply if light wind conditions (less than 3 km/h) are forecast to persist for more than 18 consecutive hours from the time the application starts until 48 hr after the application is complete.

Establish a buffer zone for fumigant applications. A buffer zone is an area established around the perimeter of each application block. See the label for the buffer zone area specific to each product. Before applying one of the fumigation products in Table 1–5. *Pre-Plant Management of Vegetable Pests Through Fumigation*, develop and implement a soil fumigation management plan. See product labels for details.

Fumigation Management Plan

A written Fumigation Management Plan must be developed prior to the start of any soil fumigant application. Entry into the application block by any person (other than fumigant handlers, emergency personnel, and local, provincial or federal officials performing inspection, sampling or other similar official duties) is PROHIBITED during the application block period. Any person involved in the use of fumigants is considered a fumigant handler. All fumigant handlers must hold an appropriate pesticide applicator certificate or licence recognized by the provincial/territorial pesticide regulatory agency where the pesticide application is to occur. Only fumigant handlers with an appropriate pesticide applicator certificate or licence may be in the application block from the start of the application until the Application Block Period expires, and in the buffer zone during the Buffer Zone Period.

The application block period begins at the start of application and expires at least 5 days after the application is complete, depending on criteria during the application (i.e., tarped or non-tarped, etc.). The applicator must verbally warn workers of the application.

Fumigant Application signs must be posted on all entrances to the application block. Signs must be posted prior to the start of the application (but no sooner than 24 hr prior to application) and remain posted for the duration of the application block period. Signs must be removed within 3 days after the end of the application block period.

Table 1–5. Pre-Plant Management of Vegetable Pests Through Fumigation

This information does not replace that included in product labels. The following is provided as general information only.
Carefully follow the manufacturer's directions for the use of soil fumigants. Avoid mixing untreated soil with treated soil.

Common Name	Trade Name (PCP#) ¹	Crops	Application	Rate	Pests Controlled	Application Notes
chloropicrin	Chloropicrin 100 (25863)	tomatoes, peppers	broadcast or banded ²	93 L/ha	Soil-borne pests (early-season): • root knot nematode • root lesion nematode • diseases, certain species of • <i>Phytophthora</i> spp. • <i>Thielaviopsis</i> spp. • <i>Fusarium</i> spp. • <i>Pythium</i> spp.	Prior to application, soil should be in condition for planting with sufficient moisture to support seed germination. Seal immediately after application by dragging a cultipacker immediately behind chisels, or wet down treated area to a depth of 2.5 cm (1 in.). Leave soil undisturbed for 10–14 days. Aerate for at least 5 days after cultivation.
		potatoes	banded ²	55 L/ha		
		root vegetables (CG 1) including: table beets, carrots, horseradish, parsnip, radish, rutabaga, sweet potatoes, sugarbeets, turnips	broadcast or banded ²	93 L/ha	Soil-borne pests (early-season): • root knot nematode • root lesion nematode • diseases, certain species of • <i>Phytophthora</i> spp. • <i>Thielaviopsis</i> spp. • <i>Fusarium</i> spp. • <i>Pythium</i> spp.	
		bulb vegetables (CG 3-07)	broadcast or banded ²	93 L/ha		
		cucurbit vegetables (CG 9)	broadcast or banded ²	93 L/ha		
		onions	broadcast or banded ²	93–140 L/ha	• pink root (<i>Phoma terrestris</i>)	
	Pic Plus (28715)	tomatoes, peppers	broadcast or banded ²	108 L/ha	Soil-borne pests (early-season): • root knot nematode • diseases, certain species of • <i>Phytophthora</i> spp. • <i>Thielaviopsis</i> spp. • <i>Verticillium</i> spp.	All areas broadcasted with a product containing chloropicrin must be covered with a plastic tarpaulin or Raven Vaporsafe 1 mil. film for a minimum of 5 days.
		potatoes	banded ²	64 L/ha		
		root vegetables (CG 1) including: table beets, carrots, horseradish, parsnip, radish, rutabaga, sweet potatoes, sugarbeets, turnips	broadcast or banded ²	108 L/ha	Soil-borne pests (early-season): • root knot nematode • root lesion nematode • diseases, certain species of • <i>Phytophthora</i> spp. • <i>Thielaviopsis</i> spp. • <i>Fusarium</i> spp. • <i>Pythium</i> spp.	
		bulb vegetables (CG 3-07)	broadcast or banded ²	108 L/ha		
		cucurbit vegetables (CG 9) <i>Phytophthora</i> and <i>Thielaviopsis</i>	broadcast or banded ²	108 L/ha		
		onions	broadcast or banded ²	108–162 L/ha	• pink root (<i>Phoma terrestris</i>)	

¹ The product registration number (PCP#) has been placed in the guide for convenience, but the pesticide label in possession should always be used for the most accurate and current PCP#.

² For banded applications, the broadcast equivalent application rate must be calculated to determine the buffer zone distance required by the label. Refer to the *Calculating the Broadcast Equivalent Application Rate* section on the label for help determining the rate based on your spacing.

Table 1–5. Pre-Plant Management of Vegetable Pests Through Fumigation

This information does not replace that included in product labels. The following is provided as general information only.
Carefully follow the manufacturer's directions for the use of soil fumigants. Avoid mixing untreated soil with treated soil.

Common Name	Trade Name (PCP#) ¹	Crops	Application	Rate	Pests Controlled	Application Notes
dazomet	Basamid Granular (15032)	eggplant, lettuce, pepper, tomato	seedbeds	3.25–5 kg/100 m ²	<ul style="list-style-type: none"> • nematodes (unencysted only — will not control cyst nematode) • most germinating weed seeds • soil fungi 	Apply to well-cultivated, moist soil in seedbed condition only. Soil should have a fine tilth and be free from clods and undecomposed roots or plant residues. Soil moisture level must be suitable for seed germination for a 5–7-day period prior to treatment. Water the soil as necessary to achieve and maintain this level. Incorporate and seal immediately after application. Leave soil undisturbed for 5–7 days after application when soil is warm or 2–4 weeks if soil is cool. Do not use if soil temperatures are below 6°C. Perform a safety germination test before planting, as described on label. See label for appropriate planting intervals and application details.
metam potassium	Busan 1180 (25124)	vegetables	banded ² bed or rows (injection)	231–434 L/ha	Soil-borne pests: <ul style="list-style-type: none"> • nematodes • weeds and germinating weed seeds (see label for list of weeds) • diseases <ul style="list-style-type: none"> • <i>Rhizoctonia</i> spp. • <i>Pythium</i> spp. • <i>Phytophthora</i> spp. • <i>Verticillium</i> spp. • <i>Sclerotinia</i> spp. • clubroot of crucifers 	Inject into well-cultivated, moist soil only. Before applying, always cultivate area thoroughly, breaking up clods and loosening soil deeply and thoroughly. A week before treatment, moisten soil after cultivation to desired depth. Lightly cultivate immediately before application if soil has crusted. Seal immediately after incorporation. See the label for sprinkler recommendations and specifics on planting intervals. Planting may take place 21 days after treatment if soil is well-drained, light-textured and relatively dry and warm. May need to wait at least 30 days to plant if soils are heavy, high in organic matter or are wet and/or cold. Wait at least 60 days after application of 576 L/ha. Make frequent shallow cultivations to aerate heavy clay or if cold and wet conditions persisted after application.
			broadcast (injection)	231–576 L/ha		

¹ The product registration number (PCP#) has been placed in the guide for convenience, but the pesticide label in possession should always be used for the most accurate and current PCP#.

² For banded applications, the broadcast equivalent application rate must be calculated to determine the buffer zone distance required by the label. Refer to the *Calculating the Broadcast Equivalent Application Rate* section on the label for help determining the rate based on your spacing.

Table 1–5. Pre-Plant Management of Vegetable Pests Through Fumigation

This information does not replace that included in product labels. The following is provided as general information only.
Carefully follow the manufacturer's directions for the use of soil fumigants. Avoid mixing untreated soil with treated soil.

Common Name	Trade Name (PCP#) ¹	Crops	Application	Rate	Pests Controlled	Application Notes
metam sodium	Enfuse M 510 (29142)	agricultural	broadcast	260 L/ha	Soil-borne pests: • nematodes • weeds • fungi	Before applying, cultivate area thoroughly, breaking up clods and loosening soil deeply and thoroughly. A week before treatment, moisten loosened soil. Lightly cultivate immediately before application. Apply evenly over the moist, cultivated soil. Wait 7 days after application, then rake soil to a depth of 8 cm (3 in.). Rake again 7 days later to a depth of 5 cm (2 in.). Planting may take place 21 days after treatment if soil is well-drained, light- to medium-textured and relatively dry and warm. May need to wait at least 30 days to plant if soils are wet and/or cold.
	Busan 1020 (19421)	vegetables	banded ² (injection)	375–709 L/ha	Soil-borne pests: • nematodes	Inject into well-cultivated, moist soil only. Before applying, always cultivate area thoroughly, breaking up clods and loosening soil deeply and thoroughly. A week before treatment, moisten soil after cultivation to desired depth with watering. Keep the soil moist with watering if necessary until time to treat. Lightly cultivate immediately before application if soil has crusted. Seal immediately after injection. See the label for post-application cultivation and sprinkler recommendations. Planting may take place 21 days after treatment if soil is well-drained, light-textured and relatively dry and warm. If soils are heavy or especially high in organic matter or remain wet and/or cold following application, observe a minimum interval of 30 days after application. If in doubt, transplant a seeding plant and examine for injury before planting crop. On heavy and wet soils, light surface cultivation to break up crusting and promote drying of the soil should be done 5–7 days after application. This cultivation may be repeated as necessary. To avoid re-infesting treated soils, cultural practices should be such that untreated soils are not mixed with treated soils.
			broadcast (injection)	375–935 L/ha	• germinating weed seeds (see label for list of weeds)	
	Busan 1236 (25103)	vegetables	banded ² (injection)	274–521 L/ha	• diseases: • <i>Rhizoctonia</i> spp.	
			broadcast (injection)	274–683 L/ha	• <i>Pythium</i> spp. • <i>Fusarium</i> spp.	
	Vapam HL (29128)	vegetables	banded ² (injection)	279–529 L/ha	(Vapam HL only) • <i>Phytophthora</i> spp.	
			broadcast (injection)	279–696 L/ha	• <i>Verticillium</i> spp. • <i>Sclerotinia</i> spp. • clubroot of crucifers	

¹ The product registration number (PCP#) has been placed in the guide for convenience, but the pesticide label in possession should always be used for the most accurate and current PCP#.

² For banded applications, the broadcast equivalent application rate must be calculated to determine the buffer zone distance required by the label. Refer to the *Calculating the Broadcast Equivalent Application Rate* section on the label for help determining the rate based on your spacing.

2. Using Pesticides in Ontario

Visit www.ontario.ca/usingpesticides for up-to-date information on provincial pesticide use requirements. Some of the information provided in this generic chapter may not apply to all crops.

Read the label before use.

Product labels may change.

Review the Grower Pesticide Safety Course Manual at
www.opep.ca/courses/pick-up-a-gpsc-manual

Keep detailed spray records.

Federal Registration of Pesticides

Before a pesticide (pest control product) can be sold or used in Ontario, it must be registered under the federal *Pest Control Products Act* (PCP Act). The Pest Management Regulatory Agency (PMRA) of Health Canada registers pesticides for use in Canada following an evaluation of scientific data to ensure that any human health and environmental risks associated with its proposed uses are acceptable, and that the products have value.

The PMRA re-evaluates registered pesticides to determine whether today's health and environmental protection standards are still met when the pesticide is used according to the label. The PMRA also assesses whether the pesticide still has value. Re-evaluations are initiated every 15 years. Outcomes of a re-evaluation can be:

- no change to the registration
- amendments to the label (e.g., changes to personal protective equipment requirements, restricted entry intervals, buffer zones)
- modifications to existing Maximum Residue Limits (MRLs)
- elimination or phasing-out of certain uses or formulations
- discontinuation of the registration

A special review of a registered pesticide can be initiated at any time by the PMRA if the PMRA has reason to believe its use may pose unacceptable risk to human health or the environment or the pesticide no longer has value. Special reviews focus on a specific concern (e.g., neonicotinoid pesticides and impacts to pollinator health).

The pesticide label is a legal document. Follow all label directions. Labels for all registered pesticides are under "Search Pesticide Labels" on the PMRA website at www.healthcanada.gc.ca/pmra. Ensure you have the most current label and are aware of any re-evaluation decisions. Emergency registrations are temporary registrations (1 year or less) for pesticides needed by growers to manage a new invasive pest or pest outbreak. Know the expiration date for pesticides you are using under an emergency registration.

Maximum Residue Limit (MRL)

When you apply a pesticide to a crop, some residue may remain on the crop at harvest time. A Maximum Residue Limit (MRL) is the maximum amount of pesticide residue that may remain on food after a pesticide is applied as per label directions and which can safely be consumed. The PMRA sets the MRL well below a level that may cause harm to human health. The MRL is specific for every pesticide-crop combination.

The Canadian Food Inspection Agency (CFIA) is responsible for enforcing the MRLs established by the PMRA. OMAFRA's Food Inspection Branch conducts an annual Produce Food Safety Monitoring Program which involves collecting Ontario grown fresh fruits and vegetables and testing them for pesticide residues and pathogenic organisms (e.g., *Listeria monocytogenes*, *E. coli* O157:H7).

If you apply a pesticide at a higher rate, make too many applications or harvest a crop before the Pre-Harvest Interval has ended, there may be pesticide residues in excess of the MRLs set by PMRA.

When exporting your food product, it is important to confirm the importing country's MRLs because it may be different than ours. Processors or retailers may demand more restrictive limits. Growers should seek advice of their intended market to determine if more restrictive limitations apply. Keep accurate and up-to-date records on pesticide use in each crop.

For more information on MRLs, see:

- PMRA's MRL database at <http://pr-rp.hc-sc.gc.ca/mrl-irm/index-eng.php> provides information on established Canadian MRLs. This database includes importing MRLs that may have pesticide-crop combinations that are not registered for use in Canada. Always check the current Canadian pesticide label for registered uses.
- Global MRL Database at www.globalmrl.com provides free access to U.S. MRL information.
- Agricultural Chemical Companies can provide MRL information for their products. Companies' contact information are found on the pesticide labels, company websites and in OMAFRA's crop protection publications.
- Summaries of OMAFRA's Food Safety Monitoring Program results can be found at www.ontario.ca/producesafety.
- CFIA's Chemical Residue Surveillance Program at <https://www.inspection.gc.ca/food-safety-for-industry/food-chemistry-and-microbiology/food-safety-testing-bulletin-and-reports/eng/1453324778043/1453327843364>

Regulation of Pesticides in Ontario

The Ontario Ministry of the Environment, Conservation and Parks (MECP) is responsible for regulating the sale, use, transportation, storage and disposal of pesticides in Ontario. Ontario regulates pesticides by placing appropriate education, licensing and/or permit requirements on their use, under the *Pesticides Act* and Regulation 63/09. All pesticides must be used in accordance with requirements under the *Pesticides Act* and Regulation 63/09, which are available on the e-laws website at ontario.ca/laws or by calling Service Ontario at 1-800-668-9938 or 416-326-5300.

Classification of Pesticides

The PMRA classifies a pesticide into one of four classes – manufacturing, restricted, commercial and domestic. As of May 1, 2020, Ontario's pesticides classes have been aligned with the federal government's pesticide categories to remove duplication and reduce complexity for the sale and use of pesticides in Ontario, while ensuring continued protection of human health and the environment.

The MECP automatically classifies pesticides in Ontario as Class A, B, C or D based on the federal classification system plus one additional class (Class E) for regulating the sale and use of neonicotinoid-treated corn and soybean seed.

Table 2–1. Federal and Provincial Classification

Federal Product Class	Federal Class Description	Provincial Class
Manufacturing	The pesticide is only used to manufacture a pest control product.	Class A
Restricted	The pesticide is restricted by the federal government out of concern of environmental risk or human health. Additional information must be shown on the label regarding essential conditions for display, distribution and limitations on use. Specific qualifications may be required for a person to use this product.	Class B
Commercial	The pesticide can only be used in commercial activities that are specified on the label.	Class C
Domestic	The pesticide is primarily used by the general public for personal use and in and around their homes.	Class D
N/A		Class E* Corn and soybean seeds that are treated with imidacloprid, clothianidin or thiamethoxam neonicotinoids

* Class E pesticides do not apply to:

- popping corn
- sweet corn
- corn used for the production of seed
- soybean seed planted for the purpose of producing a soybean seed crop of certified status under contract
- corn seed and soybean seed treated only with fungicide.

Each Ontario Class has specific certification, licensing and/or permit requirements and restriction on its use and sale.

Certification and Licensing

Certified Farmers and Their Assistants

Farmers must be certified through the Grower Pesticide Safety Course (GPSC) in order to buy and use Class B and C pesticides on their farms. Certification is not required to buy and use Class D pesticides for agricultural purposes.

Farmers become certified by successfully completing one of the following certification options:

- one-day in-person course and pass an open book certification test with a mark of at least 75%, or
- online course and successfully complete quizzes and case studies to become certified.

Farmer assistants and supervised farmers using Class B or C pesticides must complete training and assist or be supervised by a certified farmer. Farmer assistants and supervised farmers must complete one of the two training options:

- participate in a GPSC (assessment is not required) or
- participate in an On-Farm training session given by an On-Farm Instructor.

For information about farmer training and certification requirements visit the MECP website at ontario.ca/pesticides and for information on courses visit the University of Guelph's Ontario Pesticide Education Program website at www.opep.ca or call 1-800-652-8573.

To buy and use Class E pesticides, farmers are required to:

1. Complete the Integrated Pest Management (IPM) Course for Corn and Soybean
2. Complete a pest risk assessment and a [pest risk assessment report](#)
3. Sign an [IPM Written Declaration Form](#) stating that you considered IPM principles to decrease the risk of early season insect damage.

Farmers must provide these pieces of information to a vendor sales representative or custom-seed treater in order to purchase Class E pesticides. They must retain these records for at least two years.

Farmers must also carry with them or have readily available at the field when they are planting a copy of their certificate of completion of the Integrated Pest Management (IPM) Course for Corn and Soybean and pest risk assessment report.

For information on the requirements for Class E pesticides visit the MECP website ontario.ca/pesticides. For information on the IPM Course visit the University of Guelph's website at IPMCertified.ca.

Pesticide Commercial Applicators (Exterminators) and Their Assisting Technicians

All applicants for a pesticide exterminator licence must first become certified by passing an examination. Once certified, you can apply to the MECP for an exterminator licence.

For more information on how to become certified, refer to [Ontario Pesticide Training and Certification](#)

University of Guelph, Ridgetown Campus
1-888-620-9999
Email: rcoptc@uoguelph.ca
Website: www.ontariopesticide.com

For further information on pesticide licensing please refer to the document *Guide to Pesticide Licensing* available at ontario.ca/pesticides.

For information on technician training, visit:

- the Ontario Pesticide Training and Certification website at www.ontariopesticide.com or call 1-888-620-9999 or 519-674-1575
- the Pesticide Industry Council's Pesticide Technician Program website at www.horttrades.com/pesticide-technician or call 1-800-265-5656 or email pic@horttrades.com
- the Pesticide Industry Regulatory Council (PIRC) at www.oipma.ca

Ontario's Cosmetic Pesticide Ban and Excepted Uses

Ontario prohibits the use of certain pesticides for cosmetic (non-essential) purposes.

Only low risk pesticides and biopesticides may be used for cosmetic purposes such as in lawns and gardens, and these are listed in the publication "List of Active Ingredients Authorized for Cosmetic Uses (Allowable List.)"

Under the ban, the use of an active ingredient that is not on the Allowable List is permitted for appropriately licensed individuals if the use falls under one of the exceptions to the ban. There are exceptions for public health and safety (including for public works, buildings and other structures that are not a public work, and to control poisonous plants), golf courses, specialty turf, specified sports fields, arboriculture and the protection of natural resources, if certain conditions are met. There are also exceptions for agriculture, forestry, research and scientific purposes, uses of pesticides for structural exterminations (e.g., in and around homes to control insects), and uses of pesticides required by other legislation.

To locate your local MECP District Office:

<https://www.ontario.ca/environment-and-energy/ministry-environment-district-locator>

To speak with your local MECP Pesticide Specialist:

South West Region	— 519-668-9292
West Central Region	— 905-512-0981
Central Region	— 416-990-1694
Eastern Region	— 613-540-6874
Northern Region	— 705-562-0853

Pesticide Application Information

When you decide to use a pesticide, choose the least toxic and least volatile option for your situation. Use an appropriate application method and ensure equipment is properly maintained and calibrated. Take all possible precautions to prevent the exposure of people and non-target organisms to the pesticide, before, during and after the application. Read the most current pesticide label thoroughly before application. The pesticide label is a legal document and must be followed. Pesticides may only be used in accordance with label instructions. The label provides important information, such as:

- directions for use (e.g., rates of application, crops/sites it can be used on, target pests, crop rotation restrictions, total number of applications, droplet size, application equipment, timing, appropriate weather conditions)
- required personal protective equipment (PPE)
- hazard symbols and warnings
- restricted entry intervals
- pre-harvest intervals
- buffer zones / vegetative strips
- precautionary statements
- steps to be taken in case of an accident
- disposal
- equipment sanitation

For more information on hazards, consult the Safety Data Sheet (SDS) or contact the manufacturer.

For more information on pesticide application, see:

- Sprayers 101 at www.sprayers101.com
- OMAFRA Factsheet *Pesticide Drift from Ground Applications*
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) videos at www.opep.ca/resources
- OMAFRA Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*, Order No. BMP13
- OMAFRA Factsheet *Pesticide Contamination of Farm Water Supplies*
- PMRA's Factsheet *Understanding Restricted Entry Intervals for Pesticides* (English, French and Spanish): www.healthcanada.gc.ca/pmra, search for Restricted Entry Interval

Restricted Entry Intervals

Restricted Entry Interval (REI) is the minimum period of time that must elapse before hand labour tasks can be performed in an area treated with pesticide. The REI allows the pesticide residues and vapours to dissipate to safe levels to protect agricultural workers.

Hand labour tasks involve substantial worker contact with treated surfaces such as plants, plant parts or soil. Examples of these activities include planting, harvesting, pruning, detasseling, thinning, weeding, scouting, topping, sucker removal, mowing, roguing and packing produce into containers in the field or greenhouse. You can only perform these tasks after the REI has passed. Hand labour generally does not include operating, moving or repairing irrigation or water equipment, except for hand-set irrigation.

An REI can range from 12 hours to several days depending on the crop and the task (e.g., scouting, harvesting). A minimum 12-hour REI must be observed in agricultural crops, even if no REI is indicated on the label. However, REIs do not apply to biopesticides (e.g., microbials, pheromones) unless specified on the label. For golf courses and residential turf applications, the spray solution must be dry before re-entry can occur. When tank-mixing pesticides that have different REIs, you must observe the longest REI.

A Certified Farmer or Licensed Commercial Applicator (i.e., a holder of the appropriate Exterminator License, such as an Agriculture Exterminator License or a Greenhouse/Interior Plant Exterminator License) may need to enter a treated area early to do short-term tasks before the end of the REI. In these cases, the Certified Farmer or Licensed Commercial Applicator may enter between 4–12 hr after the application wearing a NIOSH-approved respirator and any other protective clothing (PC) and personal protective equipment stated on the label for mixing and loading. This Certified Farmer or Licensed Commercial Applicator (exterminator) must not be in the treated area during the REI for more than a total of 1 hr in any 24-hr period.

See Figure 2–1 for an example of a 24-hr REI on a pesticide label.

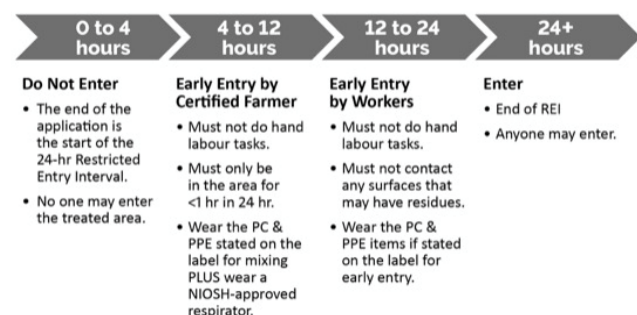


Figure 2–1. Example of a 24-hr REI on a pesticide label.

Certified Farmers and Licensed Commercial Applicators should plan pesticide applications around work tasks so that no one needs to enter treated areas before the restricted entry interval has passed.

Days to Harvest Intervals for Food Crops (Pre-harvest, Pre-grazing and Feeding Intervals)

These intervals state the minimum time that must pass between the last pesticide application and the harvesting of the crop or the grazing and cutting of the crop for livestock feed. If you harvest a crop before the pre-harvest interval (PHI) has ended, there may be pesticide residues in excess of the maximum residue limits (MRLs) set by PMRA.

“Up to the day of harvest” means the same as 0 days PHI; however, the REI may be more restrictive (e.g., a 12-hr restricted entry interval) and must be observed for harvesting that occurs on the day of pesticide application.

To avoid exceeding the maximum residue limits, always follow the directions on the label.

Spray Buffer Zones

Spray buffer zones are no-spray areas required at the time of application between the area being treated and the closest downwind edge of a sensitive aquatic or terrestrial habitat. Spray buffer zones reduce the amount of spray drift that enters non-target areas.

Sensitive terrestrial habitats include hedgerows, grasslands, shelterbelts, windbreaks, forested areas and woodlots.

Sensitive freshwater habitats include lakes, rivers, streams, creeks, reservoirs, marshes, wetlands and ponds.

The pesticide label indicates the size of the spray buffer zone, which depends on the product used, the method of application, and the crop being sprayed.

Unless forbidden by the pesticide label, Health Canada’s online Buffer Zone Calculator may allow applicators to reduce the spray buffer zones based on weather conditions, the category of the spray equipment and the droplet size. For more information, search for “Buffer Zone Calculator” at www.canada.ca.

For soil fumigation, a buffer zone is an area established around the perimeter of each application block.

Vegetative Filter Strips

A vegetative filter strip is:

- a permanently vegetated strip of land.
- sits between an agricultural field and downslope surface waters.
- must be at least 10 m wide from edge of field to the surface water body.
- must be composed of grasses, but may also contain other vegetation (shrubs, trees, etc.).

Vegetative filter strips reduce the amount of pesticide entering surface waters from runoff by slowing runoff water and filtering out pesticides carried with the runoff. Certain pesticide labels will require a vegetative filter strip. Other labels will recommend a vegetative filter strip as a best management practice.

Protect the Environment

Protect Water Sources

According to the British Crop Protection Council (BCPC), 40%–70% of surface water pesticide contamination comes from mixing and filling areas.

Where possible, load or mix pesticides on impermeable surfaces located safely away from watercourses or environmentally sensitive areas. Collect drainage and run-off and dispose of it safely (*Your Guide to Using Pesticides*, BCPC 2007).

Clean your spray equipment away from wells, ponds, streams and ditches. Apply the diluted rinse water (usually at a ratio of 10:1) to the treatment area (crop), but do not exceed the pesticide rate recommended on the label.

Do not make a direct connection between any water supply (e.g., public supply, wells, watercourse or pond) and a spray tank. Use an anti-backflow device or intermediate system to prevent back-siphoning that could contaminate the water supply.

Immediately contain and clean up any spills to prevent contamination to water sources.

Check the pesticide label for specific instructions on protection of water sources.

For more information on protecting water sources, see ontario.ca/crops:

- OMAFRA Factsheet *Pesticide Contamination of Farm Water Supplies*
- OMAFRA Factsheet *Groundwater — An Important Rural Resource: Protecting the Quality of Groundwater Supplies*
- OMAFRA Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*, Order No. BMP13

Bee Poisoning

Honey bees, native bee species (e.g., bumble bees, squash bees) and other pollinating insects are important pollinators for many Ontario crops. Insecticides, some of which may negatively affect bees, require careful management to achieve both pollination and insect control of pest species. Growers and licensed commercial applicators can protect bees by following these suggestions:

- Time insecticide applications to minimize bee exposure (e.g., apply post bloom). Daytime treatments, when bees are foraging, are most hazardous. Insecticide applications in the evening are the safest, unless there is evidence of a strong temperature inversion or high humidity. Under normal circumstances, spraying after 8 p.m. allows the spray to dry before the bees are exposed to it the next day. Spraying during early morning is the next best time, when fewer bees are foraging, but pesticide residues may still be present. Spraying should be completed well before 7 a.m. While honey bees and most other pollinating insects do not usually forage at temperatures below 13°C, bumblebees do. If you plan to spray in the morning, contact beekeepers who have bees within 5 km of your crop and spray site. The beekeepers may then have the option of taking any possible protective action.
- Do not apply insecticides while fruit trees are in bloom. The *Bees Act* makes it an offence to do so in Ontario. Do not spray any flowering crop on which bees are foraging.
- To prevent drift toward nearby hives, do not apply insecticides on windy days or when there is evidence of a strong temperature inversion.
- Bees and other pollinators may be poisoned by visiting flowering weeds, trees and cover crops that have come into contact with an insecticide via spray drift or drift of insecticide-contaminated dust during planting. Avoid spray drift to flowering weeds that are adjacent to or within the target field. Where possible, mow down flowering cover crops or flowering weeds in and bordering target fields prior to spraying to help safeguard the bees. Control dandelions and other flowering weeds within fields before spraying or planting seeds treated with an insecticide. Take measures to reduce movement of dust from insecticide seed treatments to flowering trees, weeds and water sources that are in or adjacent to the target field. For more information on reducing dust movement, search for “Pollinator Protection and Responsible Use of Treated Seed — Best Management Practices” at www.canada.ca.
- Systemic insecticides may also pose a high risk to bees and other insect pollinators. Bees can be exposed to insecticide residues in or on flowers, leaves, pollen, nectar and/or surface water. Do not apply insecticide or allow it to drift onto blooming crops or off-site habitat if bees are foraging in or adjacent to the treatment area.

- In crop settings where pesticide use is highly likely, beekeepers should remove honey bee colonies as soon as pollination and bloom are complete in the crop and before any insecticides are applied post bloom. In emergency situations, if the colonies cannot be removed in time, beekeepers can place burlap or cloth soaked in water at the entrance of the hive to disrupt the flight of the bees for up to 12 hr and provide more time for spray to dry. To help prevent overheating of the hive during this time, keep an opening of 2.5 cm on each side of the hive entrance so bees can still get out and ventilate the hive. Also, the water on the burlap or cloth will help cool the colony.
- Not all pesticides are equally toxic to bees. If there is a risk of honey bee poisoning, try to choose an insecticide that is not highly toxic to bees. When there is a choice, choose a product formulation that is less hazardous to bees.
- Always read the most current pesticide label for guidance. Some pesticides cannot be used when bees are active in the crop.

For more information on ways to reduce bee poisoning, see:

- *Practices to Reduce Bee Poisoning from Agricultural Pesticides in Canada*, available at honeycouncil.ca. Select “Bee Health Roundtable.”

Manage Drift

Pesticide drift is the aerial movement and unintentional deposit of pesticide outside the target area. Drift results in wasted product, may compromise crop protection and can adversely affect nearby sensitive environmental areas, crops and wildlife. The following strategies can help reduce the risk of pesticide drift:

- Do not spray when wind direction is changeable, or wind speeds are high or gusty. These conditions increase the potential for off-target drift. While most pesticide labels indicate allowable wind speeds, some do not.
- Regularly monitor wind conditions during spraying, preferably in the field with a handheld wind meter at nozzle height or elevated to the top of the target canopy from within the planted area. Record the wind speed and direction. As conditions change, make adjustments to manage drift potential. Adjustments may include a coarser droplet size, minimizing nozzle-to-target distance, adjusting air energy or vector on air-assisted sprayers, slowing travel speed, using a drift reducing adjuvant or discontinuing spraying until conditions improve.

- Do not spray during periods of dead calm. Periods of dead calm may occur between late evening and early morning and can result in the vapour or fine spray droplets remaining aloft, like fog. Spray-filled air can move unpredictably over great distances several hours after the spray event is completed.

Temperature inversions create problems for spray applicators because pesticide spray can:

- remain suspended and active in the air above the target for long periods of time
- move with light breezes in changeable and unpredictable directions
- move down slopes and concentrate in low-lying regions

Field air temperatures are often very different from local or regional forecasts, so the most reliable method of detecting inversion conditions is to measure temperatures at, and several metres above, the ground. Commercial hand-held inversion detectors are now available. Spray applicators can also recognize a temperature inversion from environmental cues, such as when:

- there is a big drop from daytime to nighttime temperature
- wind dies down by early evening and night
- far away sounds can be heard clearly
- odours seem more intense
- daytime cumulus clouds collapse toward evening
- overnight cloud cover is 25% or less
- smoke or dust hangs in the air and/or moves laterally in a sheet

Temperature inversions start to form about 3 hr prior to sunset, become stronger as the sun sets and continue until sunrise when the surface warms and air mixing begins. If you suspect there’s an inversion, don’t spray. Often, warnings for the risk of inversions are stated right on the product label.

- If specified, use the sprayer output indicated on the pesticide label.
- Use a nozzle at a pressure that will produce the droplet size specified on the pesticide label or delivers droplets appropriate for the job.
- Coarser droplets reduce drift significantly. Air induction nozzles used above 2bar (30psi) will produce Coarse to Ultra Coarse droplets. They can be used in the top nozzle positions on air-assist sprayers in specialty crops, or along conventional horizontal booms. Ensure the droplet size and volume are appropriate for the application being performed.
- Minimize the distance between nozzle and target as much as possible while still maintaining spray uniformity.

- Establish buffer zones for the protection of adjacent sensitive areas. Some pesticide labels will state buffer zone setbacks; follow these carefully.
- Use drift reduction technology, such as hoods, shrouds, screens or air curtains.
- If appropriate, use drift-reducing adjuvants in the spray tank. The intense agitation in air-assist sprayers for specialty crops has been shown to reduce the effectiveness of drift-reducing adjuvants. Certain combinations of drift-reducing adjuvants and air-induction nozzles have been shown to increase the incidence of fine droplets. Consult with the adjuvant manufacturer.
- When possible, use non-volatile pesticide formulations or products.

For more information about spray drift, see:

- Sprayers 101: www.sprayers101.com
- OMAFRA website: ontario.ca/spraydrift
- OMAFRA Factsheet *Pesticide Drift from Ground Applications*
- OMAFRA Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*, Order No. BMP13
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) *Drift of Pesticides* video series, available at www.opep.ca/resources (click the “YouTube” icon)

Waste Management

Empty Pesticide and Fertilizer Containers up to 23 L

Never re-use empty pesticide containers.

The Ontario Empty Pesticide and Fertilizer Container Recycling Program, an industry-led program, is available free of charge to growers and commercial applicators. Through this program, you can return triple-rinsed or pressure-rinsed plastic pesticide and fertilizer containers up to 23 L to container collection depots located throughout the province. Remove the cap and booklet from the pesticide container and metal handle from the fertilizer pail before recycling. To locate the closest container collection depot, visit www.cleanfarms.ca, call your local dealer or contact Cleanfarms at 416-622-4460 (toll-free at 877-622-4460) or info@cleanfarms.ca.

Empty Pesticide Containers Greater than 23 L (Totes and Drums)

Growers and commercial applicators should return pesticide containers that are greater than 23 L in size to the point of sale or local collection site for disposal. Contact your local dealer for details on disposal of these containers, or contact Cleanfarms at 416-622-4460 (toll-free at 877-622-4460) or info@cleanfarms.ca.

Empty Seed and Pesticide Bags

Growers can return their empty seed and pesticide bags to select retail locations. Contact your local dealer for details on disposal of these empty seed and pesticide bags, or contact Cleanfarms at 416-622-4460 (toll-free at 877-622-4460) or info@cleanfarms.ca.

Surplus Spray Mix

The best approach is to plan the spray job accurately to avoid creating a surplus.

When this is unavoidable, dispose of excess spray mix by spraying it on other crops that require an application of this pesticide. Before spraying, check the label to make sure the pesticide is registered for use on that other crop.

If you cannot find another allowable crop to spray, then dilute the remaining spray mix by adding 10 parts of water for each 1 part of spray mix.

The diluted solution can be safely applied to the original treated area as long as you do not exceed the pesticide rate recommended on the label. Be sure to check the label for any restrictions about crop rotation, days to harvest or disposal of surplus spray mix.

Never re-spray the treated field with undiluted spray mix. Spraying an area twice at the same pesticide rate will double the labeled pesticide rate. This may cause illegal pesticide residues in the harvested crop or harmful residues in the soil that can cause crop damage.

Surplus Pesticide Disposal

Be sure to safely dispose of pesticides that you do not need or cannot use. Options for proper disposal include:

- Contact the supplier. It is sometimes possible to return unused pesticide if it is still in its original, unopened container.
- Hire a licensed waste hauler who is licensed under Part V of the *Environmental Protection Act* to carry hazardous wastes.

- Cleanfarms operates a free Obsolete Pesticide and Animal Health Product Collection Program throughout the province every 3 years. To locate the closest collection point and date, visit the Cleanfarms website (www.cleanfarms.ca), contact Cleanfarms at 416-622-4460 (toll-free at 877-622-4460) or info@cleanfarms.ca or contact your local dealer for program details.
- Contact your municipality to see if any hazardous waste collection days are scheduled and verify whether quantities of agricultural pesticides will be accepted.

Storing Pesticides

Ontario's *Pesticides Act* and Regulation 63/09 provide details on storage requirements for pesticide storage facilities. As shown in Table 2–2, the storage requirements that must be followed are dependent on which classes of pesticides you store.

Table 2–2. Requirements for Pesticide Storage Facilities

Storage requirements	Pesticide Classes		
	Class B****	Class C	Class D
No contact with food or drink	YES	YES	YES
Not an impairment to health and safety	YES	YES	YES
Clean and orderly	YES	YES	YES
Warning sign G posted*	YES	YES	YES
Emergency telephone numbers posted**	YES	YES	YES
Vented to outside	YES	YES	NO
Limited access (locked)	YES	YES	NO
No floor drain	YES	YES	NO
Respiratory protection and protective clothing kept readily available	YES	YES	NO
Area used primarily for pesticides	YES	YES***	NO

Note: Sufficient precautions are needed in your storage area to prevent the pesticide from entering the natural environment. Ensure your floor drain does not enter the natural environment.

* See ontario.ca for requirements for warning sign G (Search for sample fire warning signs for pesticide use). These signs can be purchased from your pesticide dealer/vendor.

** Emergency contact numbers must include telephone numbers for the local fire department, hospital and poison control centre. The number for the MECP Spills Action Centre (1-800-268-6060) should also be readily available.

*** Only applies to Class C pesticides that are fumigants

**** Does not apply to animal repellent products that only contain the active ingredient Capsaicin or Capsaicin and related capsaicinoids.

For more information about storing pesticides, see:

- OMAFRA Factsheet *Farm Pesticide Storage Facility*
- OMAFRA Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*, Order No. BMP13
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) *Grower Pesticide Safety Course Manual*, available at www.opep.ca. Select "Learn."

Pesticide Spills

Part X of the *Environmental Protection Act* defines a spill as a discharge of pollutant (including pesticides) that is abnormal in quality or quantity, from or out of a structure, vehicle or other container into the environment. An overturned pesticide sprayer that results in the release of the pesticide spray solution to the environment is an example of a spill. A pesticide container that ruptures and leaks its contents is another example of a spill. The discharge or spraying of a pesticide in an unapproved area is also considered a spill.

Part X of the *Environmental Protection Act* requires every person having control of a pollutant that is spilled or who spills, causes or permits a spill of a pesticide shall immediately notify:

- the Ministry (through the Spills Action Centre)
- the municipality within the boundaries of the spill, and
- the owner of the pesticide or the person having charge, management or control of the pesticide.

Ontario's Spills Action Centre receives calls 24 hours a day (1-800-268-6060). Your local municipality may have additional reporting numbers such as fire department and Medical Officer of Health.

Where a spill causes or is likely to cause an adverse effect as defined by the Act, Part X of the *Environmental Protection Act* requires the owner of the pesticide and the person having control of the pesticide to:

- immediately do everything practicable to prevent, eliminate and ameliorate any harm, and
- restore the natural environment or other property to the state it was in prior to the spill.

Additionally, Ontario Regulation 63/09 under the *Pesticides Act* requires the person responsible for a pesticide to immediately notify the Ministry's Spills Action Centre in the event of a fire or other occurrence that may result in the pesticide being discharged into the environment out of the normal course of events if the discharge would be likely to:

- cause impairment of the quality of the environment for any use that can be made of it;
- cause injury or damage to property or to plant or animal life;
- cause harm or material discomfort to any person;
- adversely affect the health of any person;
- impair the safety of any person; or
- render directly or indirectly any property or plant or animal life unfit for use by humans.

Before you begin to clean up a spill of any nature, remember to protect yourself against pesticide exposure. Wear the proper protective clothing and personal protective equipment. If the spill occurs inside an enclosed area (e.g., a pesticide storage area or a vehicle during transport), ventilate the area first. Once you have protected yourself and removed other persons or animals from the spill site, take additional measures to stop the spill at the source and prevent it from spreading and/or contaminating watercourses. Specific precautions, emergency contact information and first aid procedures may be found on the label.

For minor spills, it may be possible to rectify the problem:

- **For a liquid spill** — Cover the spill with a thick layer of absorbent material such as kitty litter, vermiculite or dry soil. Sweep or shovel the material into a waste drum and dispose of the contents as you would a hazardous waste.
- **For a dust, granular or powder spill** — Sweep or shovel the material into a waste drum and dispose of the contents as you would a hazardous waste.

For major spills, it is essential to stop the spill from spreading.

The clean-up guidelines above may not be appropriate for all spill situations. Once you have contained the spill, follow directions from the manufacturer and regulatory authorities on cleaning the contaminated area.

Some of the information contained in this chapter is not authoritative. It is derived from the *Pesticides Act*, Ontario Regulation 63/09, *Environmental Protection Act* and the federal *Pest Control Products Act*, *Fisheries Act* and *Species at Risk Act* and is for informational purposes only. Efforts have been made to make it as accurate as possible, but in the event of a conflict, inconsistency or error, the requirements set out in the referenced legislation take precedence. For specific legal details, please visit ontario.ca/laws (for Ontario legislation) and www.laws-lois.justice.gc.ca (for federal legislation) and consult your lawyer if you have questions about your legal obligations.

For information on preventing spills, see:

- OMAFRA Factsheet *Ways to Avoid Pesticide Spills*
- OMAFRA Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*, Order No. BMP13
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) *Grower Pesticide Safety Course Manual*, available at www.opecp.ca. Select "Learn."

**For pesticide poisonings
and pesticide injuries, call:**

Ontario Poison Centre:

1-800-268-9017

(TTY) 1-877-750-2233

**For more information,
see Emergency and First Aid Procedures for Pesticide
Poisoning on inside back cover.**

3. Crop Protection

ASPARAGUS

In this section:

- Table 3–1.** Activity of Fungicides and Insecticides on Asparagus Diseases and Insects
Table 3–2. Asparagus Disease Control
Table 3–3. Asparagus Insect Control

This information is provided as a guideline only. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication. See product labels for complete information.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–1. Activity of Fungicides and Insecticides on Asparagus Diseases and Insects

LEGEND: C = control SC = some control of this pest may be expected when the product is used to control labelled pests
 S = suppression — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Aphids	Asparagus Beetle	Cutworms	Rust	Purple Spot (Stemphylium)	Phytophthora
FUNGICIDES							
myclobutanil	Nova	—	—	—	C	—	—
propiconazole	Bumper 432 EC	—	—	—	C	—	—
	Fitness	—	—	—	C	—	—
	Princeton	—	—	—	C	—	—
	Tilt 250 E	—	—	—	C	—	—
	Folicur	—	—	—	C	—	—
tebuconazole	Folicur	—	—	—	C	—	—
azoxystrobin	Quadris Flowable	—	—	—	—	C	—
	Azoshy 250 SC	—	—	—	—	C	—
trifloxystrobin	Flint	—	—	—	C	C	—
<i>Bacillus subtilis</i>	Serenade SOIL ¹	—	—	—	—	—	S
chlorothalonil	Bravo ZN	—	—	—	C	C	—
INSECTICIDES							
carbaryl	Sevin XLR	—	C	C ²	—	—	—
dimethoate	Cygon 480	C	—	—	—	—	—
	Lagon 480 E	C	—	—	—	—	—
malathion	Malathion 85E	—	C	—	—	—	—
cypermethrin	Mako	—	C	—	—	—	—
	Ship 250	—	C	—	—	—	—
	UP-Cyde 2.5 EC	—	C	—	—	—	—
	Decis 100 EC	—	C	—	—	—	—
deltamethrin	Poleci 2.5 EC	—	C	—	—	—	—
	Labamba	C	SC	—	—	—	—
lambda-cyhalothrin	Silencer 120 EC	C	SC	—	—	—	—
	Matador 120EC	C	SC	—	—	—	—
	Ambush 500EC	—	—	C	—	—	—
permethrin	Perm-UP	—	—	C	—	—	—
	Pounce 384EC	—	—	C	—	—	—
	Assail 70 WP	C	C	—	—	—	—
acetamiprid	Aceta 70 WP	C	C	—	—	—	—
	Delegate	—	S	—	—	—	—
spinetoram	Entrust	—	C	—	—	—	—
spinosad	Success	—	C	—	—	—	—
	Kopa Insecticidal Soap	C	—	—	—	—	—

¹ Applied at the time of planting.

² Late-season climbing cutworms only.

Table 3–2. Asparagus Disease ControlFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PURPLE SPOT (STEMPHYLIUM)					
Qol (group 11)	azoxystrobin	Quadris Flowable	0.45–1.12 L/ha (182–453 mL/acre)	180	Use high water volumes. Begin application after harvest, prior to disease development. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
		Azoshy 250 SC			
		trifloxystrobin	Flint	210–280 g/ha (85–113 g/acre)	180
chloronitrile (group M5)	chlorothalonil	Bravo ZN	3.4 L/ha (1.4 L/acre)	190	Begin applications following final harvest of spears. 48-hr restricted entry interval (4-days for scouting).
RUST					
DMI (group 3)	myclobutanil	Nova	340 g/ha (138 g/acre)	—	Post-harvest treatment of ferns. Do not make sequential applications of any group 3 fungicide. 2-day restricted entry interval.
	propiconazole	Bumper 432 EC	150 mL/ha (61 mL/acre)	240	
		Fitness			
		Princeton			
		Tilt 250E	250 mL/ha (101 mL/acre)		
		tebuconazole	Folicur 432F	292 mL/ha (118 mL/acre)	240
Qol (group 11)	trifloxystrobin	Flint	210–280 g/ha (85–113 g/acre)	180	Begin application prior to disease development. Use higher rate and shorter interval when disease pressure is severe. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
chloronitrile (group M5)	chlorothalonil	Bravo ZN	3.4 L/ha (1.4 L/acre)	190	Begin applications following final harvest of spears. 48-hr restricted entry interval.
PHYTOPHTHORA ROOT ROT					
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade SOIL ¹	2.7–14 L/ha (1.1–5.7 L/acre)	0	Suppression. See label for in-furrow application instructions. For broadcast or banded applications, incorporate into the seed zone with rainfall or overhead irrigation within 24 hr.

¹ Applied at the time of planting.

Table 3–3. Asparagus Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
organophosphate (group 1B)	dimethoate	Cygon 480 Lagon 480 E	2.3 L/ha (0.9 L/acre)	—	Post-harvest only. 12-hr restricted entry interval.
pyrethroid (group 3A)	lambda- cyhalothrin	Matador 120EC Silencer 120 EC Labamba	83 mL/ha (34 mL/acre)	180	Post-harvest only. 24-hr restricted entry interval.
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP Aceta 70 WP	56–86 g/ha (23–35 g/acre)	1	Begin applications when treatment thresholds have been reached. 12-hr restricted entry interval.
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water Apply dilute solution at a rate of 700–1,900 L/ha (283–770 L/acre).	0	Do not spray when plants are under stress. See label for crop tolerance information. Avoid spraying during full sun.
ASPARAGUS BEETLE					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5–6.4 L/ha (1–2.6 L/acre)	2	Use high water volumes. 12-hr restricted entry interval (6 days for high-contact activities).
organophosphate (group 1B)	malathion	Malathion 85E	1,220 mL/ha (494 mL/acre)	1	12-hr restricted entry interval.
pyrethroid (group 3A)	cypermethrin	Mako Ship 250 UP-Cyde 2.5 EC	86 mL/ha (35 mL/acre) 140 mL/ha (57 mL/acre)	1 1	Apply when beetles or larvae are first observed. 12-hr restricted entry interval.
	deltamethrin	Decis 100 EC Poleci 2.5 EC	100 mL/ha (40 mL/acre) 400 mL/ha (162 mL/acre)	— —	Post-harvest use only. Apply prior to egg laying. 12-hr restricted entry interval.
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP Aceta 70 WP	80–160 g/ha (32–65 g/acre)	1	Begin applications when treatment thresholds have been reached. Use higher rates when the plants are larger and under heavy pest pressure. 12-hr restricted entry interval.
spinosyn (group 5)	spinetoram	Delegate	140–280 g/ha (57–113 g/acre)	60	Post-harvest only. Suppression. Apply at egg-hatch to small larvae. Use higher rates for heavy populations or larger larvae. 12-hr restricted entry interval.
	spinosad	Entrust Success	294 mL/ha (119 mL/acre) 145 mL/ha (59 mL/acre)	60 60	Post-harvest only. Apply just after egg-hatch to small larvae. Re-entry permitted once spray deposit has dried.
CUTWORMS					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5–6.4 L/ha (1–2.6 L/acre)	2	Late-season (climbing) cutworms only. 12-hr restricted entry interval (6-days for high contact activities).
pyrethroid (group 3A)	permethrin	Ambush 500EC Perm-UP Pounce 384EC	140 mL/ha (57 mL/acre) 180 mL/ha (73 mL/acre) 180 mL/ha (73 mL/acre)	2 2 2	Do not disturb the soil surface for 5 days after treatment. See label for cutworm control on seedlings or transplants. Re-entry permitted once spray deposit has dried. Do not disturb the soil surface for 5 days after treatment. See label for cutworm control on seedlings or transplants. 12-hr restricted entry interval. Do not disturb the soil surface for 5 days after treatment. See label for cutworm control on seedlings or transplants. Re-entry permitted once spray deposit has dried.

BEANS

In this section:

- Table 3–4.** Snap and Lima Bean Seed Treatments
Table 3–5. Activity of Fungicides on Snap and Lima Bean Diseases
Table 3–6. Snap and Lima Bean Disease Control
Table 3–7. Activity of Insecticides on Snap and Lima Bean Insects
Table 3–8. Snap and Lima Bean Insect Control — Leafhoppers, Bean Beetles, Aphids
Table 3–9. Snap and Lima Bean Insect Control — European Corn Borers, Western Bean Cutworms, Cutworms, Slugs, Brown Marmorated Stink Bugs

The information is provided as a guideline only. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication. Pest control products listed in these tables are not necessarily registered on all types of beans. See product labels for complete information.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–4. Snap and Lima Bean Seed Treatments

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

LEGEND: C = control S = suppression
 SC = some control may be expected when the product is used to control labelled pests and diseases
 — = not registered for control of this pest, or activity on this pest has not been documented

Active Ingredient(s)	Trade Name	Insects			Seedling Blights				Notes	
		Seedcorn Maggot	Wireworm	Potato Leafhopper	Anthraxnose	Phytophthora	Pythium	Fusarium		Rhizoctonia
FUNGICIDE ONLY										
metalaxyl-M and S-isomer	Apron XL LS	—	—	—	—	C	C	—	—	For use in commercial seed treatment facilities. See the product label for rates.
metalaxyl	Allegiance FL	—	—	—	—	C	C	—	—	For use in commercial or on-farm seed-treatment equipment only. Use 46–110 mL/100 kg of seed.
fludioxonil/metalaxyl-M and S-isomer	Apron Maxx RFC	—	—	—	C	SC	C	C	C	For use in commercial or on-farm seed-treatment equipment only. Use 100 mL/100 kg of seed. See label for recropping restrictions.
carbathiin/thiram	Vitaflo 280	—	—	—	C	—	SC	SC	C	Snap beans only. For use in commercial seed treatment facilities. Do not store treated seed.
copper hydroxide	Kocide 2000	—	—	—	—	—	—	—	—	Suppression of seed-borne bacterial diseases (common blight, halo blight and bacterial brown spot). Use 113 g/100 kg of seed in 200 mL of warm water. May delay germination.
<i>Trichoderma harzianum</i>	RootShield HC	—	—	—	—	—	S	S	S	Seed box treatment. Use 60–125 g/50 kg of seed.
thiram	Thiram 75 WP	—	—	—	—	—	C	C	C	Snap beans only. Seed box or commercial seed treatment. Use 25–35 g/25 kg of seed.

¹ Dust generated during the planting of treated seed may be harmful to bees and other pollinators.

² Dust generated during the planting of treated seed may be harmful to bees and other pollinators. Bees can be exposed to product residues on flowers, leaves, pollen and/or nectar resulting from seed treatments.

Table 3–4. Snap and Lima Bean Seed Treatments

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

LEGEND: C = control S = suppression
 SC = some control may be expected when the product is used to control labelled pests and diseases
 — = not registered for control of this pest, or activity on this pest has not been documented

Active Ingredient(s)	Trade Name	Insects			Seedling Blights					Notes
		Seedcorn Maggot	Wireworm	Potato Leafhopper	Anthraxnose	Phytophthora	Pythium	Fusarium	Rhizoctonia	
INSECTICIDE ONLY										
imidacloprid	Gaucho 480 FL ¹	—	—	C	—	—	—	—	—	For use in commercial or on-farm seed-treatment equipment only. Use 130 mL/100 kg of seed. Gaucho-treated seed should not be carried over. Do not use any subsequent soil or foliar applications of a group 4 insecticide in the same season.
thiamethoxam	Cruiser 5FS ²	C	C	C	—	—	—	—	—	For use in commercial seed treatment facilities. See product label for rates. Request the high rate for the control of wireworm control and early-season soybean aphids. Do not use any subsequent soil or foliar applications of a group 4 insecticide in the same season.
FUNGICIDE + INSECTICIDE										
thiamethoxam + metalaxyl-M and S-isomer/ fludioxonil	Cruiser 5FS + Apron Maxx RFC	C	C	C	C	SC	C	C	C	For use in commercial seed treatment facilities. See the product labels for rates. Request the high rate for the control of wireworm control and early-season soybean aphids. Do not use any subsequent soil or foliar applications of a group 4 insecticide in the same season. See Apron Maxx RFC label for recropping restrictions.

¹ Dust generated during the planting of treated seed may be harmful to bees and other pollinators.

² Dust generated during the planting of treated seed may be harmful to bees and other pollinators. Bees can be exposed to product residues on flowers, leaves, pollen and/or nectar resulting from seed treatments.

Table 3–5. Activity of Fungicides on Snap and Lima Bean Diseases¹

LEGEND: C = control S = suppression PS = partial suppression
 SC = some control may be expected when the product is used to control labelled diseases
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Root Rots	Bacterial Blights	White Mold (Sclerotinia)	Anthraxnose	Angular Leafspot	Rust	Phytophthora Blight
iprodione	Rovral	—	—	C	—	—	—	—
metalaxyl-M and S-isomer	Ridomil Gold 480SL	C	—	—	—	—	—	—
boscalid	Lance WDG	—	—	C	—	—	—	—
penthiopyrad	Fontelis	—	—	—	C	C	C	—
isofetamid	Kenja 400SC	—	—	C	—	—	—	—
fluxapyroxad + pyraclostrobin	Priaxor	—	—	—	—	C	C	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	C	—	—	—	—
fenamidone	Reason 500SC	—	—	—	—	—	—	S
pyraclostrobin	Headline EC	—	—	—	SC	C	C	—
cyazofamid	Torrent 400SC	—	—	—	—	—	—	S
fluazinam	Allegro 500F	—	—	C	—	—	—	—
mandipropamid	Revus	—	—	—	—	—	—	C
fluopicolide	Presidio	—	—	—	—	—	—	C
<i>Bacillus subtilis</i>	Serenade Opti	—	—	S	—	—	—	—
	Serenade SOIL	S	—	—	—	—	—	—
<i>Bacillus amyloliquefaciens</i> strain F727	Stargus	—	—	PS	—	—	—	—
<i>Coniothyrium minitans</i>	Contans WG	—	—	S	—	—	—	—
hydrogen peroxide/ peroxyacetic acid	OxiDate 2.0	S	—	—	—	—	—	—
copper hydroxide	Coppercide WP	—	C	—	—	—	—	—
	Kocide 2000	—	C	—	—	—	—	—
	Parasol WG	—	C	—	—	—	—	—
copper octanoate	Cueva	—	C	—	—	—	—	—
copper sulphate	Copper 53W	—	C	—	—	—	—	—

¹ For additional seed decay and root rots, see Table 3–4. *Snap and Lima Bean Seed Treatments*.

Table 3–6. Snap and Lima Bean Disease ControlFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BACTERIAL BLIGHT (HALO AND COMMON)					
inorganic (group M1)	copper hydroxide	Coppercide WP	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	1	Make first application when plants are 15 cm (6 in.) high. 48-hr restricted entry interval.
		Kocide 2000	1.6–2.3 kg/ha (0.6–0.9 kg/acre)	2	
		Parasol WG	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	2	
	copper octanoate	Cueva	0.5%–2% solution applied at 470–940 L/ha (190–380 L/acre)	1	Also controls brown spot. Begin treatment 2 weeks before disease normally appears or when weather forecasts predict a long period of wet weather. 4-hr restricted entry interval.
	copper sulphate	Copper 53W	5.5 kg/ha (2.2 kg/acre)	2	Bacterial leaf spot. Apply as needed to keep plants covered. 48-hr restricted entry interval.
not classified (group NC)	hydrogen peroxide/ peroxyacetic acid	OxiDate 2.0	1.0% (v:v) (100 mL product per 10 L of water)	0	Partial suppression only. Do not spray during conditions of intense heat, drought or poor plant vigor. 4-hr restricted entry interval.
WHITE MOLD (SCLEROTINIA)					
SDHI (group 7)	boscalid	Lance WDG	560–770 g/ha (227–312 g/acre) gray mold control: 420 g/ha (170 g/acre)	7	Spray at 20%–50% bloom with a second application 7 days later. Do not use in areas treated with this product the previous season. Do not make more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
	isofetamid	Kenja 400SC	1.25 kg/ha (0.5 kg/acre)	7	Suppression. Do not make more than two sequential applications of any group 7 fungicides. See label for recropping restrictions.
AP/PP (group 9/ group 12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	7	Spray at 10%–20% bloom. Repeat after 7 days if the conditions remain favourable for disease development. Use the higher application rate under conditions of high disease pressure. See label for recropping restrictions. 12-hr restricted entry interval.
2,6- dinitroaniline (group 29)	fluazinam	Allegro 500F	0.6–1 L/ha (0.2–0.4 L/acre)	14	Spray at 10% bloom with a second spray 7 days later. Use the higher application rate under conditions of high disease pressure. Do not use in areas treated with this product the previous season. 24-hr restricted entry interval.
microbial (group BMO2)	<i>Coniothyrium minitans</i>	Contans WG	2–4 kg/ha (0.8–1.6 kg/acre)	0	Snap beans only. Suppression. Apply to soil prior to planting, at least 3 months before the onset of disease. Regular use of Contans WG in successive years within a long-term management strategy will improve disease control. Broadcast and lightly incorporate. If incorporation will displace soil greater than 5 cm (2 in.), increase application rate to 3–6 kg/ha (1.2–2.4 kg/acre). See label for application details and chemical compatibility precautions.
	<i>Bacillus subtilis</i>	Serenade Opti	1.7–3.3 kg/ha (0.7–1.3 kg/acre)	0	Suppression. Make the first application at planting or prior to crop emergence.
	<i>Bacillus amyloliquefaciens</i> strain F727	Stargus	4–8 L/ha (1.9–3.2 L/acre)	0	Partial Suppression only. Apply preventively when conditions favour white mold development or when symptoms first appear. Applications at growth stage R1 are most effective for protecting crop yield. A second application 7–10 days later may improve control and protect yield potential. Ensure good coverage. 4-hr or when residues have dried.

Table 3–6. Snap and Lima Bean Disease ControlFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ANGULAR LEAFSPOT, RUST					
SDHI (group 7)	penthiopyrad	Fontelis	1–2.25 L/ha (0.4–0.9 L/acre)	0	Also controls anthracnose. Do not make more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
SDHI/QoI (group 7/11)	fluxapyroxad/ pyraclostrobin	Priaxor	300 mL/ha (121 mL/acre)	7	See label for a complete list of legume vegetables. Do not make sequential applications of any group 7 or group 11 fungicides. 12-hr restricted entry interval.
QoI (group 11)	pyraclostrobin	Headline EC	400–600 mL/ha (162–243 mL/acre)	7	Lima beans. Rust. See label for recropping restrictions. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
			400 mL/ha (162 mL/acre)	7	Edible-podded beans. See label for a complete list of legume vegetables. Angular leaf spot. See label for recropping restrictions. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
ROOT ROTS					
phenylamide (group 4)	metalaxyl-M and S-isomer	Ridomil Gold 480SL	2.3 mL/100 m of row ¹ (0.7 mL/100 ft of row)	—	Snap beans only. Pythium damping-off and phytophthora root rot. Banded soil application at planting. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Suppression. Root rots caused by <i>Rhizoctonia solani</i> , <i>Pythium</i> spp. and <i>Fusarium</i> spp. See label for in-furrow application instructions. For broadcast or banded applications, incorporate into the seed zone with rainfall or overhead irrigation within 24 hours.
PHYTOPHTHORA BLIGHT					
QoI (group 11)	fenamidone	Reason 500SC	600 mL/ha (243 mL/acre)	3	Suppression. See label for recropping restrictions. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
Qil (group 21)	cyazofamid	Torrent 400SC	200 mL/ha (81 mL/acre)	0	Snap and lima beans. Suppression. Also controls downy mildew. Tank-mix with a non-ionic or organosilicone surfactant. Do not make sequential applications. See label for recropping restrictions. 12-hr restricted entry interval.
CAA (group 40)	mandipropamid	Revus	600 mL/ha (243 mL/acre)	1	Edible podded beans only. Also controls downy mildew. Apply prior to disease development. Do not make more than 2 consecutive applications before switching to a non-group 40 fungicide. 12-hr restricted entry interval.
benzamides (group 43)	fluopicolide	Presidio	295 mL/ha (119 mL/acre)	0	Edible-podded beans only. Also controls downy mildew. For resistance management, Presidio Fungicide must be tank-mixed with a labeled rate of another fungicide registered for the target pathogen, but with a different mode of action.

¹ 76 cm (30 in.) row spacing, with a 20 cm (8 in.) spray band requires 300 mL/ha (121 mL/acre) of Ridomil Gold 480SL.

Table 3–7. Activity of Insecticides on Snap and Lima Bean Insects¹**LEGEND:** C = control

S = suppression

SC = some control of this pest may be expected when the product is used to control labelled pests

N = registered, but not considered effective or resistance is documented

— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Aphids	Leafhoppers	Slugs	Cutworms	Brown Marmorated Stink Bug	European Corn Borer	Western Bean Cutworm	Mexican Bean Beetles	Bean Leaf Beetle	Spider Mite
carbaryl	Sevin XLR	—	SC	—	—	—	C	—	SC	—	—
dimethoate	Cygon 480	C	C	—	—	—	—	—	C	C	SC
	Lagon 480 E	C	C	—	—	—	—	—	C	SC	SC
malathion	Malathion 85E	N	C	—	—	—	—	—	C	—	C
naled	Dibrom	C	—	—	—	—	—	—	—	—	C
lambda-cyhalothrin	Matador 120EC	C	C	—	C	—	C	C	SC	C	—
	Silencer 120 EC	C	C	—	C	—	C	C	SC	C	—
	Labamba	C	C	—	C	—	C	C	SC	C	—
permethrin	Ambush 500EC	—	—	—	—	—	C	—	—	—	—
	Perm-UP	—	—	—	—	—	C	—	—	—	—
	Pounce 384EC	—	—	—	—	—	C	—	—	—	—
lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	C	C	—	—	—	C	C	—	C	—
flupyradifurone	Sivanto Prime	C	C	—	—	—	—	—	—	—	—
spinetoram	Delegate	—	—	—	—	—	C	—	—	—	—
spinosad	Success	—	—	—	—	—	C	—	—	—	—
	Entrust	—	—	—	—	—	C	—	—	—	—
	Scorpio Ant and Insect Bait	—	—	—	C	—	—	—	—	—	—
<i>Bacillus thuringiensis</i>	Bioprotec PLUS	—	—	—	—	—	C	—	—	—	—
novaluron	Rimon 10 EC	—	—	—	—	—	C	—	—	—	—
methoxyfenozide	Intrepid	—	—	—	—	—	C	—	—	—	—
chlorantraniliprole	Coragen	—	—	—	C	—	C	C	—	—	—
cyantraniliprole	Exirel	C	—	—	C	—	C	—	—	S	—
flonicamid	Beleaf	C	—	—	—	—	—	—	—	—	—
ferric phosphate	Sluggo Professional	—	—	C	—	—	—	—	—	—	—
potassium salts of fatty acids	Kopa Insecticidal Soap	C	—	—	—	—	—	—	—	—	C

¹ For information on seed corn maggot and seed treatments for aphid and leafhopper control, see Table 3–4. *Snap and Lima Bean Seed Treatments.*

Table 3–8. Snap and Lima Bean Insect Control — Leafhoppers, Bean Beetles, Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFHOPPERS, BEAN BEETLES, APHIDS					
Foliar Applications					
organophosphate (group 1B)	dimethoate	Cygon 480	0.7–1 L/ha (0.3–0.4 L/acre)	7	Do not graze or feed treated foliage to livestock. 12-hr restricted entry interval.
		Lagon 480 E	0.7–1 L/ha (0.3–0.4 L/acre)	7	Snap beans only. Do not graze or feed treated foliage to livestock. 12-hr restricted entry interval.
	malathion	Malathion 85E	0.73–1.34 L/ha (0.3–0.5 L/acre)	3	Less effective below 20°C. Control of aphids with malathion has been inconsistent in many areas. 1-day restricted entry interval.
	naled	Dibrom	1.05–2.1 L/ha (0.4–0.85 L/acre)	4	Lima beans only. Aphids. Do not apply when temperature is above 32°C. 48-hr restricted entry interval.
pyrethroid (group 3A)	lambda-cyhalothrin	Labamba	83–233 mL/ha (34–94 mL/acre)	7	Use low rate for leafhoppers. Use the higher rate to target higher aphid or bean leaf beetle populations. Do not graze or feed treated foliage to livestock. 24-hr restricted entry interval.
		Matador 120EC			
		Silencer 120 EC	83–233 mL/ha (34–94 mL/acre)	7	Edible podded beans. Use low rate for leafhoppers. Use the higher rate to target higher aphid or bean leaf beetle populations. Do not graze or feed treated foliage to livestock. 24-hr restricted entry interval.
				14	Lima beans. Use low rate for leafhoppers. Use the higher rate to target higher aphid or bean leaf beetle populations. Do not graze or feed treated foliage to livestock. 24-hr restricted entry interval.
pyrethroid/diamide (group 3A/28)	lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	225–500 mL/ha (91–202 mL/acre)	7	Do not graze or harvest for livestock feed. Do not use in areas treated with product the previous season. 24-hr restricted entry interval.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Aphids and suppression of leafhoppers. Do not use in areas treated with product the previous season. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 24-hr restricted entry interval.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	7	Leafhoppers, aphids. Do not use on areas treated with product the previous season. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	750–1,500 mL/ha (304–607 mL/acre)	1	Soybean aphids and suppression of bean leaf beetle. For bean leaf beetle suppression, use minimum 1 L/ha (0.4 L/acre). For aphid control, use a spray adjuvant as stated on the label. See label for crop tolerance information. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf	120–160 g/ha (50–65 g/acre)	7	Aphids. Use high rate on high populations or dense foliage. See label for recropping restrictions.
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water Apply dilute solution at a rate of 700–1,900 L/ha (283–769 L/acre).	0	Aphids. Do not spray when plants are under stress. See label for crop tolerance information. Avoid spraying during full sun.

Table 3–9. Snap and Lima Bean Insect Control — European Corn Borers, Western Bean Cutworms, Cutworms, Slugs

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
EUROPEAN CORN BORERS					
carbamate (group 1A)	carbaryl	Sevin XLR	5.25 L/ha (2.12 L/acre)	5	Machine-harvested snap beans only. See label for restricted entry intervals.
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	7	Apply before corn borer larvae tunnel into the stalk or pods. Do not graze or feed treated foliage to livestock. 24-hr restricted entry interval.
		Silencer 120 EC	83 mL/ha (34 mL/acre)	7	Edible podded beans. Apply before corn borer larvae tunnel into the stalk or pods. Do not graze or feed treated foliage to livestock. 24-hr restricted entry interval.
				14	Lima beans. Apply before corn borer larvae tunnel into the stalk or pods. Do not graze or feed treated foliage to livestock. 24-hr restricted entry interval.
		Labamba	83 mL/ha (34 mL/acre)	7	Apply in the late evening or at night. Do not graze or feed treated foliage to livestock. 24-hr restricted entry interval.
	permethrin	Ambush 500EC	200 mL/ha (81 mL/acre)	7	Snap beans only. Re-entry permitted when dry.
		Perm-UP	260 mL/ha (105 mL/acre)	7	Snap beans only. 12-hr restricted entry interval.
		Pounce 384EC	260 mL/ha (105 mL/acre)	7	Snap beans only. Re-entry permitted when dry.
pyrethroid/ diamide (group 3A/28)	lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	7	Also controls armyworm. Do not use in areas treated with product the previous season. Do not graze or harvest for livestock feed. 24-hr restricted entry interval.
spinosyn (group 5)	spinetoram	Delegate	120–210 g/ha (49–85 g/acre)	3	Snap beans only. Time applications to coincide with peak egg hatch. 12-hr restricted entry interval.
	spinosad	Entrust	167 mL/ha (68 mL/acre)	3	Snap beans only. Use only on small larvae and low infestations. Maintain a spray pH of 6 or greater.
		Success	83 mL/ha (34 mL/acre)	3	Re-entry permitted when residues are dry.
microbial (group BMO2)	<i>Bacillus thuringiensis</i>	Bioprotec PLUS	1.8–2.5 L/ha (0.72–1.0 L/acre)	1	Snap and Lima beans. Allow 5–10 days between applications. 4-hr or when residues have dried.
benzoylurea (group 15)	novaluron	Rimon 10 EC	410–820 mL/ha (166–332 mL/acre)	2	Snap beans only. Apply just prior to egg-hatch. 12-hr restricted entry interval.
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	7	Apply just prior to egg-hatch. Do not use in areas treated with product the previous season. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Do not use on areas treated with product the previous season. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	Use 500 mL/ha (202 mL/acre) for armyworm control. See label for crop tolerance information. 12-hr restricted entry interval.

Table 3–9. Snap and Lima Bean Insect Control — European Corn Borers, Western Bean Cutworms, Cutworms, Slugs

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
WESTERN BEAN CUTWORMS					
pyrethroid (group 3A)	lambda-cyhalothrin	Labamba	83–187 mL/ha (34–76 mL/acre)	7	Do not graze or feed treated foliage to livestock. 24-hr restricted entry interval.
		Matador 120EC			
		Silencer 120 EC	83–187 mL/ha (34–76 mL/acre)	7	Edible podded beans. Do not graze or feed treated foliage to livestock. 24-hr restricted entry interval.
				14	Lima beans. Do not graze or feed treated foliage to livestock. 24-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Do not use on areas treated with product the previous season. 12-hr restricted entry interval.
pyrethroid/ diamide (group 3A/28)	lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	7	Also controls armyworm. Do not use in areas treated with product the previous season. Do not graze or harvest for livestock feed. 24-hr restricted entry interval.
CUTWORMS					
pyrethroid (group 3A)	lambda-cyhalothrin	Labamba	83 mL/ha (34 mL/acre)	7	Apply in the late evening or at night. Do not graze or feed treated foliage to livestock. 24-hr restricted entry interval.
		Matador 120EC			
		Silencer 120 EC	83 mL/ha (34 mL/acre)	7	Edible podded beans. Apply in the late evening or at night. Do not graze or feed treated foliage to livestock. 24-hr restricted entry interval.
				14	Lima beans. Apply in the late evening or at night. Do not graze or feed treated foliage to livestock. 24-hr restricted entry interval.
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	3	Black cutworm only. Also reduction in damage to wireworm (see label for application details). Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Apply to small plants when no rain is forecast in the next 24 hr. Do not use on areas treated with product the previous season. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	Apply to small plants when no rain is forecast in the next 24 hr. See label for crop tolerance information. 12-hr restricted entry.
SLUGS					
not classified (group NC)	ferric phosphate	Sluggo Professional	25–50 kg/ha (10–20 kg/acre)	0	Apply to moist soils. Use higher rates on severe infestations.

BEETS, TABLE

In this section:

- Table 3–10.** Table Beet Seed Treatments
Table 3–11. Activity of Fungicides on Table Beet Diseases
Table 3–12. Table Beet Disease Control
Table 3–13. Activity of Insecticides on Table Beet Insects
Table 3–14. Table Beet Insect Control — Aphids, Cutworms, Flea Beetles
Table 3–15. Table Beet Insect Control — Leafhoppers, Tarnished Plant Bug, White Grubs

This information is provided as a guideline only. Some products are under re-evaluation with the PMRA and may change within the lifetime of this publication. See product labels for complete information.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–10. Table Beet Seed Treatments

Group Name (Group #)	Active Ingredients	Trade Name	Rate	Pests Controlled	Notes
phenylamide (group 4)	metalaxyl-M and S-isomer	Apron XL LS	20–40 mL/100 kg seed	pythium damping-off	For use in commercial seed treatment facilities.
PP/phenylamide (group 4/12)	fludioxonil/metalaxyl-M	Apron Maxx RTA	665 mL/100 kg seed	damping-off and seedling blight caused by <i>Fusarium</i> , <i>Pythium</i> and <i>Rhizoctonia</i>	For use in commercial seed treatment facilities.
PP (group 12)	fludioxonil	Maxim 480FS	5.2–10.4 mL/100 kg seed	seed- and soil-borne diseases (fusarium, rhizoctonia, aspergillus, penicillium)	For import use only; do not treat seed in Canada.
dithiocarbamate (group M03)	thiram	Thiram 75 WP	90 g/25 kg seed	seed decay, seedling blight, damping-off	Seed box or commercial seed treatment. Do not graze or feed treated clippings to livestock.

Table 3–11. Activity of Fungicides on Table Beet Diseases

LEGEND: C = control S = suppression
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Alternaria	Cercospora Leaf Spot	Powdery Mildew	Rhizoctonia Root Rot, Crown Rot, Stem Canker
propiconazole	Tilt 250E	—	C	—	—
fluxapyroxad	Sercadis	C	—	C	—
penthiopyrad	Fontelis	—	—	C	—
pydiflumetofen/difenoconazole	Miravis Duo	C	C	C	—
fluopyram/trifloxystrobin	Luna Sensation	C	—	C	—
azoxystrobin	Quadris	—	—	—	C
	Azoshy 250 SC	—	—	—	C
pyraclostrobin	Cabrio EG	C	C	C	—
trifloxystrobin	Flint	C	—	—	—
<i>Bacillus subtilis</i>	Serenade SOIL	—	—	—	S
copper octanoate	Cueva	—	C	—	—
copper sulphate	Copper 53W	—	C	—	—

Table 3–12. Table Beet Disease ControlFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CERCOSPORA LEAF SPOT					
DMI (group 3)	propiconazole	Tilt 250E	500 mL/ha (202 mL/acre)	14	Not for use on beet greens. Do not apply more than two sequential applications of any Group 3 fungicide. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.40 L/acre)	7	Not for use on beet greens. Do not make more than 2 consecutive applications before switching to a fungicide that is not in Group 7 or Group 3. 12-hr restricted entry interval.
QoI (group 11)	pyraclostrobin	Cabrio EG	560–840 g/ha (227–340 g/acre)	3	Beets and beet greens. Do not make sequential applications of any group 11 fungicides. See label for restricted entry interval.
inorganic (group M01)	copper sulphate	Copper 53W	4 kg/ha (1.6 kg/acre)	2	Not for use on beet greens. 48-hr restricted entry interval.
	copper octanoate	Cueva	0.5%–2% (v/v) solution. Applied in 470–940 L solution/ha (190–380 L/acre)	1	Not for use on beet greens. 4-hr restricted entry interval.
RHIZOCTONIA ROOT AND CROWN ROT					
QoI (group 11)	azoxystrobin	Quadris	4–6 mL/100 m of row (1.2–1.8 mL/100 ft of row)	40	Not for use on beet greens. One application/yr, applied in-furrow at planting or banded within 30 days of emergence. 12-hr restricted entry interval.
		Azoshy 250 SC			
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Not for use on beet greens. Suppression. Soil application. See label for application details.
POWDERY MILDEW					
SDHI (group 7)	fluxapyroxad	Sercadis	250–333 mL/ha (101–134 mL/acre)	7	Not for use on beet greens. Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
	penthiopyrad	Fontelis	1–1.75 L/ha (0.4–0.7 L/acre)	3	Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.40 L/acre)	7	Do not make more than 2 consecutive applications before switching to a fungicide that is not in group 7 or group 3. 12-hr restricted entry interval.
SDHI/QoI (group 7/11)	fluopyram/ trifloxystrobin	Luna Sensation	300–400 mL/ha (122–162 mL/acre)	7	Use high rate when disease pressure is high. Do not make sequential applications of any group 11 or more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
QoI (group 11)	pyraclostrobin	Cabrio EG	560–840 g/ha (227–339 g/acre)	3	Beets and beet greens. Do not make sequential applications of any group 11 fungicides. See label for restricted entry interval.

Table 3–13. Activity of Insecticides on Table Beet Insects

LEGEND: C = control RN = reduction in numbers only
 N = registered, but not considered effective or resistance is documented
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Aphids	Cutworms	Flea Beetles	Leafhoppers	Tarnished Plant Bug	Stink Bugs	White Grubs
carbaryl	Sevin XLR	—	—	C	C	C	N	—
dimethoate	Cygon 480	C ¹	—	—	C ¹	—	—	—
	Lagon 480 E	C ¹	—	—	C ¹	C	—	—
malathion	Malathion 85E	N	—	—	C	—	—	—
permethrin	Perm-UP	—	C	—	—	—	—	—
	Pounce 384EC	—	C	—	—	—	—	—
imidacloprid	Admire 240	C ²	—	C	C ²	—	—	RN ²
thiamethoxam	Actara 25WG	C	—	—	C	—	—	—
sulfoxaflor	Closer	C	—	—	C	C	—	—
flupyradifurone	Sivanto Prime	C	—	—	C	—	—	—
spinosad	Scorpio Ant and Insect Bait	—	C	—	—	—	—	—
chlorantraniliprole	Coragen	—	C	—	—	—	—	—
cyantraniliprole	Exirel	C	C	C	—	—	—	—
	Verimark	—	—	C ²	—	—	—	—
flonicamid	Beleaf 50SG	C	—	—	—	—	—	—
potassium salts of fatty acids	Kopa Insecticidal Soap	C	—	—	—	—	—	—

¹ Beet greens only.

² See label for details.

Table 3–14. Table Beet Insect Control — Aphids, Cutworms, Flea Beetles

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides with different modes of action. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
Soil Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240	7.5–12 mL/ 100 m of row (2.3–3.7 mL/ 100 ft of row)	21	Beets and beet greens. See label for soil application options. Do not use subsequent foliar group 4 insecticides in the same season. 24-hr restricted entry interval.
Foliar Applications					
organophosphate (group 1B)	dimethoate	Cygon 480	700 mL/ha (283 mL/acre)	14	Beet greens only. 3-day restricted entry interval.
		Lagon 480 E	700 mL/ha (283 mL/acre)	21	Beet greens only. 3-day restricted entry interval.
	malathion	Malathion 85E	535–1,345 mL/ha (217–544 mL/acre)	7	Beets. Less effective below 20°C. Resistance to this group of products has been documented in some areas. 24-hr restricted entry interval.
neonicotinoid (group 4A)	imidacloprid	Admire 240	200 mL/ha (81 mL/acre)	7	Beets and beet greens. Suppression. Do not apply foliar group 4 insecticides in the same season as a soil application 24-hr restricted entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Not for use on beet greens. Do not apply foliar group 4 insecticides in the same season as a soil application. 12-hr restricted entry interval.
sulfoximine (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–61 mL/acre)	7	Not for use on beet greens. 12-hr restricted entry interval.
butenolide (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	7	Not for use on beet greens. Tops or greens may not be fed to livestock or used for human consumption. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	7	Not for use on beet greens. See label for guidance on adjuvant use for aphids. See label for crop tolerance information. Do not apply a foliar group 28 insecticide for a minimum of 60 days following a soil application. Do not make more than two sequential applications of group 28 insecticides. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	3	Not for use on beet greens. 12-hr restricted entry interval.
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L water. Applied at 700–1,900 L solution/ha (156–770 L/acre).	0	Beets only. Do not spray when plants are under stress. See label for crop tolerance information. Avoid spraying during full sun.

Table 3–14. Table Beet Insect Control — Aphids, Cutworms, Flea Beetles

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides with different modes of action. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
pyrethroid (group 3A)	permethrin	Perm-UP	180–390 mL/ha (73–158 mL/acre)	—	Beets only. See label for application details. 12-hr restricted entry interval.
		Pounce 384EC	180–390 mL/ha (73–158 mL/acre)	—	Beets only. See label for application details. Re-entry permitted once spray deposit has dried.
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	3	Not for use on beet greens. Black cutworm only. Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–151 mL/acre)	1	Not for use on beet greens. Early application on larval stages provides best control. Do not apply a foliar group 28 insecticide for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	7	Not for use on beet greens. Variegated cutworm only. See label for crop tolerance information. Do not apply a foliar group 28 insecticide for a minimum of 60 days following a soil application. Do not make more than two sequential applications of group 28 insecticides. 12-hr restricted entry interval.
FLEA BEETLES					
Soil Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240	7.5–12 mL/100 m of row (2.3–3.7 mL/100 ft of row)	21	Beets and beet greens. See label for soil application options. Do not use subsequent foliar group 4 insecticides in the same season. 24-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Verimark	6.75–9 mL/100 m of row (2.05–2.74 mL/100 ft of row)	21	Not for use on beet greens. Early season damage reduction. See label for application details. Do not use a subsequent foliar group 28 insecticide for a minimum of 60 days. 12-hr restricted entry interval.
Foliar Applications					
diamide (group 28)	cyantraniliprole	Exirel	500–1,000 mL/ha (202–404 mL/acre)	7	Not for use on beet greens. See label for crop tolerance information. Do not apply a foliar group 28 insecticide for a minimum of 60 days following a soil application. Do not make more than two sequential applications of group 28 insecticides. 12-hr restricted entry interval.

Table 3–15. Table Beet Insect Control — Leafhoppers, Tarnished Plant Bug, White Grubs

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides with different modes of action. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFHOPPERS					
Soil Application					
neonicotinoid (group 4A)	imidacloprid	Admire 240	7.5–12 mL/100 m of row (2.3–3.7 mL/100 ft of row)	21	Beets and beet greens. See label for soil application options. Do not use subsequent foliar group 4 insecticides in the same season. 24-hr restricted entry interval.
Foliar Applications					
organophosphate (group 1B)	dimethoate	Cygon 480	700 mL/ha (283 mL/acre)	14	Beet greens only. 3-day restricted entry interval.
		Lagon 480 E	700 mL/ha (283 mL/acre)	21	Beet greens only. 3-day restricted entry interval.
neonicotinoid (group 4A)	imidacloprid	Admire 240	200 mL/ha (81 mL/acre)	7	Beets and beet greens. Suppression. See label for soil application options. Do not apply foliar group 4 insecticides in the same season as a soil application. 24-hr restricted entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Aster leafhopper. Do not apply foliar group 4 insecticides in the same season as a soil application. 12-hr restricted entry interval.
sulfoximine (group 4C)	sulfoxaflor	Closer	300 mL/ha (121 mL/acre)	7	Not for use on beet greens. 12-hr restricted entry interval.
butenolide (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	7	Not for use on beet greens. Tops or greens may not be fed to livestock or used for human consumption. 12-hr restricted entry interval.
TARNISHED PLANT BUG					
organophosphate (group 1B)	dimethoate	Lagon 480 E	700 mL/ha (283 mL/acre)	12	Beets only. 3-day restricted entry interval.
sulfoximine (group 4C)	sulfoxaflor	Closer	300 mL/ha (121 mL/acre)	7	Not for use on beet greens. 12-hr restricted entry interval.
WHITE GRUBS					
neonicotinoid (group 4A)	imidacloprid	Admire 240	1,200 mL/ha (486 mL/acre)	21	Beets and beet greens. Reduction in numbers of larvae of European chafer. See label for soil application options. Time just prior to or during egg hatch. Do not apply foliar group 4 insecticides in the same season as a soil application. 24-hr restricted entry interval.

BRASSICA CROPS

broccoli, Brussels sprouts, cabbage, cauliflower, kale, kohlrabi and specialty vegetables, including headed Chinese cabbage (napa), leafy Chinese cabbage (bok choy, pak choy, etc.), Chinese mustard, broccoli raab, collards, mizuna, mustard greens, mustard spinach and rape greens

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Pest control products listed in these tables are not necessarily registered on all brassica crops.

See the most up-to-date pest control product labels to ensure the registration on a specific crop. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication.

This information is provided as a guideline only. See product labels for complete information.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–16. Brassica Crop Seed Treatments

Group Name (Group #)	Common Name	Trade Name	Rate	Pests Controlled	Notes
SEED AND SEEDLING DISEASE					
phenylamide (group 4)	metalaxyl-M and S-isomer	Apron XL LS	20–40 mL/ 100 kg seed	damping-off (<i>Pythium</i> spp.)	See label for complete list of brassica crops, including specialty brassicas. For import use only; do not treat seeds in Canada.
QoI (group 11)	azoxystrobin	Dynasty 100FS	25–50 mL/ 100 kg seed	damping-off (<i>Rhizoctonia solani</i>)	See label for complete list of brassica crops, including specialty brassicas. For import use only; do not treat seeds in Canada. See label for recropping restrictions.
PP (group 12)	fludioxonil	Maxim 480FS	5.2–10.4 mL/ 100 kg seed	damping-off (<i>Fusarium</i> and <i>Rhizoctonia</i>)	See label for complete list of brassica crops, including specialty brassicas. For use in commercial seed treatment facilities.
PP (group 12)	fludioxonil	Maxim 480FS	5.2–10.4 mL/ 100 kg seed	seed- and soil- borne diseases (<i>Fusarium</i> , <i>Rhizoctonia</i> , <i>Aspergillus</i> , <i>Penicillium</i>)	See label for complete list of brassica crops, including specialty brassicas. For import use only; do not treat seeds in Canada.
PP/phenylamide (group 12/4)	fludioxonil + metalaxyl-M and S-isomer	Apron Maxx	665 mL/ 100 kg seed	seed- and soil- borne diseases (<i>Fusarium</i> , <i>Rhizoctonia</i> , <i>Aspergillus</i> , <i>Penicillium</i>)	See label for complete list of brassica crops, including specialty brassicas. For import use only; do not treat seeds in Canada.
dithiocarbamate (group M3)	thiram	Thiram 75 WP	90 g/ 25 kg seed	seed decay, seedling blight and damping-off	Broccoli, Brussels sprouts, cabbage, cauliflower and mustard. Seed box or commercial seed treatment.
INSECTS					
neonicotinoid (group 4A)	clothianidin/ imidacloprid	Sepresto 75 WS	1.6 g/ 1,000 seeds	aphids and flea beetle	Broccoli and cabbage. For import use only; do not treat seeds in Canada. Do not use any subsequent soil, in-furrow, transplant or foliar applications of a group 4 insecticide in the same season. See label for rotational crop restrictions.

Table 3–17. Activity of Fungicides on Brassica Crop Diseases

Listed pest control products are not necessarily registered on all brassica crops.
See the most up-to-date product label to ensure registration on a specific crop.

LEGEND: C = control

S = suppression

— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Damping-Off	Black Rot	Downy Mildew	Alternaria	Sclerotinia	Powdery Mildew	Botrytis Gray Mold
metalaxyl-M and S-isomer	Apron XL LS	C	—	—	—	—	—	—
fluxapyroxad	Sercadis	—	—	—	S	S	—	—
fluopyram/trifloxystrobin	Luna Sensation	—	—	—	C	C	C	—
penthiopyrad	Fontelis	—	—	—	C	S	C	C
fluopyram	Velum Prime	—	—	—	—	—	S	—
pydiflumetofen/difenoconazole	Miravis Duo	—	—	—	C	—	C	—
boscalid/pyraclostrobin	Pristine WG	—	—	S	—	—	—	C
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	—	S	—	C	—
azoxystrobin	Dynasty 100FS	C	—	—	—	—	—	—
	Quadris	—	—	—	S	—	—	—
fenamidone	Reason 500SC	—	—	S	—	—	—	—
azoxystrobin/difenoconazole	Quadris Top	—	—	—	C	—	C	—
fludioxonil	Maxim 480FS	C	—	—	—	—	—	—
cyazofamid	Torrent 400SC	C	—	S	—	—	—	—
fluazinam	Allegro 500F	—	—	—	—	—	—	—
fosetyl-AL	Aliette WDG	—	—	C	—	—	—	—
mono- and di-basic sodium, potassium and ammonium phosphites	Phostrol	—	—	S	—	—	—	—
mono- and di-potassium salts of phosphorous acid	Confine Extra	—	—	S	—	—	—	—
dimethomorph	Forum	—	—	S	—	—	—	—
mandipropamid	Revus	—	—	C	—	—	—	—
mandipropamid/oxathiapiprolin	Orondis Ultra	—	—	C	—	—	—	—
fluopicolide	Presidio	—	—	C	—	—	—	—
<i>Bacillus subtilis</i>	Cease	—	—	S	S ¹	—	S	—
	Serenade Opti	—	—	S	S ¹	S	—	—
	Serenade Soil	S	—	—	—	—	—	—
ametoctradin/dimethomorph	Zampro	—	—	C	—	—	—	—
copper octanoate	Cueva	—	S	—	—	—	—	—
copper sulphate	Copper 53W	—	—	C	C	—	—	—
thiram	Thiram 75 WP	C	—	—	—	—	—	—
captan	Maestro 80DF	C	—	—	—	—	—	—
	Sharda Captan 80 WDG	C	—	—	—	—	—	—
chlorothalonil	Bravo ZN/ZNC	—	—	C	C	—	—	—
	Echo 90DF	—	—	C	C	—	—	—
<i>Coniothyrium minitans</i>	Contans WG	—	—	—	—	S	—	—
<i>Gliocladium catenulatum</i>	Lalstop G46 WG	S	—	—	—	—	—	—
<i>Streptomyces</i>	Mycostop	S	—	—	—	—	—	—
<i>Trichoderma harzianum</i>	RootShield WP	S	—	—	—	—	—	S
hydrogen peroxide/ peroxyacetic acid	OxiDate 2.0	—	—	S	—	—	—	—

Table 3–18. Brassica Crop Disease Control for TransplantsFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
GREENHOUSE TRANSPLANT DISEASE CONTROL (DAMPING-OFF, ROOT ROT)					
Qil (group 21)	cyazofamid	Torrent 400SC	30 mL in 100 L of water/ha Apply as a soil drench to thoroughly wet the growing medium.	60	Pythium damping-off and root rot. Apply immediately after seeding. Do not use any surfactant with drench application. Do not make sequential applications of any group 21 fungicides. 12-hr restricted entry interval.
phosphonate (group 33)	fosetyl-AL	Aliette WDG	20–30 g in 20 L of water/100 m ²	7	See label for complete list of brassica crops, including specialty brassicas. Soil drench treatment. See label for tank-mix and crop tolerance information. 12-hr restricted entry interval.
not classified (group NC)	<i>Gliocladium catenulatum</i>	Lalstop G46 WG	Refer to label for rates and instructions.	—	Broccoli and cauliflower greenhouse transplants. <i>Rhizoctonia solani</i> and pythium damping-off. Suppression. Growing media or drench application. Do not tank-mix with any fungicides, insecticides, herbicides or adjuvants.
	<i>Streptomyces</i>	Mycostop	Refer to label for rates and instructions.	—	<i>Fusarium</i> spp. Suppression. Drench or soil spray application. Apply first spray after emergence using lower rate.
	<i>Trichoderma harzianum</i> Rifai strain KRL-AG2 and <i>Trichoderma virens</i> strain G-41	RootShield Plus WP	600–1,200 g of product per m ³ of potting soil	—	See label for complete list of brassica crops, including specialty brassicas. Root rots caused by <i>Fusarium</i> spp., <i>Pythium</i> spp. and <i>Rhizoctonia</i> spp. Suppression. Potting mix application or drench. 4-hr restricted entry interval.
	<i>Trichoderma harzianum</i> Rifai strain T22	Triatum P	1.5 g /m ² of cultivated area, suspended in 2.5–5 L of water		Root rots caused by <i>Fusarium</i> spp., <i>Pythium</i> spp. and <i>Rhizoctonia</i> spp. Suppression. Apply immediately before seeding or planting. 4-hr restricted entry interval.
GREENHOUSE TRANSPLANT PIN ROT (ALTERNARIA/XANTHOMONAS COMPLEX)					
microbial (group BM02)	<i>Bacillus subtilis</i>	Cease	1–2 L/100 L water	0	See label for complete list of brassica crops, including specialty brassicas. Suppression.
GREENHOUSE TRANSPLANT POWDERY MILDEW, DOWNY MILDEW					
microbial (group BM02)	<i>Bacillus subtilis</i>	Cease	1–2 L/100 L water	0	See label for complete list of brassica crops, including specialty brassicas. Suppression.

Table 3–19. Brassica Crop Disease Control — Downy MildewFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DOWNY MILDEW					
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	1 kg/ha (0.4 kg/acre)	4	See label for complete list of brassica crops, including specialty brassicas. Suppression. Also controls botrytis gray mold. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 or group 11 fungicides. See label for recropping restrictions. 4-day restricted entry interval.
QoI (group 11)	fenamidone	Reason 500SC	400–600 mL/ha (162–243 mL/acre)	2	See label for complete list of brassica crops, including specialty brassicas. Suppression. Apply a non-group 11 fungicide within 7–10 days. See label for recropping restrictions. 2-day restricted entry interval.
Qil (group 21)	cyazofamid	Torrent 400SC	200 mL/ha (81 mL/acre)	1	See label for complete list of brassica crops, including specialty brassicas. Suppression. Tank-mix with a non-ionic or organosilicone surfactant. Do not make sequential applications. 12-hr restricted entry interval.
phosphonate (group 33)	fosetyl-AL	Aliette WDG	2.25–3.125 kg/ha (0.9–1.3 kg/acre)	7	See label for complete list of brassica crops, including specialty brassicas. See label for tank-mix and crop tolerance information. 12-hr restricted entry interval.
	mono- and di-potassium salts of phosphorous acid	Confine Extra	3–6 L/ha (1.2–2.4 L/acre)	1	See label for complete list of brassica crops, including specialty brassicas. Suppression. See label for tank-mix and crop tolerance information. May be applied as foliar sprays or through sprinkler chemigation.
	mono- and di-basic sodium, potassium and ammonium phosphites	Phostrol	2.9–5.8 L/ha (1.2–2.3 L/acre)	0	See label for complete list of brassica crops, including specialty brassicas. Suppression. See label for tank-mix and crop tolerance information. Begin preventive applications when conditions favour disease development. 12-hr restricted entry interval.
CAA (group 40)	dimethomorph	Forum	450 mL/ha (182 mL/acre)	7	See label for complete list of brassica crops, including specialty brassicas. Suppression. Tank-mix with another fungicide with activity against downy mildew. Do not make sequential applications of any group 40 fungicides. See label for recropping restrictions and restricted entry intervals.
	mandipropamid	Revus	400–600 mL/ha (162–243 mL/acre)	1	See label for complete list of brassica crops, including specialty brassicas. Tank-mix with a non-ionic surfactant. Do not make sequential applications of any group 40 fungicides. See label for recropping restrictions. 12-hr restricted entry interval.
CAA/OSBPI (group 40/49)	mandipropamid /oxathiapiprolin	Orondis Ultra	600 mL/ha (243 mL/acre)	1	Do not use on areas treated with product the previous season. Begin applications prior to disease development. Do not make sequential applications of any group 40 or 49 fungicides. Do not apply foliar applications in the same season as a soil application. Tank-mix with a non-ionic surfactant. See label for rotational crop restrictions. 12-hr restricted entry interval.

¹ Fixed copper may be phytotoxic to cauliflower.

Table 3–19. Brassica Crop Disease Control — Downy MildewFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DOWNY MILDEW (continued)					
QxI/CAA (group 45/40)	ametoctradin/ dimethomorph	Zampro	0.8–1 L/ha (0.3–0.4 L/acre)	0	See label for complete list of brassica crops, including specialty brassicas. See label for guidance on adjuvant use. Do not make sequential applications of any group 40 or 45 fungicides. See label for recropping restrictions and restricted entry intervals.
benzamide (group 43)	fluopicolide	Presidio	220–292 mL/ha (89–118 mL/acre)	7	Broccoli, Brussels sprouts, cabbage and cauliflower. Must be used in tank-mix with Bravo. Do not use on areas treated with product the previous season. Do not make more than 2 sequential applications. See label for rotational crop restrictions. 48-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade Opti	1.1–1.7 kg/ha (0.4–0.7 kg/acre)	0	See label for complete list of brassica crops, including specialty brassicas. Suppression.
inorganic (group M1)	copper sulphate ¹	Copper 53W ¹	4 kg/ha (1.6 kg/acre)	2	Broccoli, Brussels sprouts, cabbage and cauliflower. 48-hr restricted entry interval.
chloronitrile (group M5)	chlorothalonil	Bravo ZN/ZNC	2.5–4.8 L/ha (1–1.9 L/acre)	7	Broccoli, Brussels sprouts, and cauliflower. Maximum one application per year. Restricted entry intervals: • scouting/topping – 5 days • all other activities – 12 hr Cabbage. Maximum two applications per year. Restricted entry intervals: • scouting, thinning – 2 days • hand weeding – 1 day • all other activities – 12 hr
		Echo 90DF	1.4–2.7 kg/ha (0.6–1.1 kg/acre)		
not classified (group NC)	hydrogen peroxide (27%) + peroxyacetic acid (2.5%)	OxiDate 2.0	1.0% (v:v) (100 mL product per 10 L of water)	0	Broccoli, cauliflower. Do not spray during conditions of intense heat, drought or poor plant vigor. 4-hr restricted entry interval.

¹ Fixed copper may be phytotoxic to cauliflower.

Table 3–20. Brassica Crop Disease Control — Alternaria, Sclerotinia (White Mold, White Rot, Watery Soft Rot), Black Rot
For resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ALTERNARIA					
SDHI fungicide (group 7)	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.71 L/acre)	0	See label for complete list of brassica crops, including specialty brassicas. Do not make sequential applications of any group 7 fungicides. See label for tank-mix precautions and rotational crop restrictions. 12-hr restricted entry interval.
SDHI/ DMI fungicide (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	728–1000 mL/ha (0.29–0.40 mL/acre)	5	See label for complete list of brassica crops including specialty brassicas. Do not make more than two sequential applications. Apply prior to disease establishment. Restricted entry intervals: <ul style="list-style-type: none"> • scouting/topping/tying – 3 days • weeding – 4 days • hand harvesting – 5 days
SDHI/Qol (group 7/11)	fluopyram/ trifloxystrobin	Luna Sensation	300–500 mL/ha (121–202 mL/acre)	0	Do not make sequential applications of any group 11 or more than two sequential applications of any group 7 fungicide.
Qol (group 11)	azoxystrobin	Quadris	1.12 L/ha (0.45 L/acre)	1	Cabbage only. Suppression. Do not make sequential applications of any group 11 fungicides. Do not use on areas treated with product the previous season. See label for recropping restrictions. 12-hr restricted entry interval.
Qol/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	3	See label for complete list of brassica crops, including specialty brassicas. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 11 fungicides or more than two sequential applications of any group 3 fungicides. See label for recropping restrictions and restricted entry intervals.
chloronitrile (group M5)	chlorothalonil	Bravo ZN/ZNC	2.5–4.8 L/ha (1–1.9 L/acre)	7	Broccoli, Brussels sprouts, and cauliflower. Maximum one application per year. Restricted entry intervals: <ul style="list-style-type: none"> • scouting/topping – 5 days • all other activities – 12 hr Cabbage. Maximum two applications per year. Restricted entry intervals: <ul style="list-style-type: none"> • scouting, thinning – 2 days • hand weeding – 1 day • all other activities – 12 hr
		Echo 90DF	1.3–2.7 kg/ha (0.5–1.1 kg/acre)		
AP/PP (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (314–394 g/acre)	7	See label for complete list of brassica crops, including specialty brassicas. Suppression. Do not use on areas treated with product the previous season. Do not make more than two sequential applications. See label for recropping restrictions. 12-hr restricted entry interval.
SCLEROTINIA (WHITE MOLD, WHITE ROT, WATERY SOFT ROT)					
SDHI (group 7)	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	3	See label for complete list of brassica crops, including specialty brassicas. Suppression. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	0	See label for complete list of brassica crops, including specialty brassicas. Suppression. Do not make sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
microbial (group BMO2)	<i>Bacillus subtilis</i>	Serenade Opti	1.7–3.3 kg/ha (0.7–1.3 kg/acre)	0	See label for complete list of brassica crops, including specialty brassicas. Suppression.
SDHI/Qol (group 7/11)	fluopyram/ trifloxystrobin	Luna Sensation	400–600 mL/ha (162–243 mL/acre)	0	Do not make sequential applications of any group 11 or more than two sequential applications of any group 7 fungicide.
not classified (group NC)	<i>Coniothyrium minitans</i>	Contans WG	2–4 kg/ha (0.8–1.6 kg/acre)	0	Cabbage only. Suppression. Apply to soil prior planting, at least 3 months before the onset of disease. Broadcast and lightly incorporate. If incorporation will displace soil greater than 5 cm, increase application rate to 3–6 kg/ha (1.2–2.4 kg/acre). See label for application details and chemical compatibility precautions.

Table 3–20. Brassica Crop Disease Control — *Alternaria*, *Sclerotinia* (White Mold, White Rot, Watery Soft Rot), Black Rot
For resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BLACK ROT					
inorganic (group M1)	copper octanoate	Cueva	0.5%–2% solution, applied at 470–940 L/ha (190–380 L/acre)	1	Bok choy, broccoli, Brussels sprouts, cabbage, cauliflower, kale, kohlrabi, mustard and pak choy. Suppression. Rotate with products with a different mode of action when available. 4-hr restricted entry interval.

Table 3–21. Brassica Crop Disease Control — Powdery Mildew, Botrytis Gray Mold, Root Rots, Nematodes

For resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
POWDERY MILDEW					
SDHI fungicide (group 7)	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.71 L/acre)	0	See label for complete list of brassica crops, including specialty brassicas. Do not make sequential applications of any group 7 fungicides. See label for tank-mix precautions and rotational crop restrictions. 12-hr restricted entry interval.
SDHI fungicide (group 7)	fluopyram	Velum Prime	500 mL/ha (202 mL/acre)	0	See label for complete list of brassica crops including specialty brassicas. Suppression. Do not make more than two sequential applications. 12-hr restricted entry interval.
SDHI/ DMI fungicide (group 7/3)	pydiflumetofen/difenoconazole	Miravis Duo	728–1000 mL/ha (0.29–0.40 mL/acre)	3	See label for complete list of brassica crops including specialty brassicas. Do not make more than two sequential applications. Apply prior to disease establishment. 4-day restricted entry interval.
SDHI/QoI (group 7/11)	fluopyram/trifloxystrobin	Luna Sensation	300–400 mL/ha (121–162 mL/acre)	0	Powdery mildew. Do not make sequential applications of any group 11 or more than two sequential applications of any group 7 fungicide.
AP/PP (group 9/12)	cyprodinil/fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	7	Mustard greens only. Do not use on areas treated with product the previous season. Do not make more than two sequential applications. See label for recropping restrictions. 12-hr restricted entry interval.
QoI/DMI (group 11/3)	azoxystrobin/difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	3	See label for complete list of brassica crops, including specialty brassicas. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 11 fungicides or more than two sequential applications of any group 3 fungicides. See label for recropping restrictions and restricted entry intervals.
BOTRYTIS GRAY MOLD					
SDHI (group 7)	penthiopyrad	Fontelis	1.25–2.25 L/ha (0.5–0.9 L/acre)	0	See label for complete list of brassica crops, including specialty brassicas. Do not make sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
ROOT ROTS					
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Broccoli, Brussels sprouts, cabbage, cauliflower, collards, kale, kohlrabi and mustard greens. Root rots caused by <i>Rhizoctonia solani</i> and <i>Pythium</i> spp. Suppression. Soil application. See label for application details.
NEMATODES					
SDHI fungicide (group 7)	fluopyram	Velum Prime	500 mL/ha (202 mL/acre)	0	See label for complete list of brassica crops including specialty brassicas. Root lesion and root knot nematodes. Suppression. See label for application details. Do not make more than two sequential applications. 12-hr restricted entry interval.

Table 3–22. Activity of Insecticides on Brassica Crop Insects

Listed pest control products are not necessarily registered on all brassica crops.
See the most up-to-date product label to ensure registration on a specific crop.

LEGEND: C = control S = suppression RD = reduction in damage													
N = registered, but not considered effective or resistance is documented													
— = not registered for control of this pest, or activity on this pest has not been documented													
Common Name	Trade Name	Aphids	Cutworms	Leafhoppers	Slugs	Cabbage Maggot	Flea Beetles	Thrips	Imported Cabbageworm	Cabbage Looper	Diamondback Moth	Swede Midge	Leafminer
carbaryl	Sevin XLR	—	—	C	—	—	C	—	C	—	C	—	—
methomyl	Lannate Toss-N-Go	—	—	—	C	—	—	—	C	C	C	—	—
acephate	Orthene 97% SG	C	—	—	—	—	—	—	C	C	C	—	—
chlorpyrifos	Lorsban NT	—	C	—	—	C	—	—	—	—	—	—	—
	Pyrinex 480 EC	—	C	—	—	C	—	—	—	—	—	—	—
	Nufos 4E	—	C	—	—	C	—	—	—	—	—	—	—
	Warhawk 480 EC	—	C	—	—	C	—	—	—	—	—	—	—
	Lorsban 50W	—	C	—	—	C	—	—	—	—	—	—	—
	Lorsban 15G	—	—	—	—	C	—	—	—	—	—	—	—
	Pyrifos 15G	—	—	—	—	C	—	—	—	—	—	—	—
	Sharphos	—	C	—	—	C	—	—	—	—	—	—	—
dimethoate	Cygon 480	C	—	C	—	—	—	—	—	—	—	—	—
	Lagon 480 E	C	—	C	—	—	—	C	—	—	—	—	—
malathion	Malathion 85E	N	—	—	—	—	—	—	C	C	—	—	—
naled	Dibrom	C	—	—	—	—	—	—	C	C	C	—	—
cypermethrin	Mako	—	C	—	—	—	C	C	C	C	C	—	—
	UP-Cyde 2.5 EC	—	C	—	—	—	C	C	C	C	C	—	—
	Ship 250	—	C	—	—	—	C	C	C	C	C	—	—
deltamethrin	Decis 5 EC	—	—	—	—	—	C	—	C	C	C	—	—
	Decis 100 EC	—	—	—	—	—	C	—	C	C	C	—	—
	Poleci 2.5 EC	—	—	—	—	—	C	—	C	C	C	—	—
lambda-cyhalothrin	Labamba	—	—	—	—	—	C	C	C	C	C	C	—
	Matador 120EC	—	—	—	—	—	C	C	C	C	C	C	—
	Silencer 120 EC	—	—	—	—	—	C	C	C	C	C	C	—
permethrin	Perm-UP	—	C	—	—	—	C	—	C	C	C	—	—
	Pounce 384EC	—	C	—	—	—	C	—	C	C	C	—	—
lambda-cyhalothrin/chlorantraniliprole	Voliam Xpress	—	C	—	—	—	—	C	—	—	—	—	C
acetamiprid	Aceta 70 WP	C	—	—	—	—	—	—	—	—	—	C	RD ¹
	Assail 70 WP	C	—	—	—	—	—	—	—	—	—	C	RD ¹
imidacloprid	Admire 240	C	—	S	—	—	—	—	—	—	—	—	—
	Alias 240 SC	C	—	—	—	—	—	—	—	—	—	—	—
thiamethoxam	Actara 240SC	C	—	—	—	—	S	—	—	—	—	—	—
imidacloprid/deltamethrin	Concept	C	—	—	—	—	C	—	C	C	C	—	—
thiamethoxam/cyantraniliprole	Minecto Duo 40WG	C	—	—	—	—	C	S	C ¹	C ¹	C ¹	—	C ²
acetamiprid & novaluron	Cormoran	C	—	—	—	—	—	—	C	C	C	C	—
sulfoxaflor	Closer	C	—	—	—	—	—	—	—	—	—	—	—
flupyradifurone	Sivanto Prime	C	—	—	—	—	—	—	—	—	—	—	—

¹ Early season control.² Dipteran leafminers only.³ Pea leafminers only.⁴ Vegetable and serpentine leafminers only.

Table 3–22. Activity of Insecticides on Brassica Crop Insects

Listed pest control products are not necessarily registered on all brassica crops.
See the most up-to-date product label to ensure registration on a specific crop.

LEGEND: C = control S = suppression RD = reduction in damage
N = registered, but not considered effective or resistance is documented
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Aphids	Cutworms	Leafhoppers	Slugs	Cabbage Maggot	Flea Beetles	Thrips	Imported Cabbageworm	Cabbage Looper	Diamondback Moth	Swede Midge	Leafminer
spinosad	Entrust	—	—	—	—	—	S	S	C	C	C	RD	—
	Success	—	—	—	—	—	S	S	C	C	C	RD	—
	Scorpio Ant and Insect Bait	—	C	—	—	—	—	—	—	—	—	—	—
spinetoram	Delegate	—	—	—	—	—	—	S	C	C	C	—	—
<i>Bacillus thuringiensis</i>	Dipel 2X DF	—	—	—	—	—	—	—	C	C	C	—	—
	Bioprotec PLUS	—	—	—	—	—	—	—	C	C	C	—	—
	XenTari WG	—	—	—	—	—	—	—	C	C	C	—	—
novaluron	Rimon 10 EC	—	—	—	—	—	—	—	C	C	C	—	—
cyromazine	Citation 75WP	—	—	—	—	—	—	—	—	—	—	—	C ³
methoxyfenozide	Intrepid	—	—	—	—	—	—	—	C	C	S	—	—
spirotetramat	Movento 240 SC	C	—	—	—	—	—	—	—	—	—	C	—
chlorantraniliprole	Coragen	—	C	—	—	—	—	—	C	C	C	C	C ⁴
cyantraniliprole	Exirel	C	C	—	—	—	C	—	C	C	C	C	C ²
	Verimark	—	—	—	—	C	RD	—	C	C	C	RD	—
cyclaniliprole	Harvanta 50SL	—	—	—	—	—	—	S	—	C	C	—	C ⁴
tetraniliprole	Vayego 200 SC	S	C	—	—	—	—	—	C	S	C	—	—
flonicamid	Beleaf 50SG	C	—	—	—	—	—	—	—	—	—	—	—
ferric phosphate	Sluggo Professional	—	—	—	C	—	—	—	—	—	—	—	—
potassium salts of fatty acids	Kopa Insecticidal Soap	C	—	—	—	—	—	—	—	—	—	—	—

¹ Early season control.

² Dipteran leafminers only.

³ Pea leafminers only.

⁴ Vegetable and serpentine leafminers only.

Table 3–23. Brassica Crop Insect Control for Transplants

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE MAGGOT					
spinosyn (group 5)	spinosad	Entrust	25 mL in 2 L of water Apply 2 L of solution/1,000 plants as a drench before transplanting.	—	Broccoli transplants only. Greenhouse drench. See label for application details. Do not rinse product out of the transplant medium. 24-hr restricted entry interval for greenhouse drench applications. See label for complete list of brassica crops, including specialty brassicas. Greenhouse drench. See label for application details. Do not rinse product out of the transplant medium. 24-hr restricted entry interval for greenhouse drench applications.
		Success	12.5 mL in 2 L of water Apply 2 L of solution/1,000 plants as a drench before transplanting.		
APHIDS					
not classified (group NC)	<i>Beauveria bassiana</i> strain ANT-03	BioCeres G WP	2–4 g/L	0	See label for complete list of brassica crops, including specialty brassicas. Also reduces numbers of thrips and whitefly. See label for application details.

Table 3–24. Brassica Crop Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
Soil Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240	6.5 mL/ 100 m of row (1.98 mL/ 100 ft of row)	21	See label for complete list of brassica crops, including specialty brassicas. See label for application details. Do not use on areas treated with product the previous season. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. See label for rotational crop restrictions. 24-hr restricted entry interval.
		Alias 240 SC	730 mL/ha (295 mL/acre)	21	See label for complete list of brassica crops, including specialty brassicas. See label for application details. Do not use on areas treated with product the previous season. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. See label for rotational crop restrictions. 24-hr restricted entry interval.
	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	See label for complete list of brassica crops, including specialty brassicas. See label for application details. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. See label for recropping restrictions. 12-hr restricted entry interval.
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	See label for complete list of brassica crops, including specialty brassicas. See label for application details. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 or group 28 insecticides in the same season. See label for rotational crop restrictions. 12-hr restricted entry interval.
Foliar Applications					
organophosphate (group 1B)	acephate	Orthene 97% SG	580–850 g/ha (235–344 g/acre)	28	Brussels sprouts, cabbage and cauliflower. 12-hr restricted entry interval.
	dimethoate	Cygon 480	0.6–1 L/ha (0.24–0.4 L/acre)	7	Bok choy and Chinese broccoli. 4-day restricted entry interval.
			0.7–1 L/ha (0.28–0.4 L/acre)	7	Broccoli and cauliflower. 5-day restricted entry interval.

Table 3–24. Brassica Crop Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS — Foliar Applications (continued)					
organophosphate (group 1B)	dimethoate	Cygon 480	0.7–1 L/ha (0.28–0.4 L/acre)	21	Brussels sprouts. Use low rate on Brussels sprouts. 2-day restricted entry interval.
			0.7 L/ha (0.28 L/acre)	14	Kale. 3-day restricted entry interval.
		Lagon 480 E	0.6–1 L/ha (0.24–0.4 L/acre)	7	Bok choy and Chinese broccoli. 4-day restricted entry interval.
			0.7–1 L/ha (0.28–0.4 L/acre)	7	Broccoli and cauliflower. 5-day restricted entry interval.
				21	Brussels sprouts. 2-day restricted entry interval.
	malathion	Malathion 85E	0.7 L/ha (0.28 L/acre)	14	Kale. 3-day restricted entry interval.
			535–1,345 mL/ha (216–544 mL/acre)	3	Broccoli, Brussels sprouts, cabbage and cauliflower. Control of aphids with malathion has been inconsistent in many areas. Ensure thorough coverage. Apply when temperature is at or above 20°C. 2-day restricted entry interval. Kale and kohlrabi. Control of aphids with malathion has been inconsistent in many areas. Ensure thorough coverage. Apply when temperature is at or above 20°C. 24-hr restricted entry interval.
			1,100 mL/ha (445 mL/acre)	7	Collards. Control of aphids with malathion has been inconsistent in many areas. Ensure thorough coverage. Apply when temperature is at or above 20°C. 24-hr restricted entry interval.
neonicotinoid (group 4A)	naled	Dibrom	1.05 L/ha (0.4 L/acre)	4	Broccoli, Brussels sprouts, cabbage and cauliflower. 48-hr restricted entry interval.
	acetamiprid	Aceta 70 WP	56–86 g/ha (23–35 g/acre)	7	See label for complete list of brassica crops, including specialty brassicas. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. See label for restricted entry intervals.
		Assail 70 WP			
	imidacloprid	Admire 240	200 mL/ha (81 mL/acre)	7	See label for complete list of brassica crops, including specialty brassicas. Suppression. Do not use on areas treated with product the previous season. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. See label for rotational crop restrictions. 24-hr restricted entry interval.
neonicotinoid/ pyrethroid (group 4A/3A)	imidacloprid	Alias 240 SC	200 mL/ha (81 mL/acre)	7	See label for complete list of brassica crops, including specialty brassicas. Do not use on areas treated with product the previous season. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. See label for rotational crop restrictions. 24-hr restricted entry interval.
	imidacloprid/ deltamethrin	Concept	650 mL/ha (263 mL/acre)	7	See label for complete list of brassica crops, including specialty brassicas. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. See label for rotational crop restrictions. 12-hr restricted entry interval.

Table 3–24. Brassica Crop Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS — Foliar Applications (continued)					
neonicotinoid/ spinosyn (group 4/15)	acetamiprid/ novaluron	Cormoran	650–750 mL/ha (263–304 mL/acre)	7	See label for complete list of brassica crops including specialty brassicas. Apply a minimum of 7 days apart. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 12-hr restricted entry interval.
sulfoximines (group 4C)	sulfoxaflor	Closer	100–150 mL/ha (40–61 mL/acre)	3	See label for complete list of brassica crops, including specialty brassicas. Also controls tarnished plant bug. See label for recropping restrictions. 12-hr restricted entry interval or until spray deposit has dried.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	1	See label for complete list of brassica crops, including specialty brassicas. Do not use on areas treated with product the previous season. See label for rotational crop restrictions. 12-hr restricted entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	1	Do not apply to bok choy, napa or mustard spinach. See label for complete list of brassica crops, including specialty brassicas. Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. See label for guidance on adjuvant use and recropping restrictions. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	See label for complete list of brassica crops, including specialty brassicas. See label for guidance on adjuvant use. Do not make a foliar application for a minimum of 60 days following a soil application of any group 28 insecticide. See label for tank-mix and crop tolerance information and rotational crop restrictions. 12-hr restricted entry interval.
	tetraniliprole	Vayego 200 SC	150 mL/ha (61 mL/acre)	1	See label for complete list of brassica crops including specialty brassicas. Suppression. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	0	See label for complete list of brassica crops, including specialty brassicas. Use higher rates for high pest populations or dense foliage. See label for recropping restrictions. 12-hr restricted entry interval.
not classified (group NC)	mineral oil	SuffOil-X	13 L/1,000 L water	0	See label for complete list of crops. Reduction in damage. Also suppresses spider mites. 12-hr restricted entry interval.
	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water Applied at 700–1,900 L solution/ha (283–770 L/acre)	0	Broccoli, Brussels sprouts, cabbage, cauliflower, collards, kale, mustard greens. Do not spray when plants are under stress. See label for tank-mix and crop tolerance information. Avoid spraying during full sun.

Table 3–25. Brassica Crop Insect Control — Cutworms, Leafhoppers, Slugs

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
organophosphate (group 1B)	chlorpyrifos	Lorsban NT	1.2–2.4 L/ha (0.5–1 L/acre)	32	Broccoli, Brussels sprouts, cabbage, cauliflower and Chinese cabbage. Apply at 2–5-leaf stage. See label for recropping restrictions and restricted entry intervals.
		Pyrinex 480 EC			
		Nufos 4E			
		Warhawk 480 EC			
		Sharphos			
pyrethroid (group 3A)	cypermethrin	Mako	175 mL/ha (71 mL/acre)	21	Broccoli, Brussels sprouts, cabbage and cauliflower. Do not disturb soil surface for 5 days after application. 12-hr restricted entry interval.
		Ship 250	140 mL/ha (57 mL/acre)	1	
	permethrin	Pounce 384EC	180–390 mL/ha (73–158 mL/acre)	—	Do not disturb soil surface for 5 days following application. Re-entry permitted once spray deposit has dried.
		Perm-UP		—	Do not disturb soil surface for 5 days following application. 12-hr restricted entry interval.
pyrethroid/ diamide (group 3A/28)	lambda- cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	3	Mechanical harvest. See label for complete list of brassica crops, including specialty brassicas. Black cutworm. Do not use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a soil application. See label for restricted entry intervals.
				8	Hand harvest. See label for complete list of brassica crops, including specialty brassicas. Black cutworm. Do not use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a soil application. See label for restricted entry intervals.
neonicotinoid/ pyrethroid (group 4A/3A)	imidacloprid/ deltamethrin	Concept	650 mL/ha (263 mL/acre)	7	See label for complete list of brassica crops, including specialty brassicas. Do not apply foliar group 4 insecticides in the same season as a seed treatment, soil, in-furrow or transplant application. See label for rotational crop restrictions. 12-hr restricted entry interval.
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	3	Black cutworm only. Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	3	See label for complete list of brassica crops, including specialty brassicas. Black cutworm. See label for guidance on adjuvant use. Do not use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	See label for complete list of brassica crops, including specialty brassicas. See label for guidance on adjuvant use. Do not make a foliar application for a minimum of 60 days following a soil application of any group 28 insecticide. See label for tank-mix and crop tolerance information and rotational crop restrictions. 12-hr restricted entry interval.

Table 3–25. Brassica Crop Insect Control — Cutworms, Leafhoppers, Slugs

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFHOPPERS					
neonicotinoid (group 4A)	imidacloprid	Admire 240	200 mL/ha (81 mL/acre)	7	See label for complete list of brassica crops, including specialty brassicas. Suppression. Do not use on areas treated with product the previous season. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. See label for rotational crop restrictions. 24-hr restricted entry interval.
SLUGS					
not classified (group NC)	ferric phosphate	Sluggo Professional	12–50 kg/ha (5–20 kg/acre)	—	Use high rates on heavy infestations or after heavy rains.
carbamate (group 1A)	methomyl	Lannate Toss-N-Go	775 g/ha (314 g/acre)	30	Brussels sprouts only. 12-hr restricted entry interval.

Table 3–26. Brassica Crop Insect Control — Cabbage Maggot

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE MAGGOT					
Treatment at Planting					
organophosphate (group 1B)	chlorpyrifos	Lorsban 50W	32.5 g/ 100 L of water Apply in 200 mL water/plant.	32	Cabbage only. Transplant water treatment. Do not use with starter fertilizers. See label for recropping restrictions. 24-hr restricted entry interval.
		Lorsban 15G Pyrifos 15G	0.6–1 kg/ 1,000 m of row	32	Direct-seeded broccoli, Brussels sprouts, cabbage and cauliflower. In-furrow treatment. See label for recropping restrictions and restricted entry intervals.
		Sharphos	1.2–1.4 L/ha (0.49–0.57 L/acre)	32	Broccoli, Brussels sprouts, cabbage, cauliflower and Chinese cabbage. Drench treatment. See label for application details. See label for recropping restrictions.
diamide (group 28)	cyantraniliprole	Verimark	10–15 mL/100 m of row or 1,100–1,700 mL/ha (445–687 mL/acre)	—	See label for complete list of brassica crops, including specialty brassicas. In-furrow, transplant water or banded treatment. See label for application details. Do not make a foliar application for a minimum of 60 days following a soil application of any group 28 insecticide. See label for rotational crop restrictions. 12-hr restricted entry interval.
Treatment After Planting					
organophosphate (group 1B)	chlorpyrifos	Lorsban NT	210 mL/ 1,000 m of row	32	Broccoli, Brussels sprouts, cabbage, cauliflower and Chinese cabbage. Drench treatment. See label for application details. See label for recropping restrictions and restricted entry intervals.
		Nufos 4E			
		Pyrinex 480 EC			
		Warhawk 480 EC			
		Lorsban NT	210 mL/ 1,000 m of row	15	Pak choy only. Drench treatment. See label for application details and recropping restrictions. 24-hr restricted entry interval.
		Nufos 4E			
		Pyrinex 480 EC			
		Warhawk 480 EC			
		Lorsban NT	150 mL in 800 L/ 1,000 m of row	21	Chinese broccoli only. Soil treatment. See label for application details and recropping restrictions. 24-hr restricted entry interval.
		Nufos 4E			
		Pyrinex 480 EC			
		Warhawk 480 EC			
		Sharphos	1.2–1.4 L/ha (0.49–0.57 L/acre)	32	Broccoli, Brussels sprouts, cabbage, cauliflower and Chinese cabbage. Apply at 2–5-leaf stage. See label for recropping restrictions and restricted entry intervals.

Table 3–27. Brassica Crop Insect Control — Flea Beetles

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
FLEA BEETLES					
Soil Applications					
neonicotinoid (group 4A)	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	See label for complete list of brassica crops, including specialty brassicas. Early-season suppression. See label for application details. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. See label for recropping restrictions. 12-hr restricted entry interval.
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	See label for complete list of brassica crops, including specialty brassicas. Early-season suppression. See label for application details. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 or group 28 insecticides in the same season. See label for rotational crop restrictions. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Verimark	750–1,000 mL/ha (304–405 mL/acre)	—	See label for complete list of brassica crops, including specialty brassicas. Early season reduction in damage. In-furrow, transplant water or banded treatment. See label for application details. Do not make a foliar application for a minimum of 60 days following a soil application of any group 28 insecticide. See label for rotational crop restrictions. 12-hr restricted entry interval.

Table 3–27. Brassica Crop Insect Control — Flea Beetles

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Foliar Applications					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	5	Kohlrabi. See label for restricted entry intervals.
				21	Chinese cabbage and mustard greens. See label for restricted entry intervals.
pyrethroid (group 3A)	cypermethrin	Mako	87.5–125 mL/ha (35–51 mL/acre)	3	Broccoli, Brussels sprouts, cabbage and cauliflower. Do not apply to muck soils.
		Ship 250	140 mL/ha (57 mL/acre)	1	Broccoli, Brussels sprouts, cabbage and cauliflower. Do not disturb soil surface for 5 days after application. 12-hr restricted entry interval.
	deltamethrin	Decis 5 EC	150–200 mL/ha (61–81 mL/acre)	3	Cabbage. 12-hr restricted entry interval.
		Decis 100 EC	75–100 mL/ha (30–40 mL/acre)		
		Poleci 2.5 EC	400 mL/ha (162 mL/acre)		
	lambda-cyhalothrin	Labamba	42 mL/ha (17 mL/acre)	1	Cabbage. 24-hr restricted entry interval.
		Matador 120EC		3	Broccoli, Brussels sprouts and cauliflower. 24-hr restricted entry interval.
		Silencer 120 EC	42 mL/ha (17 mL/acre)	3	Broccoli, Brussels sprouts and cauliflower. 24-hr restricted entry interval.
	permethrin	Perm-UP	90–180 mL/ha (36–73 mL/acre)	3	Brussels sprouts, cabbage and cauliflower. See label for guidance on adjuvant use. 12-hr restricted entry interval.
				7	Broccoli. See label for guidance on adjuvant use. 12-hr restricted entry interval.
		Pounce 384EC	90–180 mL/ha (36–73 mL/acre)	3	Brussels sprouts, cabbage and cauliflower. See label for guidance on adjuvant use. Re-entry permitted once spray deposit has dried.
				7	Broccoli. See label for guidance on adjuvant use. Re-entry permitted once spray deposit has dried.
neonicotinoid/ pyrethroid (group 4A/3A)	imidacloprid/ deltamethrin	Concept	650 mL/ha (263 mL/acre)	7	See label for complete list of brassica crops, including specialty brassicas. Do not apply foliar group 4 insecticides in the same season as a seed treatment, soil, in-furrow or transplant application. See label for rotational crop restrictions. 12-hr restricted entry interval.
spinosyn (group 5)	spinosad	Entrust	364 mL/ha (147 mL/acre)	3	See label for complete list of brassica crops, including specialty brassicas. Suppression. See label for restricted entry intervals.
diamide (group 28)	cyantraniliprole	Exirel	500–1,000 mL/ha (202–405 mL/acre)	1	See label for complete list of brassica crops, including specialty brassicas. See label for guidance on adjuvant use. Do not make a foliar application for a minimum of 60 days following a soil application of any group 28 insecticide. See label for tank-mix and crop tolerance information and rotational crop restrictions. 12-hr restricted entry interval.

Table 3–28. Brassica Crop Insect Control — Thrips

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
THRIPS					
Soil Applications					
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	See label for complete list of brassica crops, including specialty brassicas. Early-season suppression. See label for application details. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 or group 28 insecticides in the same season. See label for rotational crop restrictions. 12-hr restricted entry interval.
Foliar Applications					
pyrethroid (group 3A)	cypermethrin	Mako	87.5–125 mL/ha (35–51 mL/acre)	3	Broccoli, Brussels sprouts, cabbage and cauliflower. Do not apply to muck soils.
		UP-Cyde 2.5 EC	200 mL/ha (81 mL/acre)	3	Broccoli, Brussels sprouts, cabbage and cauliflower. See label for guidance on adjuvant use. Do not apply to muck soils. 12-hr restricted entry interval.
		Ship 250	140 mL/ha (57 mL/acre)	1	Broccoli, Brussels sprouts, cabbage and cauliflower. Do not disturb soil surface for 5 days after application. 12-hr restricted entry interval.
	lambda-cyhalothrin	Labamba	188 mL/ha (76 mL/acre)	1	Mechanical harvest. Cabbage. Onion thrips. See label for restricted entry intervals.
		Matador 120EC		3	Mechanical harvest. See label for complete list of brassica crops, including specialty brassicas. Onion thrips. See label for restricted entry intervals.
		Silencer 120 EC		6	Hand harvest. See label for complete list of brassica crops, including specialty brassicas. Onion thrips. See label for restricted entry intervals.
pyrethroid/ diamide (group 3A/28)	lambda- cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	3	Mechanical harvest. See label for complete list of brassica crops, including specialty brassicas. Onion thrips. Do not use on areas treated with product the previous season. Do not make a subsequent application of any group 28 insecticide in the same season as a soil application. See label for restricted entry intervals.
pyrethroid/ diamide (group 3A/28)	lambda- cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	8	Hand harvest. See label for complete list of brassica crops, including specialty brassicas. Onion thrips. Do not use on areas treated with product the previous season. Do not make a subsequent application of any group 28 insecticide in the same season as a soil application. See label for restricted entry intervals.
spinosyn (group 5)	spinosad	Success	146 mL/ha (59 mL/acre)	3	See label for complete list of brassica crops, including specialty brassicas. Suppression. See label for restricted entry intervals.
		Entrust	292 mL/ha (118 mL/acre)	3	
	spinetoram	Delegate	200–336 g/ha (81–136 g/acre)	1	See label for complete list of brassica crops, including specialty brassicas. Onion thrips. Suppression. 12-hr restricted entry interval.
diamide (group 28)	cyclaniliprole	Harvanta 50SL	1.2 L/ha (0.49 L/acre)	1	Suppression. Do not make sequential applications of any group 28 insecticide after two consecutive applications within a 30-day period. 12-hr restricted entry interval.

Table 3–29. Brassica Crop Insect Control — Imported Cabbageworm, Cabbage Looper, Diamondback Moth Caterpillars

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
IMPORTED CABBAGEWORM, CABBAGE LOOPER, DIAMONDBACK MOTH CATERPILLARS					
Soil Applications					
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	See label for complete list of brassica crops, including specialty brassicas. Early season control. See label for application details. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 or group 28 insecticides in the same season. See label for rotational crop restrictions. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Verimark	750–1,000 mL/ha (304–405 mL/acre)	—	See label for complete list of brassica crops, including specialty brassicas. In-furrow, transplant water or banded treatment. See label for application details. Do not make a foliar application for a minimum of 60 days following a soil application of any group 28 insecticide. See label for rotational crop restrictions. 12-hr restricted entry interval.
Foliar Applications					
carbamate ¹ (group 1A)	carbaryl	Sevin XLR	2.5–5.25 L/ha (1–2.1 L/acre)	5	Kohlrabi only. Imported cabbageworm and diamondback moth. See label for restricted entry intervals.
				21	Chinese cabbage and mustard greens only. Imported cabbageworm and diamondback moth. See label for restricted entry intervals.
	methomyl	Lannate Toss-N-Go	270–540 g/ha (109–219 g/acre)	1	Cabbage. See label for restricted entry intervals.
				7	Broccoli, Brussels sprouts and cauliflower. Do not apply after August 15. See label for restricted entry intervals.
organophosphate (group 1B)	acephate	Orthene 97% SG	580–850 g/ha (235–344 g/acre)	28	Brussels sprouts, cabbage and cauliflower only. 12-hr restricted entry interval.
	malathion	Malathion 85E	535–1,345 mL/ha (216–544 mL/acre)	3	Broccoli, Brussels sprouts, cabbage and cauliflower. Imported cabbageworm and cabbage looper. Ensure thorough coverage. Apply when temperature is at or above 20°C. 2-day restricted entry interval.
					Kale and kohlrabi. Imported cabbageworm and cabbage looper. Ensure thorough coverage. Apply when temperature is at or above 20°C. 24-hr restricted entry interval.
	naled	Dibrom	1.05 L/ha (0.4 L/acre)	4	Broccoli, Brussels sprouts, cabbage and cauliflower. Imported cabbageworm and diamondback moth. 48-hr restricted entry interval.
			1.05–2.1 L/ha (0.4–0.85 L/acre)	4	Broccoli, Brussels sprouts, cabbage and cauliflower. Cabbage loopers. 48-hr restricted entry interval.

¹ The carbamates and the pyrethroids have provided inconsistent control in some areas.

Table 3–29. Brassica Crop Insect Control — Imported Cabbageworm, Cabbage Looper, Diamondback Moth Caterpillars

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Foliar Applications (continued)					
pyrethroid ¹ (group 3A)	cypermethrin	Mako	87.5–125 mL/ha (35–51 mL/acre)	3	Broccoli, Brussels sprouts, cabbage and cauliflower. Do not apply to muck soils.
		UP-Cyde 2.5 EC	140 mL/ha (57 mL/acre)	3	Broccoli, Brussels sprouts, cabbage and cauliflower. See label for guidance on adjuvant use. Do not apply to muck soils. 12-hr restricted entry interval.
		Ship 250	140 mL/ha (57 mL/acre)	1	Broccoli, Brussels sprouts, cabbage and cauliflower. Do not disturb soil surface for 5 days after application. 12-hr restricted entry interval.
	deltamethrin	Decis 5 EC	200 mL/ha (80 mL/acre)	1	Kale. 12-hr restricted entry interval.
		Decis 100 EC	75–100 mL/ha (30–40 mL/acre)	1	Brussels sprouts. 12-hr restricted entry interval.
				3	Broccoli, cabbage and cauliflower. 12-hr restricted entry interval.
			100 mL/ha (40 mL/acre)	1	Kale. 12-hr restricted entry interval.
		Poleci 2.5 EC	300–400 mL/ha (121–162 mL/acre)	1	Brussels sprouts. Do not apply after August 1. See label for precautions on high organic content soils. 12-hr restricted entry interval.
				3	Broccoli, cabbage and cauliflower. Do not apply after August 1. See label for precautions on high organic content soils. 12-hr restricted entry interval.
			400 mL/ha (162 mL/acre)	1	Kale. Do not apply after August 1. See label for precautions on high organic content soils. 12-hr restricted entry interval.
	lambda-cyhalothrin	Labamba	42 mL/ha (17 mL/acre)	1	Cabbage. Imported cabbageworm and diamondback moth larvae. 24-hr restricted entry interval.
		Matador 120EC			
		Silencer 120EC		3	Broccoli, Brussels sprouts and cauliflower. Imported cabbageworm and diamondback moth larvae. 24-hr restricted entry interval.
		Labamba	83 mL/ha (34 mL/acre)	1	Cabbage. Cabbage looper. 24-hr restricted entry interval.
		Matador 120EC			
		Silencer 120EC		3	Broccoli, Brussels sprouts and cauliflower. Cabbage looper. 24-hr restricted entry interval.

¹ The carbamates and the pyrethroids have provided inconsistent control in some areas.

Table 3–29. Brassica Crop Insect Control — Imported Cabbageworm, Cabbage Looper, Diamondback Moth Caterpillars

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Foliar Applications (continued)					
pyrethroid ¹ (group 3A) (continued)	permethrin	Pounce 384EC	90–180 mL/ha (36–73 mL/acre)	3	Brussels sprouts, cabbage, and cauliflower. See label for guidance on adjuvant use. Re-entry permitted once spray deposit has dried.
				7	Broccoli and Chinese broccoli. See label for guidance on adjuvant use. Re-entry permitted once spray deposit has dried.
			180 mL/ha (73 mL/acre)	3	Pak choy and Chinese cabbage. See label for guidance on adjuvant use. Re-entry permitted once spray deposit has dried.
		Perm-UP	90–180 mL/ha (36–73 mL/acre)	3	Brussels sprouts, cabbage and cauliflower. See label for guidance on adjuvant use. 12-hr restricted entry interval.
				7	Broccoli and Chinese broccoli. See label for guidance on adjuvant use. 12-hr restricted entry interval.
			180 mL/ha (73 mL/acre)	3	Chinese cabbage and pak choy only. See label for guidance on adjuvant use. 12-hr restricted entry interval.
neonicotinoid/ pyrethroid (group 4A/3A)	imidacloprid/ deltamethrin	Concept	650 mL/ha (263 mL/acre)	7	See label for complete list of brassica crops, including specialty brassicas. Do not apply foliar group 4 insecticides in the same season as a seed treatment, soil, in-furrow or transplant application. See label for rotational crop restrictions. 12-hr restricted entry interval.
neonicotinoid/ spinosyn (group 4/15)	acetamiprid/ novaluron	Cormoran	440–750 mL/ha (178–304 mL/acre)	7	See label for complete list of Brassica crops including specialty brassicas. Apply a minimum of 7 days apart. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 12-hr restricted entry interval.
spinosyn (group 5)	spinosad	Entrust	364 mL/ha (147 mL/acre)	3	See label for complete list of brassica crops, including specialty brassicas. See label for restricted entry intervals.
		Success	182 mL/ha (74 mL/acre)	3	See label for complete list of brassica crops, including specialty brassicas. See label for restricted entry intervals.
	spinetoram	Delegate	140–200 g/ha (57–81 g/acre)	1	See label for complete list of brassica crops, including specialty brassicas. Use the higher rate for high infestations or advanced growth stages of the target pest. 12-hr restricted entry interval.
benzoylurea (group 15)	novaluron	Rimon 10 EC	410–820 mL/ha (166–332 mL/acre)	2–4	Broccoli, Chinese broccoli, Brussels sprouts, cabbage, Chinese cabbage, gai choy, cauliflower, cavalo broccoli and kohlrabi. 12-hr restricted entry interval.
				7	Broccoli raab (rapini), Chinese cabbage (bok choy), collards, kale, mizuna, mustard greens, mustard spinach and rape greens. 12-hr restricted entry interval.

¹ The carbamates and the pyrethroids have provided inconsistent control in some areas.

Table 3–29. Brassica Crop Insect Control — Imported Cabbageworm, Cabbage Looper, Diamondback Moth Caterpillars

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Foliar Applications (continued)					
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i>	Dipel 2X DF	275–550 g/ha (111–223 g/acre)	0	See label for complete list of brassica crops. Cabbage looper.
			110–275 g/ha (45–111 g/acre)	0	See label for complete list of brassica crops. Diamondback moth and imported cabbageworm.
		Bioprotec PLUS	0.9–1.8 L/ha (0.36–0.73 L/acre)	0	See label for complete list of brassica crops, including specialty brassicas.
	<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i>	XenTari WG	500–1000 g/ha (203–405 g/acre)	0	Cabbage looper, diamondback moth and imported cabbageworm. For best results apply in evening or on cloudy days. Thorough coverage required to ensure pests consume product.
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	1	See label for complete list of brassica crops, including specialty brassicas. Suppression of diamondback moth. Control of imported cabbageworm and cabbage looper. Tank-mix with a non-ionic surfactant. See label for rotational crop restrictions. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	3	See label for complete list of brassica crops, including specialty brassicas. See label for guidance on adjuvant use. Do not use on areas treated with product the previous season. Do not make a foliar application for a minimum of 60 days following a soil application of any group 28 insecticide. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	250–500 mL/ha (101–202 mL/acre)	1	See label for complete list of brassica crops, including specialty brassicas. See label for guidance on adjuvant use. Do not make a foliar application for a minimum of 60 days following a soil application of any group 28 insecticide. See label for tank-mix and crop tolerance information and rotational crop restrictions. 12-hr restricted entry interval.
	cyclaniliprole	Harvanta 50SL	0.8–1.2 L/ha (0.32–0.49 L/acre)	1	Control of cabbage looper and diamondback moth. Do not make sequential applications of any group 28 insecticide after two consecutive applications within a 30-day period. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
	tetraniliprole	Vayego 200 SC	150 mL/ha (61 mL/acre)	1	See label for complete list of brassica crops including specialty brassicas. Cabbage looper. Suppression. 12-hr restricted entry interval.
			225 mL/ha (91 mL/acre)	1	See label for complete list of brassica crops including specialty brassicas. Imported cabbageworm, diamondback moth and cutworm. Suppression. 12-hr restricted entry interval.

¹ The carbamates and the pyrethroids have provided inconsistent control in some areas.

Table 3–30. Brassica Crop Insect Control — Swede Midge

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
SWEDE MIDGE					
Soil Applications					
diamide (group 28)	cyantraniliprole	Verimark	750–1,000 mL/ha (304–405 mL/acre)	—	See label for complete list of brassica crops, including specialty brassicas. Early-season reduction in damage. In-furrow, transplant water or banded treatment. See label for application details. Do not make a foliar application for a minimum of 60 days following a soil application of any group 28 insecticide. See label for rotational crop restrictions. 12-hr restricted entry interval.
Foliar Applications					
pyrethroid (group 3A)	lambda-cyhalothrin	Labamba	83 mL/ha (34 mL/acre)	1	Cabbage, Chinese cabbage (napa) and Chinese mustard cabbage (gai choy). 24-hr restricted entry interval.
		Matador 120EC		3	Broccoli, Brussels sprouts, cauliflower, Chinese broccoli, cavolo broccolo and kohlrabi. 24-hr restricted entry interval.
		Silencer 120 EC		1	Cabbage. 24-hr restricted entry interval.
			3	Broccoli, Brussels sprouts and cauliflower. 24-hr restricted entry interval.	
neonicotinoid (group 4A)	acetamiprid	Aceta 70 WP	86 g/ha (35 g/acre)	7	See label for complete list of brassica crops, including specialty brassicas. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. See label for restricted entry intervals.
		Assail 70 WP			
neonicotinoid/ spinosyn (group 4/15)	acetamiprid/ novaluron	Cormoran	740 mL/ha (300 mL/acre)	7	See label for complete list of brassica crops including specialty brassicas. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 12-hr restricted entry interval.
spinosyn (group 5)	spinosad	Entrust	292 mL/ha (118 mL/acre)	3	See label for complete list of brassica crops, including specialty brassicas. Reduction in damage. See label for restricted entry intervals.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	1	Do not apply to bok choy, napa or mustard spinach. See label for complete list of brassica crops, including specialty brassicas. Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. See label for guidance on adjuvant use and recropping restrictions. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	3	See label for complete list of brassica crops, including specialty brassicas. See label for guidance on adjuvant use. Do not use on areas treated with product the previous season. Do not make a foliar application for a minimum of 60 days following a soil application of any group 28 insecticide. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	See label for complete list of brassica crops, including specialty brassicas. See label for guidance on adjuvant use. Do not make a foliar application for a minimum of 60 days following a soil application of any group 28 insecticide. See label for tank-mix and crop tolerance information and rotational crop restrictions. 12-hr restricted entry interval.

Table 3–31. Brassica Crop Insect Control — Leafminers

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFMINERS					
Soil Applications					
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	See label for complete list of brassica crops, including specialty brassicas. Dipteran leafminers. See label for application details. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 or group 28 insecticides in the same season. See label for rotational crop restrictions. 12-hr restricted entry interval.
Foliar Applications					
pyrethroid/ diamide (group 3A/28)	lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	3	Mechanical harvest. See label for complete list of brassica crops, including specialty brassicas. <i>Liriomyza</i> spp. leafminers. Do not use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a soil, in-furrow or transplant application. See label for restricted entry intervals.
				8	Hand harvest. See label for complete list of brassica crops, including specialty brassicas. <i>Liriomyza</i> spp. leafminers. Do not use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a soil, in-furrow or transplant application. See label for restricted entry intervals.
neonicotinoid (group 4A)	acetamiprid	Aceta 70 WP Assail 70 WP	86 g/ha (35 g/acre)	7	See the label for a complete list of brassica crops, including specialty brassicas. Pea leafminers. Reduction in damage. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. See label for restricted entry intervals.
cyromazine (group 17)	cyromazine	Citation 75WP	188 g/ha in 200 L water (76 g/acre in 20 gal water)	7	Leafy brassica greens only. See the label for a complete list of brassica crops, including specialty brassicas. Pea leafminers. Do not use on areas treated with product the previous season. See label for rotational crop restrictions. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	1–1.5 L/ha (0.4–0.6 L/acre)	1	See the label for a complete list of brassica crops, including specialty brassicas. Dipteran leafminers. See label for guidance on adjuvant use. Do not make a foliar application for a minimum of 60 days following a soil application of any group 28 insecticide. See label for tank-mix and crop tolerance information and rotational crop restrictions. 12-hr restricted entry interval.
	cyclaniliprole	Harvanta 50SL	1.2 L/ha (0.49 L/acre)	1	<i>Liriomyza</i> spp. leafminers. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.

CARROTS

In this section:

Table 3–32.	Carrot Seed Treatments
Table 3–33.	Activity of Fungicides on Carrot Diseases
Table 3–34.	Carrot Disease Control — Leaf Blights (<i>Alternaria</i> and <i>Cercospora</i>)
Table 3–35.	Carrot Disease Control — Cavity Spot, <i>Rhizoctonia</i> Crown Rot and Root Rot, <i>Sclerotinia</i> White Mold
Table 3–36.	Activity of Insecticides on Carrot Insects
Table 3–37.	Carrot Insect Control — Carrot Weevil, Carrot Rust Fly, Leafhoppers
Table 3–38.	Carrot Insect Control — Cutworms, Wireworms

The information is provided as a guideline only. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication. See product labels for complete information.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–32. Carrot Seed Treatments

Group Name (Group #)	Active Ingredient	Trade Name	Rate	Pests Controlled	Notes
FUNGICIDES					
dicarboximide (group 2)	iprodione	Rovral	521 mL/ 100 kg seed	seed-borne alternaria	For imported seed only; do not treat in Canada.
phenylamide (group 4)	metalaxyl-M and S-isomer	Apron XL LS	20–40 mL/ 100 kg seed	damping-off (<i>Pythium</i> spp.)	For use in commercial seed treatment facilities.
PP/PA (group 12/4)	fludioxonil/metalaxyl-m	Apron Maxx	665 mL/ 100 kg seed	Seed rot, damping-off (<i>Fusarium</i> spp. <i>Rhizoctonia</i> spp. and <i>Pythium</i> spp.)	For use in commercial seed treatment facilities.
QoI (group 11)	azoxystrobin	Dynasty 100FS	25–50 mL/ 100 kg seed	seed rot, damping-off (<i>Rhizoctonia solani</i>)	For import use only; do not treat in Canada.
PP (group 12)	fludioxonil	Maxim 480FS	5.2–10.4 mL/ 100 kg of seed	seed decay, damping-off	For use in commercial seed treatment facilities.
dithiocarbamate (group M3)	thiram	Thiram 75 WP	90 g/ 25 kg seed	seed decay, seedling blight, damping-off	Seed box or commercial seed treatment.
INSECTICIDES					
neonicotinoid (group 4A)	clothianidin/imidacloprid	Sepresto 75 WS	0.062–0.12 g/ 1,000 seed	carrot rust fly (suppression)	For import use only; do not treat in Canada. Do not use any subsequent soil or foliar applications of a group 4 insecticide in the same season.

Table 3–33. Activity of Fungicides on Carrot Diseases

LEGEND: C = control S = suppression
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Damping-Off (<i>Pythium</i> spp.)	Alternaria Leaf Blight	Cercospora Leaf Blight	Powdery Mildew	Cavity Spot (<i>Pythium</i> spp.)	Rhizoctonia Crown/Root Rot	Sclerotinia White Mold	Botrytis Gray Mold
fludioxonil	Scholar 230SC	—	—	—	—	—	—	C	—
metalaxyl	Ridomil Gold 1G	—	—	—	—	C	—	—	—
boscalid	Cantus WDG	—	C	—	—	—	—	—	—
fluxapyroxad	Sercadis	—	C	—	C	—	—	—	—
penthiopyrad	Fontelis	—	C	—	C	—	—	—	C
pydiflumetofen/difenoconazole	Miravis Duo	—	C	—	C	—	—	S	—
boscalid/pyraclostrobin	Pristine WG	—	C	—	—	—	—	—	—
fluopyram/trifloxystrobin	Luna Sensation	—	C	—	C	—	—	C	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	C	—	—	—	—	C	C
pyraclostrobin	Cabrio EG	—	C	C	C	—	—	—	—
trifloxystrobin	Flint	—	C	C	—	—	—	—	—
fenamidone	Reason 500SC	C	—	—	—	C	—	—	—
azoxystrobin	Quadris Flowable	—	—	—	—	—	C	—	—
	Azoshy 250 SC	—	—	—	—	—	C	—	—
azoxystrobin/difenoconazole	Quadris Top	—	C	C	—	—	—	—	—
cyazofamid	Torrent 400SC	—	—	—	—	S	—	—	—
fluazinam	Allegro 500F	—	C	—	—	—	—	C	—
copper sulphate	Copper 53W	—	—	C	—	—	—	—	—
mancozeb	Manzate Pro-Stick	—	C	C	—	—	—	—	—
	Dithane Rainshield	—	C	C	—	—	—	—	—
	Penncozeb 75DF Raincoat	—	C	C	—	—	—	—	—
chlorothalonil	Bravo ZN/ZNC	—	C	C	—	—	—	—	—
	Echo 90DF	—	C	C	—	—	—	—	—
<i>Bacillus subtilis</i>	Serenade Opti	—	—	—	—	—	—	S	—
<i>Trichoderma harzianum</i>	Triatum G/P	—	—	—	—	S	—	—	—
<i>Coniothyrium minitans</i>	Contans WG	—	—	—	—	—	—	S	—

Table 3–34. Carrot Disease Control — Leaf Blights (*Alternaria* and *Cercospora*)For resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
SDHI (group 7)	boscalid	Cantus WDG	315 g/ha (127 g/acre)	0	Alternaria leaf blight. Do not make more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	7	Alternaria leaf blight. Also controls powdery mildew. Do not make more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
	penthiopyrad	Fontelis	1.25–2.25 L/ha (0.5–0.9 L/acre)	0	Alternaria leaf blight. Also controls powdery mildew. Do not make more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.40 L/acre)	7	Alternaria leaf blight. Also controls powdery mildew. Do not make more than two sequential applications of any group 3 or group 7 fungicide. 12-hr restricted entry interval.
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	580–735 g/ha (234–297 g/acre)	0	Alternaria leaf blight. Do not make sequential applications of any group 11 or more than two sequential applications of any group 7 fungicide. 3-day restricted entry interval for hand harvesting. Re-entry permitted once spray deposit has dried for all other activities.
	fluopyram/ trifloxystrobin	Luna Sensation	300–500 mL/ha (121–202 mL/acre)	7	Alternaria leaf blight. Do not make sequential applications of any group 11 or more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
AP/PP (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	7	Alternaria leaf blight. Also controls botrytis gray mold. 12-hr restricted entry interval.
QoI (group 11)	pyraclostrobin	Cabrio EG	0.56–1.1 kg/ha (226–445 g/acre)	3	Alternaria leaf blight. Do not make sequential applications of any group 11 fungicide. 3-day restricted entry interval for hand harvesting. 12-hr restricted entry interval for all other activities.
			0.56–0.84 kg/ha (226–340 g/acre)	3	Cercospora leaf blight. Also controls powdery mildew. Do not make sequential applications of any group 11 fungicide. 3-day restricted entry interval for hand harvesting. 12-hr restricted entry interval for all other activities.
	trifloxystrobin	Flint	140–210 g/ha (56–85 g/acre)	7	Alternaria and cercospora leaf blights. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	566–1,000 mL/ha (229–404 mL/acre)	7	Alternaria and cercospora leaf blights. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
2,6-dinitroaniline (group 29)	fluazinam	Allegro 500F	1.16 L/ha (0.47 L/acre)	7	Alternaria leaf blight. 24-hr restricted entry interval.
inorganic (group M1)	copper sulphate	Copper 53W	4 kg/ha (1.6 kg/acre)	2	Cercospora leaf blight. 48-hr restricted entry interval.
dithiocarbamate (group M3)	mancozeb	Dithane Rainshield	2.25 kg/ha (0.9 kg/acre)	7	Alternaria and cercospora leaf blights. 24-hr restricted entry interval.
		Manzate Pro-Stick			
		Penncozeb 75DF Raincoat			
chloronitrile (group M5)	chlorothalonil	Bravo ZN/ZNC	2.4–3.2 L/ha (1.0–1.3 L/acre)	2	Alternaria and cercospora leaf blights. 7-day restricted entry interval for scouting.
		Echo 90DF	1.3–1.8 kg/ha (0.53–0.73 kg/acre)	1	22-day restricted entry interval for hand harvesting. 12-hr restricted entry interval for all other activities.

Table 3–35. Carrot Disease Control — Cavity Spot, Rhizoctonia Crown Rot and Root Rot, Sclerotinia White MoldFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CAVITY SPOT (PYTHIUM SPP.)					
PA (group 4)	metalaxyl-M and S-isomer	Ridomil Gold 1G	25 kg/treated ha (10 kg/treated acre)	—	Treatment rate varies with bed and planting shoe width. See label for application and rate details. 12-hr restricted entry interval.
Qol (group 11)	fenamidone	Reason 500SC	600 mL/ha (243 mL/acre)	14	Also controls damping off caused by <i>Pythium</i> spp. Post-plant application. First application made within 7 days after planting. Do not make sequential applications of any group 11 fungicide. Re-entry permitted once spray deposit has dried.
Qil (group 21)	cyazofamid	Torrent 400SC	0.44 L/ha (0.18 L/acre)	30	Suppression of cavity spot and root dieback/forking caused by <i>Pythium</i> spp. See label for application details. Do not make sequential applications of any group 21 fungicide. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Suppression. See label for application details.
	<i>Trichoderma harzianum</i> Rifai strain T22	Triatum G	in-furrow: 15 kg/ha (6.07 kg/acre)	n/a	Suppression. Apply in-furrow or incorporate into beds. Disease suppression is not effective while soils remain cold and is more effective in neutral or acidic soils than in alkaline soils.
		Triatum P	in-furrow: 1.5 kg/ha (0.61 kg/acre)		
RHIZOCTONIA CROWN ROT AND ROOT ROT					
Qol (group 11)	azoxystrobin	Quadris Flowable Azoshy 250 SC	4–6 mL/100 m of row (1.2–1.8 mL/100 ft of row)	40	Apply in-furrow at seeding or as one banded application over the row after emergence or within 30 days of emergence. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Suppression. Root rot caused by <i>Rhizoctonia solani</i>. May be applied at planting and/or post-planting. See label for application instructions.
SCLEROTINIA WHITE MOLD					
Post-Harvest					
PP (group 12)	fludioxonil	Scholar 230SC	496 mL/378 L water can treat up to 90,000 kg of carrots.	—	Domestic use only. Do not use on carrots destined for the U.S. Apply as a post-harvest dip or drench immediately before storage. See label for further application details.
Foliar Applications					
SDHI/DMI (group 7/3)	pydiflumetofen/difenoconazole	Miravis Duo	1 L/ha (0.40 L/acre)	7	Suppression. Apply preventively. Do not make more than two sequential applications of any group 3 or group 7 fungicide. 12-hr restricted entry interval.
SDHI/Qol (group 7/11)	fluopyram/trifloxystrobin	Luna Sensation	500 mL/ha (202 mL/acre)	7	Do not make sequential applications of any group 11 or more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
AP/PP (group 9/12)	cyprodinil/fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	7	12-hr restricted entry interval.
2,6-dinitroaniline (group 29)	fluazinam	Allegro 500F	1.16 L/ha (0.47 L/acre)	7	24-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade Opti	1.1–2.2 kg/ha (0.4–0.9 kg/acre)	0	Suppression. Begin application soon after emergence. See label for application details.
not classified (group NC)	<i>Coniothyrium minitans</i>	Contans WG	2–4 kg/ha (0.8–1.6 kg/acre)	0	Suppression. Apply to soil prior planting, at least 3 months before the onset of disease. Regular use of Contans WG in successive years within a long-term management strategy will improve disease control. Broadcast and lightly incorporate. If incorporation will displace soil greater than 5 cm (2 in.), increase application rate to 3–6 kg/ha (1.2–2.4 kg/acre). See label for application details and chemical compatibility precautions.

Table 3–36. Activity of Insecticides on Carrot Insects

LEGEND: C = control S = suppression RD = reduction in damage
 N = registered, but not considered effective or resistance is documented
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Carrot Weevil	Carrot Rust Fly	Leafhoppers	Aster Leafhopper	Cutworm	Aphids	Flea Beetle	European Chafer Grubs
carbaryl	Sevin XLR	—	—	C	C	—	—	—	—
chlorpyrifos	Lorsban 4E/NT	—	—	—	—	C	—	—	—
	Pyrinex 480 EC	—	—	—	—	C	—	—	—
	Nufos 4E	—	—	—	—	C	—	—	—
	Sharphos	—	—	—	—	C	—	—	—
	Warhawk 480 EC	—	—	—	—	C	—	—	—
malathion	Malathion 85E	—	—	—	—	—	N	—	—
phosmet	Imidan 70-WP	C	—	—	—	—	—	—	—
cypermethrin	Mako	—	C	—	—	C	—	—	—
	UP-Cyde 2.5 EC	—	C	—	—	—	—	—	—
lambda-cyhalothrin	Labamba	C	C	—	—	—	—	—	—
	Matador 120EC	C	C	—	—	—	—	—	—
	Silencer 120 EC	C	C	—	—	—	—	—	—
permethrin	Perm-UP	—	—	—	—	C	—	—	—
	Pounce 384EC	—	—	—	—	C	—	—	—
imidacloprid	Admire 240 F	—	—	C or S ¹	—	—	C	C	RD
thiamethoxam	Actara 25WG	—	—	—	C	—	C	—	—
sulfoxaflor	Closer	—	—	C	—	—	C	—	—
flupyradifurone	Sivanto Prime	—	—	C	C	—	C	—	—
spinetoram	Delegate	—	—	—	—	—	—	S	—
spinosad	Scorpio Ant and Insect Bait	—	—	—	—	C	—	—	—
novaluron	Rimon 10 EC	RD	—	—	—	—	—	—	—
spirotetramet	Movento 240 SC	—	—	—	—	—	C	—	—
chlorantraniliprole	Coragen	—	—	—	—	C	—	—	—
cyantraniliprole	Exirel	C	—	—	—	C	C	C	—
	Verimark	—	—	—	—	—	—	RD	—
flonicamid	Beleaf 50SG	—	—	—	—	—	C	—	—
kaolin clay	Surround WP	—	—	—	RD	—	—	—	—

¹ Level of control for leafhoppers depends on application method.

Table 3–37. Carrot Insect Control — Carrot Weevil, Carrot Rust Fly, Leafhoppers

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CARROT WEEVIL					
organophosphate (group 1B)	phosmet	Imidan 70-WP	1.6 kg/ha (0.64 kg/acre)	40	Resistance to Imidan has been confirmed in Ontario. 5-day restricted entry interval.
pyrethroid (group 3A)	lambda-cyhalothrin	Labamba	83 mL/ha (34 mL/acre)	14	Make first application at 2–3-leaf stage when insects or damage appear. 24-hr restricted entry interval.
		Matador 120EC			
		Silencer 120 EC		7	
benzoylurea (group 15)	novaluron	Rimon 10 EC	410–820 mL/ha (166–332 mL/acre)	3	Reduction in damage. Effective on eggs and larvae only. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	1000–1500 mL/ha (400–600 mL/ac)	1	Begin applications at the 2–3 leaf stage or when scouting indicates the presence of weevils. Do not make a foliar application for a minimum of 60 days following an in-furrow or soil application with any group 28 insecticide. 12-hr restricted entry interval.
CARROT RUST FLY					
pyrethroid (group 3A)	cypermethrin	Mako	175 mL/ha (71 mL/acre)	35	12-hr restricted entry interval.
		UP-Cyde 2.5 EC	280 mL/ha (113 mL/acre)	35	12-hr restricted entry interval.
	lambda-cyhalothrin	Labamba	83 mL/ha (34 mL/acre)	14	24-hr restricted entry interval.
		Matador 120EC			
		Silencer 120 EC		7	
LEAFHOPPERS					
Soil Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/ 100 m of row (2.3–3.6 mL/ 100 ft of row)	21	Also controls aphids and flea beetles. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. 24-hr restricted entry interval.
Foliar Applications					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	1	Leafhoppers and aster leafhoppers. 12-hr restricted entry interval.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Suppression. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 24-hr restricted entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Aster leafhoppers. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 12-hr restricted entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	300 mL/ha (121 mL/acre)	7	Leafhoppers. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 12-hr restricted entry interval.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	7	Leafhoppers and aster leafhoppers. 12-hr restricted entry interval.
not classified (group NC)	kaolin	Surround WP	12.5–25 kg/ha (5–10 kg/acre)	0	May reduce damage caused by aster leafhopper.

Table 3–38. Carrot Insect Control — Cutworms, Wireworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT	2.4–4.8 L/ha (1–2 L/acre)	60	Seedling treatment. See label for application details. 24-hr restricted entry interval.
		Pyrinex 480 EC			
		Nufos 4E			
		Sharphos			
		Warhawk 480 EC			
pyrethroid (group 3A)	permethrin	Perm-UP	180–390 mL/ha (73–158 mL/acre)	—	Seedling treatment. Do not disturb soil for 5 days after application. Use high rate on large larvae, dry soils or muck soils. 12-hr restricted entry interval.
		Pounce 384EC			
	cypermethrin	Mako	175 mL/ha (71 mL/acre)	21	Seedling treatment. Do not disturb soil for 5 days after application. 12-hr restricted entry interval.
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	3	Black cutworm only. Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Black and variegated cutworm. Use low rate for black cutworm. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	7	Variegated cutworm. Also controls aphids and flea beetles. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
WIREWORMS					
Soil applications					
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	3	Reduction in damage. Incorporate into the soil at planting to a depth of 10–20 cm (4–8 in.).

CELERY

In this section:

- Table 3–39.** Celery Seed Treatments and Transplant Disease Control
- Table 3–40.** Activity of Fungicides on Celery Diseases
- Table 3–41.** Celery Disease Control — Leaf Blights
- Table 3–42.** Celery Disease Control — Celery Leaf Curl (Anthracnose), Pink Rot, Botrytis Gray Mold
- Table 3–43.** Activity of Insecticides on Celery Insects
- Table 3–44.** Celery Insect Control — Aphids
- Table 3–45.** Celery Insect Control — Leafhoppers, Carrot Weevil, Tarnished Plant Bug
- Table 3–46.** Celery Insect Control — Cabbage Looper, Cutworms
- Table 3–47.** Celery Insect Control — Leafminers, Onion Thrips

This information is provided as a guideline only. See product labels for complete information. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–39. Celery Seed Treatments and Transplant Disease Control

Group Name (Group #)	Common Name	Trade Name	Rate	Notes
SEED TREATMENTS				
QoI (group 11)	azoxystrobin	Dynasty 100FS	25–50 mL/ 100 kg of seed	Seed rot/pre-emergence damping-off caused by <i>Rhizoctonia solani</i>. For import use only; do not treat seed in Canada.
PP (group 12)	fludioxonil	Maxim 480FS	5.2–10.4 mL/ 100 kg of seed	Seed decay and damping-off. For use in commercial seed treatment facilities.
dithiocarbamate (group M3)	thiram	Thiram 75 WP	90 g/25 kg of seed	Seed decay, seedling blight and damping-off. Seed box or commercial seed treatment.
GREENHOUSE TREATMENTS				
phosphonate (group 33)	mono- and dibasic sodium, potassium and ammonium phosphites	Phostrol	3.2 L/ 1000 L of water	Suppression of pythium. Greenhouse treatment only. Make the first application after seeding. Repeat at a 7–14-day interval. Do not make more than four applications during the celery transplant season.
microbial (group BM02)	<i>Bacillus subtilis</i>	Cease	1–2 L/100 L water	Sclerotinia rot, botrytis gray mold and powdery mildew. Suppression. See label for application details.
inorganic (group M1)	copper octanoate	Cueva	0.5%–2% solution, applied at 4.7–9.4 L/100 m ²	Early and late blight. 4-hr restricted entry interval.
phthalamide (group M4)	captan	Maestro 80DF	1.25 kg/1,000 L of water applied in 50–85 L of solution/100 m ²	Damping-off and fungal root rot. Soil treatment. 48-hr restricted entry interval.
not classified (group NC)	<i>Trichoderma harzianum</i> and <i>Trichoderma virens</i>	Rootshield Plus WP	30–60 g in 100 L of water applied to 10 m ² of soil	Root rots caused by <i>Rhizoctonia</i> spp., <i>Pythium</i> spp. and <i>Fusarium</i> spp. Suppression. Drench application to potting mix, soil or planting beds. 4-hr restricted entry interval.

Table 3–40. Activity of Fungicides on Celery Diseases

LEGEND: C = control S = suppression
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Early Blight (Cercospora)	Late Blight (Septoria)	Downy Mildew (Peronospora)	Pink Rot (Sclerotinia)	Botrytis Gray Mold	Leaf Curl (Anthracnose)
penthiopyrad	Fontelis	—	C	—	—	C	—
fluxapyroxad	Sercadis	—	—	—	C	—	—
boscalid/ pyraclostrobin	Pristine WG	S	S	—	S	—	—
fluopyram/ trifloxystrobin	Luna Sensation	—	C	—	—	—	—
cyprodinil/ fludioxonil	Switch 62.5 WG	—	—	—	—	—	C
pydiflumetofen/ fludioxonil	Miravis Prime	—	—	—	C	C	—
azoxystrobin	Quadris Flowable	C	C	—	—	—	C
	Azoshy 250 SC	C	C	—	—	—	—
trifloxystrobin	Flint	C	C	—	—	—	—
<i>Bacillus subtilis</i>	Serenade Opti	—	—	—	S	S	—
hydrogen peroxide/ peroxyacetic acid	OxiDate 2.0	—	—	S	—	—	—
copper octanoate	Cueva	C	C	—	—	—	—
copper oxychloride	Copper Spray	C	C	—	—	—	—
copper sulphate	Copper 53W	C	C	—	—	—	—
mancozeb	Dithane Rainshield	C	C	—	—	—	—
	Penncozeb 75DF Raincoat	C	C	—	—	—	—
	Manzate Pro-Stick	C	C	—	—	—	—
metiram	Polyram DF	C	C	—	—	—	—
chlorothalonil	Bravo ZN/ZNC	C	C	—	—	—	—
	Echo 90DF	C	C	—	—	—	—
<i>Coniothyrium minitans</i>	Contans WG	—	—	—	S	—	—

Table 3–41. Celery Disease Control — Leaf BlightsFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAF BLIGHTS					
SDHI (group 7)	penthiopyrad	Fontelis	1–1.75 L/ha (0.4–0.7 L/acre)	3	Late blight. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	1 kg/ha (0.4 kg/acre)	0	Early and late blight. Suppression. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 or group 11 fungicides. See label for rotational crop restrictions and restricted entry intervals.
	fluopyram/ trifloxystrobin	Luna Sensation	300–400 mL/ha (122–162 mL/acre)	0	Use high rate when disease pressure is high. Do not make sequential applications of any group 11 or more than two sequential applications of any group 7 fungicide.
QoI (group 11)	azoxystrobin	Quadris Flowable	672–1,120 mL/ha (272–453 mL/acre)	1	Early and late blight. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 11 fungicides. 12-hr restricted entry interval.
		Azoshy 250 SC			
	trifloxystrobin	Flint	190–210 g/ha (77–85 g/acre)	7	Early blight. Do not make sequential applications of any group 11 fungicides. 12-hr restricted entry interval.
			210 g/ha (85 g/acre)	7	Late blight. Do not make sequential applications of any group 11 fungicides. 12-hr restricted entry interval.
inorganic (group M1)	copper octanoate	Cueva	0.5%–2% (v/v) solution, applied in 470–940 L solution/ha (190–380 L/acre)	1	Early and late blight. 4-hr restricted entry interval.
	copper oxychloride	Copper Spray	4 kg/ha (1.6 kg/acre)	1	Early and late blight. 48-hr restricted entry interval.
	copper sulphate	Copper 53W	3.8 kg/ha (1.5 kg/acre)	1	
dithiocarbamate (group M3)	mancozeb	Dithane Rainshield	2.25 kg/ha (0.9 kg/acre)	14	Early and late blight. Wash and trim at harvest. 24-hr restricted entry interval.
		Manzate Pro-Stick	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	14	
		Penncozeb 75DF Raincoat	2.25 kg/ha (0.9 kg/acre)	14	
	metiram	Polyram DF	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	14	Early and late blight. Wash and trim at harvest. 24-hr restricted entry interval.
chloronitrile (group M5)	chlorothalonil	Bravo ZN/ZNC	1.6–2.4 L/ha (0.6–0.9 L/acre)	7	Early blight. Maximum two applications per year. 12-hr restricted entry interval.
			2.4–4 L/ha (0.9–1.6 L/acre)	7	Late blight. Maximum two applications per year. 12-hr restricted entry interval.
		Echo 90DF	0.9–1.3 kg/ha (0.4–0.5 kg/acre)	7	Early blight. Maximum two applications per year. 12-hr restricted entry interval.
			1.3–2.3 kg/ha (0.5–0.9 kg/acre)	7	Late blight. Maximum two applications per year. 12-hr restricted entry interval.

Table 3–42. Celery Disease Control — Celery Leaf Curl (Anthracnose), Pink Rot, Botrytis Gray MoldFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CELERY LEAF CURL ANTHRACNOSE (<i>COLLETOTRICHUM ACUTATUM</i>)					
AP/PP (group 7/12)	cyprodinil/fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	0	Suppression. Maximum two applications per year. See label for rotational restrictions.
QoI (group 11)	azoxystrobin	Quadris Flowable	1,120 mL/ha (453 mL/acre)	1	Do not use on areas treated with product the previous season. Do not make more than one application targeting this disease before rotating to a different fungicide group. 12-hr restricted entry interval.
PINK ROT (<i>SCLEROTINIA</i>)					
SDHI (group 7)	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	1	Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
SDHI/ (group 7/12)	pydiflumetofen/ fludioxonil	Miravis Prime	800–1,000 mL/ha (324–405 mL/acre)	0	In direct seeded leafy vegetables, apply immediately after emergence or prior to disease development. If transplanted, apply immediately after transplanting or prior to disease development. Apply a second application after the soil is disturbed by cultivation/thinning, or when conditions are conducive to disease development. Do not make more than two applications before switching to a non-group 7 and 12 fungicide. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade Opti	1.7–3.3 kg/ha (0.7–1.3 kg/acre)	0	Suppression. See label for application details.
NC (not classified)	<i>Coniothyrium minitans</i>	Contans WG	2–4 kg/ha (0.8–1.6 kg/acre)	0	Suppression. Apply to soil prior to planting, at least 3 months before the onset of disease. Broadcast and lightly incorporate. If incorporation will displace soil greater than 5 cm (2 in.), increase application rate to 3–6 kg/ha (1.2–2.4 kg/acre). See label for application details and chemical compatibility precautions.
BOTRYTIS GRAY MOLD					
SDHI (group 7)	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	Do not make sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
SDHI/ (group 7/12)	pydiflumetofen/ fludioxonil	Miravis Prime	800–1,000 mL/ha (324–405 mL/acre)	0	Suppression. Do not make more than two applications before switching to a non-group 7 and 12 fungicide. 12-hr restricted entry interval.
ROOT ROTS					
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Root rots caused by <i>Rhizoctonia solani</i> and <i>Pythium</i> spp. Suppression. May be applied at planting and/or post-planting. See label for application instructions.

Table 3–43. Activity of Insecticides on Celery Insects

LEGEND: C = control S = suppression RD = reduction in damage
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Aphids	Leafhoppers	Aster Leafhoppers	Carrot Weevil	Tarnished Plant Bug	Cabbage Looper	Cutworms	Leafminers
carbaryl	Sevin XLR	—	C	C	—	—	—	—	—
acephate	Orthene 97% SG	C ¹	—	—	—	C	—	—	—
dimethoate	Lagon 480 E	C	—	—	—	—	—	—	—
phosmet	Imidan 70-WP	—	—	—	C	—	—	—	—
chlorpyrifos	Lorsban 4E/NT	—	—	—	—	—	—	C	—
	Pyrinex 480 EC	—	—	—	—	—	—	C	—
	Nufos 4E	—	—	—	—	—	—	C	—
	Sharphos	—	—	—	—	—	—	C	—
	Warhawk 480 EC	—	—	—	—	—	—	C	—
malathion	Malathion 85E	C	—	C	—	—	—	—	—
cypermethrin	Mako	—	C ²	—	—	—	—	—	—
	Ship 250	—	C ²	—	—	—	—	—	—
	UP-Cyde 2.5 EC	—	C ²	—	—	—	—	—	—
lambda-cyhalothrin	Labamba	—	—	—	—	C	—	—	—
	Matador 120EC	—	—	—	—	C	—	—	—
acetamiprid	Aceta 70 WP	C	—	—	—	—	—	—	RD ³
	Assail 70 WP	C	—	—	—	—	—	—	RD ³
imidacloprid	Admire 240 F	C	—	—	—	—	—	—	—
thiamethoxam	Actara 240SC	C	C	—	—	—	—	—	C ⁴
	Actara 25WG	C	—	—	—	RD	—	—	—
thiamethoxam/cyantraniliprole	Minecto Duo 40WG	C	C	C	—	—	C	—	C
sulfoxaflor	Closer	C	—	—	—	—	—	—	—
flupyradifurone	Sivanto Prime	C	—	—	—	—	—	—	—
spinosad	Success	—	—	—	—	—	C	—	—
	Entrust	—	—	—	—	—	C	—	—
	Scorpio Ant and Insect Bait	—	—	—	—	—	—	C	—
spinetoram	Delegate WG	—	—	—	—	—	C	—	—
abamectin	Agri-mek SC	—	—	—	—	—	—	—	C ³
abamectin/cyantraniliprole	Minecto Pro	—	—	—	—	—	C	—	—
<i>Bacillus thuringiensis</i>	Thuricide HPC	—	—	—	—	—	C	—	—
	Bioprotec PLUS	—	—	—	—	—	C	—	—
<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i>	XenTari WG	—	—	—	—	—	C	—	—
cyromazine	Citation 75WP	—	—	—	—	—	—	—	C
methoxyfenozide	Intrepid	—	—	—	—	—	C	—	—
spirotetramat	Movento 240 SC	C	—	—	—	—	—	—	—
chlorantraniliprole	Coragen	—	—	—	—	—	C	C	C ⁵
cyantraniliprole	Exirel	C	—	—	—	—	C	C	C ⁴
flonicamid	Beleaf 50SG	C	—	—	—	—	—	—	—
potassium salts of fatty acids	Kopa Insecticidal Soap	C	—	—	—	—	—	—	—
kaolin clay	Surround WP	—	—	RD	—	—	—	—	—
<i>Beauveria bassiana</i> strain ANT-03	BioCeres G WP	—	—	—	—	RD	—	—	—

¹ Green peach aphids only.² Potato leafhopper only.³ Pea leafminer only.⁴ Dipteran leafminers.⁵ Vegetable and serpentine leafminers only.

Table 3–44. Celery Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
Soil Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	6 mL/100 m of row (1.8 mL/100 ft of row)	45	See label for application details and rotational crop restrictions. Do not use on areas treated with product the previous season. Do not use subsequent foliar group 4 insecticides in the same season. 24-hr restricted entry interval.
	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Also suppresses early-season flea beetles. See label for application details and rotational crop restrictions. Do not use subsequent foliar group 4 insecticides in the same season. 12-hr restricted entry interval.
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	Also suppresses early-season flea beetles. See label for application details and rotational crop restrictions. Do not use subsequent foliar group 4 or group 28 insecticides in the same season. 12-hr restricted entry interval.
Foliar Applications					
organophosphate (group 1B)	acephate	Orthene 97% SG	580–850 g/ha (235–344 g/acre)	21	Green peach aphid. 24-hr restricted entry interval. Workers must wear gloves and cotton coveralls in the fields for 2 weeks after the restricted entry interval.
	dimethoate	Lagon 480 E	700 mL/ha (283 mL/acre)	7	3-day restricted entry interval.
neonicotinoid (group 4A)	acetamiprid	Aceta 70 WP Assail 70 WP	56–86 g/ha (23–35 g/acre)	7	Do not apply foliar group 4 insecticides in the same season as a soil application. 12-hr restricted entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	See label for rotational crop restrictions. Do not apply foliar group 4 insecticides in the same season as a soil application. 12-hr restricted entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	100–150 mL/ha (40–61 mL/acre)	3	See label for rotational crop restrictions. 12-hr restricted entry interval or re-entry permitted once spray deposit has dried.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	1	Do not use on areas treated with product the previous season. See label for rotational crop restrictions. 12-hr restricted entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	3	Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. See label for application details and rotational crop restrictions. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	See label for application details. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (48–65 g/acre)	0	See label for rotational crop restrictions. 12-hr restricted entry interval.
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water applied at 700–1,900 L solution/ha (283–770 L/acre)	0	Do not spray when plants are under stress. See label for tank-mix and crop tolerance information. Avoid spraying during full sun.

Table 3–45. Celery Insect Control — Leafhoppers, Carrot Weevil, Tarnished Plant Bug

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFHOPPERS					
Soil Applications					
neonicotinoid (group 4A)	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Also suppresses early-season flea beetles. See label for application details. Do not use subsequent foliar group 4 insecticides in the same season. 12-hr restricted entry interval.
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	Also suppresses early-season flea beetles. See label for application details and rotational crop restrictions. Do not use subsequent foliar group 4 or group 28 insecticides in the same season. 12-hr restricted entry interval.
Foliar Applications					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	5	See label for restricted entry intervals.
organophosphate (group 1B)	malathion	Malathion 85E	1,100 mL/ha (445 mL/acre)	7	Aster leafhopper. 24-hr restricted entry interval.
pyrethroid (group 3A)	cypermethrin	Mako	86 mL/ha (35 mL/acre)	7	Potato leafhopper. Avoid application when temperature exceeds 27°C. 12-hr restricted entry interval.
		Ship 250 UP-Cyde 2.5 EC	140 mL/ha (57 mL/acre)	7	Potato leafhopper. Avoid application when temperature exceeds 27°C. 12-hr restricted entry interval.
not classified	kaolin clay	Surround WP	12.5–25 kg in 500 L water/ha (5–10 kg in 45 gal water/acre)	0	Aster leafhopper. Reduction in damage.
CARROT WEEVIL					
organophosphate (group 1B)	phosmet	Imidan 70-WP	1.6 kg/ha (0.65 kg/acre)	40	See label for restricted entry intervals.
TARNISHED PLANT BUG					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5–5.25 L/ha (1–2.1 L/acre)	5	See label for restricted entry intervals.
organophosphate (group 1B)	acephate	Orthene 97% SG	580–850 g/ha (235–344 g/acre)	21	24-hr restricted entry interval. Workers must wear gloves and cotton coveralls in the fields for 2 weeks after the restricted entry interval.
pyrethroid (group 3A)	lambda- cyhalothrin	Labamba	83 mL/ha (34 mL/acre)	3	24-hr restricted entry interval.
		Matador 120EC			
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	210 g/ha (85 g/acre)	7	Reduction in damage. See label for rotational crop restrictions. Do not apply foliar group 4 insecticides in the same season as a soil application. 12-hr restricted entry interval.
not classified (group NC)	<i>Beauveria bassiana</i> strain ANT-03	BioCeres G WP	4–8 g/L	0	Reduction in damage. 4-day restricted entry interval.

Table 3–46. Celery Insect Control — Cabbage Looper, Cutworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE LOOPER					
Soil Application					
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	Early-season control. See label for application details and rotational crop restrictions. Do not use subsequent foliar group 4 or group 28 insecticides in the same season. 12-hr restricted entry interval.
Foliar Applications					
spinosyn (group 5)	spinosad	Entrust	364 mL/ha (147 mL/acre)	1	12-hr restricted entry interval.
		Success	182 mL/ha (74 mL/acre)	1	
	spinetoram	Delegate WG	140–200 g/ha (57–81 g/acre)	1	12-hr restricted entry interval.
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	370 mL/ha (150 mL/acre)	7	Also controls armyworms, carmine spider mite, two spotted spider mite, and corn earworm. Tank-mix with a non-ionic surfactant. Do not make sequential applications of any group 6 or 28 insecticides.
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i>	Thuricide HPC	2–4.25 L/ha (0.8–1.7 L/acre)	0	See label for application details.
		Bioprotec PLUS	0.9–1.8 L/ha (0.36–0.73 L/acre)	0	See label for application details.
	<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i>	XenTari WG	500–1000 g/ha (203–405 g/acre)	0	For best results apply in evening or on cloudy days.
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	1	Do not use on areas treated with product the previous season. See label for rotational crop restrictions. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Do not use on areas treated with product the previous season. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	250–500 mL/ha (101–202 mL/acre)	1	See label for tank-mix directions, crop tolerance information and rotational crop restrictions. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.

¹ Seedling treatments.

Table 3–46. Celery Insect Control — Cabbage Looper, Cutworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
organophosphate (group 1B)	chlorpyrifos ¹	Lorsban 4E/NT	1.2–2.4 L/ha (0.5–1 L/acre)	70	See label for rotational crop restrictions. 24-hr restricted entry interval.
		Pyrinex 480 EC			
		Nufos 4E			
		Sharphos			
		Warhawk 480 EC			
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha	1	Black cutworm only. Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	370–566 mL/ha (150–225 mL/acre)	7	Tank-mix with a non-ionic surfactant. Do not make sequential applications of any group 6 or 28 insecticides.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Black cutworm. Do not use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	See label for tank-mix directions, crop tolerance information and rotational crop restrictions. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.

¹ Seedling treatments.

Table 3–47. Celery Insect Control — Leafminers, Onion Thrips

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFMINERS					
Soil Applications					
neonicotinoid (group 4A)	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Dipteran leafminers. Also suppresses early-season flea beetles. See label for rotational crop restrictions. Do not use subsequent foliar group 4 insecticides in the same season. 12-hr restricted entry interval.
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	See label for application details and rotational crop restrictions. Do not use subsequent foliar group 4 or group 28 insecticides in the same season. 12-hr restricted entry interval.
Foliar Applications					
neonicotinoid (group 4A)	acetamiprid	Aceta 70 WP	86 g/ha (35 g/acre)	7	Pea leafminer. Reduction in damage. See label for rotational crop restrictions. Do not apply a foliar group 4 insecticide in the same season as a soil application. 12-hr restricted entry interval.
		Assail 70 WP			
avermectin (group 6)	abamectin	Agri-mek SC	135–250 mL/ha (55–101 mL/acre)	14	Pea leafminer. See label for surfactant use details. Do not make sequential applications. 12-hr restricted entry interval.
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	370–741 mL/ha (150–300 mL/acre)	7	Pea leafminer. Tank-mix with a non-ionic surfactant. Do not make sequential applications of any group 6 or 28 insecticides.
cyromazine (group 17)	cyromazine	Citation 75WP	188 g/ha (76 g/acre)	7	See label for rotational crop restrictions. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Vegetable and serpentine leafminers. Do not use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	1–1.5 L/ha (405–607 mL/acre)	1	Dipteran leafminers. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
ONION THRIPS					
spinosyn (group 5)	spinetoram	Delegate	200–336 g/ha (81–136 g/ha)	1	Suppression. 12-hr restricted entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	365 mL/ha (148 mL/acre)	3	See label for application details and rotational crop restrictions. 12-hr restricted entry interval.

CUCURBITS

cucumber, melons (including cantaloupe, muskmelon, watermelon and bittermelon), pumpkin, squash and gourds

In this section:

Table 3–48. Cucurbit Seed and Planting Treatments for Disease Control

Table 3–49. Activity of Fungicides on Cucurbit Diseases

Table 3–50. Cucurbit Downy Mildew Fungicides

Table 3–51. Cucurbit Disease Control — Angular Leaf Spot, Powdery Mildew

Table 3–52. Cucurbit Disease Control — Alternaria, Anthracnose, Gummy Stem Blight, Scab, Phytophthora Blight, Fusarium Wilt

Table 3–53. Activity of Insecticides on Cucurbit Insects

Table 3–54. Cucurbit Insect Control — Cucumber Beetles, Aphids

Table 3–55. Cucurbit Insect Control — Two-Spotted Spider Mite, Cutworms, Brown Marmorated Stink Bug

The information is provided as a guideline only. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication. Pest control products listed in these tables are not necessarily registered on all cucurbit crops. See product labels for complete information.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–48. Cucurbit Seed and Planting Treatments for Disease Control

See Table 3–54. *Cucurbit Insect Control — Cucumber Beetles, Aphids*, for soil-applied insect control.

LEGEND: C = control

S = suppression

— = not registered for control of this pest, or activity on this pest has not been documented

Active Ingredients	Trade Name	Rate	Fusarium	Rhizoctonia	Pythium	Notes
prothioconazole	Proline 480 SC	420 mL/ha (170 mL/acre)	C	—	—	Also controls gummy stem blight. Apply at planting via drip/drench. Follow soil application with foliar applications. See label for restricted entry intervals and a complete list of cucurbit crops.
metalaxyl-M and S-isomer	Apron XL LS	20–40 mL/ 100 kg seed	—	—	C	For use on imported seed only; do not treat seeds in Canada. May be tank-mixed with Maxim 480FS. See label for a complete list of cucurbit crops.
	Ridomil Gold 480SL	2.25–4.5 mL/ 100 m row	—	—	C	Cucumbers only. Apply as an 18-cm (7-in.) band centred over the row immediately after seeding or before transplanting followed by 15–25 mm of rain or irrigation. 12-hr restricted entry interval.
fludioxonil + metalaxyl-M and S-isomer	Apron Maxx RTA	665 mL/ 100 kg seed	C	C	C	For use on imported seed only; not for domestic commercial or on-farm seed treatment.
azoxystrobin	Dynasty 100FS	25–50 mL/ 100 kg seed	—	C	—	For import use only; not for domestic commercial or on-farm treatment.
fludioxonil	Maxim 480FS	5.2–10.4 mL/ 100 kg seed	C	C	—	May be tank-mixed with Apron XL LS. For use in commercial seed treatment facilities. See label for a complete list of cucurbit crops.
cyazofamid	Torrent 400SC	30 mL/ 100 L water	—	—	C	Cucumber transplants only. Make a single application as a soil drench to thoroughly wet the growing medium immediately after seeding. Do not use any surfactant with drench application. 60-day pre-harvest interval. 12-hr restricted entry interval.
thiram	Thiram 75 WP	50 g/25 kg seed	C	C	C	Seed box or commercial seed treatment. See label for a complete list of cucurbit crops.

Table 3–48. Cucurbit Seed and Planting Treatments for Disease ControlSee Table 3–54. *Cucurbit Insect Control — Cucumber Beetles, Aphids*, for soil-applied insect control.

LEGEND: C = control S = suppression
 — = not registered for control of this pest, or activity on this pest has not been documented

Active Ingredients	Trade Name	Rate	Fusarium	Rhizoctonia	Pythium	Notes
<i>Gliocladium catenulatum</i>	Prestop	Refer to label for rates and application instructions.	—	S	S	Cucumber transplants only. Apply as a growing media or soil drench application. Do not tank-mix.
<i>Trichoderma harzianum</i> Rifai strain KRL-AG2 and <i>Trichoderma virens</i> strain G-41	RootShield PLUS G	600–1,200 g of product per m ³ of soil/potting mixture	S	S	S	Root diseases caused by <i>Pythium</i> , <i>Rhizoctonia</i> , <i>Fusarium</i> and <i>Phytophthora</i> . Suppression. Potting mix application.
<i>Trichoderma harzianum</i> Rifai strain T22	Trianium P	Refer to label for rates and application instructions.	—	S	—	Post-emergence damping off caused by <i>Rhizoctonia solani</i> . Starting drench application immediately after planting.
<i>Streptomyces</i>	Mycostop	Refer to label for rates and application instructions.	S	—	S	Cucumber transplants only. Drench or soil spray application after seedling emergence.
		5 g/1 kg seed	S	—	—	Cucumber transplants only. Seed treatment. See label for application instructions.

Table 3–49. Activity of Fungicides on Cucurbit Diseases

For information on seed decay and root rots,
 See Table 3–48. *Cucurbit Seed and Planting Treatments for Disease Control*.

LEGEND: C = control S = suppression
 SC = some control may be expected when the product is used to control labelled diseases
 N = registered, but not considered effective or resistance is documented
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Downy Mildew	Powdery Mildew	Angular Leaf Spot	Scab	Anthraxnose	Alternaria	Gummy Stem Blight/Black Rot	Phytophthora Blight	Fusarium
myclobutanil	Nova	—	C	—	—	—	—	—	—	—
prothioconazole	Proline 480 SC	—	C	—	—	—	—	C	—	C
tetraconazole	Mettle 125 ME Fungicide	—	C	—	—	—	—	S	—	—
benzovindiflupyr	Aprovia	—	C	—	—	C	C	C	—	—
benzovindiflupyr/difenoconazole	Aprovia Top	—	C	—	—	C	C	C	—	—
boscalid	Cantus WDG	—	—	—	—	—	C	C	—	—
fluxapyroxad	Sercadis	—	C	—	—	—	—	S	—	—
penthiopryad	Fontelis	—	C	—	—	—	—	—	—	—
fluopyram	Velum Prime	—	S	—	—	—	—	—	—	—
pydiflumetofen/difenoconazole	Miravis Duo	—	C	—	—	C	C ¹	C	—	—
boscalid/pyraclostrobin	Pristine WG	—	C	—	—	—	C	C	—	—
fluopyram/trifloxystrobin	Luna Sensation	—	C	—	—	—	—	—	—	—
fenamidone	Reason	N	—	—	—	—	—	—	—	—
pyraclostrobin	Cabrio EG	N	N	—	—	C	C	C	—	—

¹ Control of alternaria leaf spot. Suppression of alternaria blight.

Table 3–49. Activity of Fungicides on Cucurbit Diseases

For information on seed decay and root rots,
See Table 3–48. *Cucurbit Seed and Planting Treatments for Disease Control.*

LEGEND: C = control S = suppression
SC = some control may be expected when the product is used to control labelled diseases
N = registered, but not considered effective or resistance is documented
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Downy Mildew	Powdery Mildew	Angular Leaf Spot	Scab	Anthraxnose	Alternaria	Gummy Stem Blight/Black Rot	Phytophthora Blight	Fusarium
azoxystrobin/difenconazole	Quadris Top	—	C	—	—	C	C	C	—	—
quinoxifen	Quintec	—	C	—	—	—	—	—	—	—
polyoxin D zinc salt	Diplomat 5SC	S	C	—	—	C	—	C	—	—
cyazofamid	Torrent 400SC	C	—	—	—	—	—	—	—	—
mono- and dibasic sodium potassium and ammonium phosphites	Phostrol	S	—	—	—	—	—	—	—	—
dimethomorph	Forum	S	—	—	—	—	—	—	S	—
mandipropamid	Revus	S	—	—	—	—	—	—	S	—
ametoctradin/dimethomorph	Zampro	C	—	—	—	—	—	—	C	—
fluopicolide	Presidio Fungicide	N	—	—	—	—	—	—	S	—
oxathiapiprolin/mandipropamid	Orondis Ultra	C	—	—	—	—	—	—	C	—
metrafenone	Vivando SC	—	C	—	—	—	—	—	—	—
pyriofenone	Property 300SC	—	C	—	—	—	—	—	—	—
<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	—	S	—	—	—	—	—	S	—
	Stargus	S	—	—	—	—	—	—	—	—
<i>Bacillus subtilis</i>	Serenade Opti	S	S	—	—	—	—	—	—	—
	Serenade SOIL	—	—	—	—	—	—	—	S	—
copper hydroxide	Coppercide WP	—	—	C	—	—	—	—	—	—
	Parasol WG	—	—	C	—	—	—	—	—	—
copper oxychloride	Copper Spray	S	—	C	—	S	S	—	—	—
copper octanoate	Cueva	—	C	C	—	—	—	—	—	—
copper sulphate	Copper 53W	S	—	C	S	S	—	—	—	—
mancozeb	Dithane Rainshield	S	—	—	C	C	C	C	—	—
	Manzate Pro-Stick	S	—	—	C	C	C	C	—	—
	Penncozeb 75DF Raincoat	S	—	—	C	C	C	C	—	—
captan	Maestro 80DF	—	—	—	C	C	—	—	—	—
	Sharda Captan 80 WDG	—	—	—	C	C	—	—	—	—
	Supra Captan 80 WDG	—	—	—	C	C	—	—	—	—
folpet	Folpan 80 WDG	S	—	—	—	C	—	—	—	—
chlorothalonil	Bravo ZN/ZNC	S	C	—	C	C	SC	SC	—	—
	Echo 90DF	—	C	—	C	C	SC	SC	—	—
canola oil	Vegol	—	S	—	—	—	—	—	—	—
citric and lactic acid	Cyclone	—	S	—	—	—	—	—	—	—
	Tivano	—	S	—	—	—	—	—	—	—
hydrogen peroxide/ peroxyacetic acid	OxiDate 2.0	S	S	—	—	—	—	—	—	—
mineral oil	PureSpray Green Spray Oil 13E	—	S	—	—	—	—	—	—	—
	SuffOil-X	—	S	—	—	—	—	—	—	—
potassium bicarbonate	MilStop	—	S	—	—	—	—	—	—	—
extract of <i>Reynoutria sachalinensis</i>	Regalia Maxx	—	S	—	—	—	—	—	—	—

Table 3–50. Cucurbit Downy Mildew FungicidesFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BROADSPECTRUM PREVENTIVE FUNGICIDES					
Begin applications no later than vine development or earlier if weather conditions are favourable for downy mildew infections.					
dithiocarbamate (group M3)	mancozeb	Dithane Rainshield	1.1–3.25 kg/ha (0.4–1.3 kg/acre)	14	See label for a complete list of registered cucurbit crops. 24-hr restricted entry interval.
		Penncozeb 75DF Raincoat	1.1–3.25 kg/ha (0.4–1.3 kg/acre)		
		Manzate Pro-Stick	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	14	Cucumbers. 24-hr restricted entry interval.
			1.1–3.25 kg/ha (0.44–1.3 kg/acre)	14	See label for a complete list of registered cucurbit crops. 24-hr restricted entry interval.
chloronitrile (group M5)	chlorothalonil	Bravo ZN/ZNC	4.8 L/ha (1.9 L/acre)	2	See label for a complete list of registered cucurbit crops. 12-hr restricted entry interval.
DOWNY MILDEW – TARGETED PREVENTIVE FUNGICIDES					
Begin applications when weather conditions favour downy mildew or if downy mildew is identified anywhere in the Great Lakes region.					
polyoxins (group 19)	polyoxin D zinc salt	Diplomat 5SC	463–926 mL/ha (187–375 mL/ha)	0	Suppression. Begin as a preventive application when conditions favour disease development. Re-entry permitted once spray deposit has dried.
Qil (group 21)	cyazofamid	Torrent 400SC	150–200 mL/ha (61–81 mL/acre)	1	30-day plant-back interval. Tank-mix with a non-ionic or organosilicone surfactant. Do not make sequential applications. 12-hr restricted entry interval.
phosphonate (group 33)	mono- and dibasic sodium potassium and ammonium phosphites	Phostrol	2.9–5.8 L/ha (1.2–2.3 L/acre)	1	See label for a complete list of registered cucurbit crops. Preventive suppression. 12-hr restricted entry interval.
CAA (group 40)	dimethomorph	Forum	450 mL/ha (182 mL/acre)	2	See label for a complete list of registered cucurbit crops. Suppression. Must be applied as a tank-mix with another fungicide active against downy mildew. Do not make sequential applications of any group 40 fungicide. See label for recropping restrictions and restricted entry intervals.
benzamide (group 43)	fluopicolide	Presidio	292 mL/ha (118 mL/acre)	2	See label for a complete list of registered cucurbit crops. Resistance to this group of products has been documented in some regions. Tank-mix with another registered downy mildew fungicide. Also provides suppression of phytophthora blight. Do not make sequential applications. Do not use on areas treated with product the previous season. 12-hr restricted entry interval.
QoSI/CAA (group 45/40)	ametoctradin/dimethomorph	Zampro	0.8–1 L/ha (0.3–0.4 L/acre)	1	See label for a complete list of registered cucurbit crops. Do not make sequential applications of any group 45 or group 40 fungicides. See label for guidance on adjuvant use, recropping restrictions and restricted entry intervals.
OSBPI/CCA (group 49/40)	oxathiapiprolin/madipropamid	Orondis Ultra	400–600 mL/ha (162–243 mL/acre)	0	Will also suppress phytophthora blight, see label for application details. Do not use more than one in every three applications. Do not use on areas treated with product the previous season. Begin applications prior to disease development. Use high rate and shorter interval when disease pressure is high. Do not make sequential applications of any group 40 or group 49 fungicides. Tank-mix with a non-ionic surfactant. See label for recropping restrictions. 12-hr restricted entry interval.
microbial (group BMO2)	<i>Bacillus amyloliquefaciens</i>	Stargus	4–6 L/ha (1.62–2.43 L/acre)	0	Suppression. Apply preventively or when symptoms first appear. Ensure good coverage. Use in a rotational program with other registered fungicides. 4-hr restricted entry interval or when residues have dried.
	<i>Bacillus subtilis</i>	Serenade Opti	0.6–1.7 kg/ha (0.2–0.7 kg/acre)	0	Suppression only. Begin applications soon after emergence or transplanting. Use in a rotational program with other registered fungicides.
not classified (group NC)	hydrogen peroxide/peroxyacetic acid	OxiDate 2.0	1.0% (v:v) (100 mL product per 10 L of water)	0	See label for a complete list of registered cucurbit crops. Partial suppression only. Do not spray during conditions of intense heat, drought or poor plant vigor. 4-hr restricted entry interval.

Table 3–51. Cucurbit Disease Control — Angular Leaf Spot, Powdery MildewFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ANGULAR LEAF SPOT					
inorganic (group M1)	copper hydroxide	Parasol WG	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	2	Cucumbers only. 48-hr restricted entry interval.
		Coppercide WP	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	1	
	copper octanoate	Cueva	0.5%–2% solution, applied at 470–940 L/ha (190–380 L/acre)	1	4-hr restricted entry interval.
	copper oxychloride	Copper Spray	3.2–4 kg/ha (1.3–1.6 kg/acre)	2	See label for a complete list of registered cucurbit crops. Use low rate for melons, pumpkins and squash. 48-hr restricted entry interval.
	copper sulphate	Copper 53W	2.5–3 kg/ha (1–1.2 kg/acre)	2	See label for a complete list of registered cucurbit crops. 48-hr restricted entry interval.
POWDERY MILDEW					
DMI (group 3)	myclobutanil	Nova	175 g/ha (71 g/acre)	3	Apply at the first sign of disease development. Do not make sequential applications of any group 3 fungicide. 12-hr restricted entry interval.
	prothioconazole	Proline 480 SC	210–420 mL/ha (85–170 mL/acre)	7	See label for a complete list of registered cucurbit crops. Apply at the first sign of disease development. Tank-mix with a non-ionic surfactant. Do not make sequential applications of any group 3 fungicide. See label for restricted entry intervals.
	tetraconazole	Mettle 125 ME Fungicide	296–584 mL/ha (120–236 mL/acre)	0	Do not make sequential applications of any group 3 fungicides. See label for restricted entry intervals.
SDHI (group 7)	benzovindiflupyr	Aprovia	500–750 mL/ha (202–304 mL/acre)	1	Begin applications prior to disease establishment. Use high rate when disease pressure is high. Do not make more than two sequential applications of any group 7 fungicide. Do not use on areas treated with product the previous season. See label for recropping restrictions. 12-hr restricted entry interval.
	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	0	Also suppresses gummy stem blight at the high rate. Do not apply to any cucurbit crops as a tank-mix. Do not make more than two sequential applications of any group 7 fungicide. Do not use on areas treated with product the previous season. 12-hr restricted entry intervals.
	penthiopyrad	Fontelis	1.25 L/ha (0.5 L/acre)	1	See label for a complete list of registered cucurbit crops. Do not make more than two sequential applications of any group 7 fungicide. 12-hr restricted entry intervals.
	fluopyram	Velum Prime	500 mL/ha (202 mL/acre)	0.5	See label for complete list of registered cucurbit crops. Do not make more than 2 sequential applications of a group 7 fungicide. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	benzovindiflupyr/ difenoconazole	Aprovia Top	761–967 mL/ha (308–391 mL/acre)	1	Begin applications prior to disease development. If disease pressure is high, use the highest rate. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 3 or group 7 fungicides. 12-hr restricted entry interval.

Table 3–51. Cucurbit Disease Control — Angular Leaf Spot, Powdery MildewFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
POWDERY MILDEW (continued)					
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.4 L/acre)	0	Powdery mildew. Begin applications prior to disease establishment. Two consecutive applications can be made before switching to non-group 7 and 3 fungicides. Use shorter interval when disease pressure is high. 12-hr restricted entry interval.
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	0.9–1.3 kg/ha (0.3–0.5 kg/acre)	0	Mechanically harvested cucurbit crops. See label for recropping restrictions. Do not make sequential applications of any group 11 fungicide or more than two sequential applications of any group 7 fungicide. Do not use on areas treated with product the previous season. See label for restricted entry intervals.
				3	Hand-harvested cucurbit crops. See label for recropping restrictions. Do not make sequential applications of any group 11 fungicide or more than two sequential applications of any group 7 fungicide. Do not use on areas treated with product the previous season. See label for restricted entry intervals.
	fluopyram/ trifloxystrobin	Luna Sensation	300–400 mL/ha (122–162 mL/acre)	0	Use high rate when disease pressure is high. Do not make sequential applications of any group 11 or more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
QoI (group 11)	pyraclostrobin	Cabrio EG	560–840 g/ha (227–340 g/acre)	3	See label for a complete list of registered cucurbit crops. Resistance to this group of products has been documented in some regions. Do not make sequential applications of any group 11 fungicide. See label for restricted entry intervals.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	0.71–1 L/ha (287–404 mL/acre)	1	See label for a complete list of registered cucurbit crops. Begin applications prior to disease development. Use high rate when disease pressure is high. Do not make sequential applications of any group 11 or group 3 fungicide. 12-hr restricted entry interval.
aza-naphthalene (group 13)	quinoxifen	Quintec	300–440 mL/ha (121–178 mL/acre)	3	Melons, pumpkin and winter squash. Do not make sequential applications. 12-hr restricted entry interval.
polyoxins (group 19)	polyoxin D zinc salt	Diplomat 5SC	463–926 mL/ha (187–375 mL/ha)	0	Apply preventively when conditions favour disease development. Re-entry permitted once spray deposit has dried.
actin/myosin/ fimbrin function (group 50)	metrafenone	Vivando SC	0.75–1.12 L/ha (0.3–0.45 L/acre)	0	Do not make more than two sequential applications of any group 50 fungicide. See label for guidance on adjuvant use and recropping restrictions. 12-hr restricted entry interval.
	pyriofenone	Property 300SC	0.3–0.366 L/ha (0.121–0.148 L/acre)	0	Do not make more than two sequential applications of any group 50 fungicide. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade Opti	1.7–3.3 kg/ha (0.7–1.3 kg/ha)	0	Begin application soon after emergence or transplant, when conditions are conducive to disease development. Use in a rotational program with other registered fungicides.
	<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	0.5–2.5 kg/ha (0.2–1 kg/acre)	0	See label for a complete list of registered cucurbit crops. Suppression. Apply from fruit formation to maturity. See label for details on choosing a rate. Re-entry permitted once spray deposit has dried.

Table 3–51. Cucurbit Disease Control — Angular Leaf Spot, Powdery MildewFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
POWDERY MILDEW (continued)					
plant extract (group P5)	extract of <i>Reynoutria sachalinensis</i>	Regalia Maxx	0.125%–0.25% (v/v) solution applied in 500–1,000 L water/ha (162–405 L water/acre)	0	See label for a complete list of registered cucurbit crops. Suppression. Begin applications prior to disease development. Re-entry permitted once spray deposit has dried.
inorganic (group M1)	copper octanoate	Cueva	0.5%–2% solution, applied at 470–940 L/ha (190–380 L/acre)	1	4-hr restricted entry interval.
chloronitrile (group M5)	chlorothalonil	Bravo ZN/ZNC	4.8 L/ha (1.9 L/acre)	2	See label for a complete list of registered cucurbit crops. Begin applications prior to disease development. 12-hr restricted entry interval.
		Echo 90DF	2.7 kg/ha (1.1 kg/acre)	1	
not classified (group NC)	canola oil	Vegol	2% solution, applied at 700–1,900 L/ha (283–769 L/acre)	0	Suppression. Initiate sprays when conditions are favourable for disease development or when disease first appears.
	citric and lactic acid	Cyclone	12–16 L/ha (5–6 L/acre)	0	Suppression. Begin applications when conditions are conducive to disease. 4-hr restricted entry interval or when residues have dried.
		Tivano			See label for a complete list of registered cucurbit crops. Suppression. Begin applications when conditions are conducive to disease. See label for guidance on adjuvant use. 4-hr restricted entry interval.
	hydrogen peroxide/ peroxyacetic acid	OxiDate 2.0	1.0% (v/v) (100 mL product per 10 L of water)	0	See label for a complete list of registered cucurbit crops. Partial suppression only. Do not spray during conditions of intense heat, drought or poor plant vigour. 4-hr restricted entry interval.
	mineral oil	PureSpray Green Spray Oil 13E	10 L in 1,000 L water/ha (1% solution) to ensure thorough coverage	—	Suppression. Begin applications when conditions are favourable for disease development and/or when first symptoms appear. See label for crop safety and chemical compatibility precautions. 12-hr restricted entry interval.
		SuffOil-X	12.9 L/1,000 L water	0.5	
	potassium bicarbonate	MilStop	2.8–5.6 kg/ha (1.1–2.27 kg/acre)	0	Suppression. Ensure thorough spray coverage. 4-hr restricted entry interval.

Table 3–52. Cucurbit Disease Control — Alternaria, Anthracnose, Gummy Stem Blight, Scab, Phytophthora Blight, Fusarium Wilt

For resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ALTERNARIA, ANTHRACNOSE, GUMMY STEM BLIGHT, SCAB					
DMI (group 3)	prothioconazole	Proline 480 SC	420 mL/ha (170 mL/acre)	7	Gummy stem blight. Apply at planting (see Table 3–48. <i>Cucurbit Seed and Planting Treatments for Disease Control</i>), followed with foliar applications. Tank-mix with a non-ionic surfactant. Do not make sequential applications of any group 3 fungicides. See label for a complete list of cucurbit crops and restricted entry intervals.
	tetraconazole	Mettle 125 ME Fungicide	584 mL/ha (236 mL/acre)	0	Gummy stem blight suppression. Do not make sequential applications of any group 3 fungicides. See label for restricted entry intervals.
SDHI (group 7)	benzovindiflupyr	Aprovia	500–750 mL/ha (202–304 mL/acre)	1	Alternaria, anthracnose, gummy stem blight. Use high rate for anthracnose and gummy stem blight. Apply prior to disease establishment. Do not make more than two sequential applications of any group 7 fungicide. Do not use on areas treated with product the previous season. See label for recropping restrictions. 12-hr restricted entry interval.
	boscalid	Cantus WDG	460 g/ha (186 g/acre)	0	See label for a complete list of registered cucurbit crops. Alternaria and gummy stem blight. Begin applications prior to disease development. Do not make more than two sequential applications of any group 7 fungicide. Do not use on areas treated with product the previous season. 12-hr restricted entry interval.
SDHI/ DMI (group 7/3)	benzovindiflupyr/ difenoconazole	Aprovia Top	761–967 mL/ha (308–391 mL/acre)	1	Alternaria, anthracnose, gummy stem blight. Use high rate for anthracnose and gummy stem blight. Begin applications prior to disease development. If disease pressure is high, use the highest rate. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 3 or group 7 fungicides. 12-hr restricted entry interval.
SDHI/ DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.4 L/acre)	0	Alternaria, anthracnose, gummy stem blight. Begin applications prior to disease establishment. Two consecutive applications can be made before switching to non-group 7 and 3 fungicides. Use shorter interval when disease pressure is high. 12-hr restricted entry interval.
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	1.3 kg/ha (0.5 kg/acre)	0	Machine harvest. Alternaria and gummy stem blight. See label for recropping restrictions. Do not make sequential applications of any group 11 fungicide or more than two sequential applications of any group 7 fungicide. Do not use on areas treated with product the previous season. See label for restricted entry intervals.
				3	Hand-harvested cucurbit crops. Alternaria and gummy stem blight. See label for recropping restrictions. Do not make sequential applications of any group 11 fungicide or more than two sequential applications of any group 7 fungicide. Do not use on areas treated with product the previous season. See label for restricted entry intervals.

Table 3–52. Cucurbit Disease Control — Alternaria, Anthracnose, Gummy Stem Blight, Scab, Phytophthora Blight, Fusarium WiltFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ALTERNARIA, ANTHRACNOSE, GUMMY STEM BLIGHT, SCAB (continued)					
QoI (group 11)	pyraclostrobin	Cabrio EG	560–840 g/ha (227–340 g/acre)	3	See label for a complete list of registered cucurbit crops. Alternaria, anthracnose and gummy stem blight. Use high rate for gummy stem blight. Begin applications prior to disease development. Do not make sequential applications of any group 11 fungicide. See label for restricted entry intervals.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	0.71–1 L/ha (287–404 mL/acre)	1	See label for a complete list of registered cucurbit crops. Alternaria, anthracnose and gummy stem blight. Begin applications prior to disease development. Use high rate when disease pressure is high. Do not make sequential applications of any group 11 or group 3 fungicide. Do not use on areas treated with product the previous season. 12-hr restricted entry interval.
polyoxins (group 19)	polyoxin D zinc salt	Diplomat 5SC	463–926 mL/ha (187–75 mL/ha)	0	Anthracnose, gummy stem blight. Apply preventively when conditions favour disease development. Re-entry permitted once spray deposit has dried.
dithiocarbamate (group M3)	mancozeb	Dithane Rainshield	1.1–3.25 kg/ha (0.4–1.3 kg/acre)	14	See label for a complete list of registered cucurbit crops. 24-hr restricted entry interval.
		Penncozeb 75DF Raincoat			
		Manzate Pro-Stick	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	14	Cucumbers. 24-hr restricted entry interval.
			1.1–3.25/ha (0.44–1.3 kg/acre)	14	See label for a complete list of registered cucurbit crops. 24-hr restricted entry interval.
phthalimide (group M4)	captan	Maestro 80DF	2.25–4.25 kg/ha (0.9–1.7 kg/acre)	2	Cucumber only. Anthracnose and scab. Use low rate on young plants. 48-hr restricted entry interval.
		Sharda Captan 80 WDG	2–4.2 kg/ha (0.8–1.7 kg/acre)		
		Supra Captan 80 WDG	2.25–4.25 kg/ha (0.9–1.7 kg/acre)		
	folpet	Folpan 80 WDG	2.5–5 kg/ha (1–2 kg/acre)	1	See label for a complete list of registered cucurbit crops. Anthracnose. 24-hr restricted entry interval.
chloronitrile (group M5)	chlorothalonil	Bravo ZN/ZNC	4.8 L/ha (1.9 L/acre)	2	See label for a complete list of registered cucurbit crops. Anthracnose and scab. Begin applications prior to disease development. 48-hr restricted entry interval.
		Echo 90DF	2.7 kg/ha (1.1 kg/acre)		
not classified (group NC)	hydrogen peroxide/ peroxyacetic acid	OxiDate 2.0	1.0% (v:v) (100 mL product per 10 L of water)	0	Watermelon only. Partial suppression. Under severe disease conditions, reduce spray intervals.

Table 3–52. Cucurbit Disease Control — Alternaria, Anthracnose, Gummy Stem Blight, Scab, Phytophthora Blight, Fusarium Wilt

For resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PHYTOPHTHORA BLIGHT					
CAA (group 40)	mandipropamid	Revus	600 mL/ha (243 mL/acre)	0	Suppression. In-furrow or drip irrigation application. See label for application details. Do not make sequential applications of any group 40 fungicide. See label for recropping restrictions. 12-hr restricted entry interval.
QoSI/CAA (group 45/40)	ametoctradin/ dimethomorph	Zampro	1 L/ha (0.4 L/acre)	1	Apply before symptoms appear and when the risk of disease is high. See label for guidance on adjuvant use. Do not make sequential applications of any group 45 or group 40 fungicides. See label for recropping restrictions and restricted entry intervals.
microbial (group BM02)	<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	0.2–0.5 kg/ha (0.1–0.2 kg/acre)	0	See label for a complete list of registered cucurbit crops. Partial suppression. Refer to label for transplant and at-planting application instructions. Follow up applications can be made at 2–4-week intervals. Re-entry permitted once spray deposit has dried.
	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Suppression. Also suppresses fusarium, pythium and rhizoctonia root rots. See label for in-furrow application instructions. For broadcast or banded applications, incorporate into the seed zone with rainfall or overhead irrigation within 24 hr, if required.
FUSARIUM WILT					
DMI (group 3)	prothioconazole	Proline 480 SC	420 mL/ha (170 mL/acre)	7	See label for a complete list of registered cucurbit crops. Apply at planting (see Table 3–48. <i>Cucurbit Seed and Planting Treatments for Disease Control</i>), followed with foliar applications. Tank-mix with a non-ionic surfactant. Do not make sequential applications of any group 3 fungicides. See label for restricted entry intervals.

Table 3–53. Activity of Insecticides on Cucurbit Insects

LEGEND: C = control S = suppression RD = reduction in damage
 SC = some control of this pest may be expected when the product is used to control labelled pests
 N = registered, but not considered effective or resistance is documented
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Squash Bug	Cucumber Beetles	Aphids	Two-Spotted Spider Mite	Cutworms	Brown Marmorated Stink Bug
carbaryl	Sevin XLR	C	C	—	—	C	—
chlorpyrifos	Lorsban 4E/NT	—	—	—	—	C	—
	Nufos 4E	—	—	—	—	C	—
	Pyrinex 480 EC	—	—	—	—	C	—
	Sharphos	—	—	—	—	C	—
	Warhawk 480 EC	—	—	—	—	C	—
malathion	Malathion 85E	—	C	N	C	—	—
fenpropathrin	Danitol	—	C	—	—	—	—
lambda-cyhalothrin	Labamba	C	C	—	—	—	—
	Matador 120EC	C	C	—	—	—	—
lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	C	C	—	—	C	—
clothianidin	Clutch 50 WDG	S	S	—	—	—	S
imidacloprid	Admire 240 F	—	C	C	—	—	—
	Alias 240 SC	—	C	SC	—	—	—
flupyradifurone	Sivanto Prime	—	—	C	—	—	—
spinosad	Scorpio Ant and Insect Bait	—	—	—	—	C	—
abamectin + cyantraniliprole	Minecto Pro	—	—	—	C	C	—
acequinocyl	Kanemite 15SC	—	—	—	C	—	—
spiromesifen	Oberon Flowable	—	—	—	C	—	—
spirotetramat	Movento 240 SC	—	—	C	—	—	—
chlorantraniliprole	Coragen	—	—	—	—	C	—
cyantraniliprole	Exirel	—	—	C	—	C	—
	Harvanta	—	—	—	—	S	—
flonicamid	Beleaf 50SG	—	—	C	—	—	—
<i>Beauveria bassiana</i> strain ANT-03	Bio Ceres G WP	—	—	S	—	—	—
canola oil	Vegol	—	—	—	C	—	—
kaolin clay	Surround WP	—	C	—	—	—	—
mineral oil	PureSpray Green Spray Oil 13E	—	—	—	S	—	—
	SuffOil-X	—	—	RD	S	—	—
potassium salts of fatty acids	Kopa	—	—	C	C	—	—

Table 3–54. Cucurbit Insect Control — Cucumber Beetles, Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUCUMBER BEETLES, APHIDS					
Soil and Transplant Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	0.42–1 L/ha (170–404 mL/acre) ¹	21	Use high rate for cucumber beetle. Apply 7.5–18 mL/100 m of row in-furrow at planting or banded soon after planting. See the product labels for details. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. Do not use on areas treated with product the previous season. 24-hr restricted entry interval.
		Alias 240 SC	0.98 L/ha (0.36 L/acre) ²	21	Cucumber beetles. Apply 18 mL/100 m of row in-furrow at planting or banded soon after planting. See the product labels for details. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. Do not use on areas treated with product the previous season. 24-hr restricted entry interval.
		Admire 240 F Alias 240 SC	Transplant water: 25 mL/1,000 plants	21	Cucumber beetles. Do not use this application method on pickling cucumbers. Apply in-furrow at planting or banded soon after planting. Use 150 mL of water per plant. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. Do not use on areas treated with product the previous season. 24-hr restricted entry interval.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	750–1,000 mL/ 10,000 plants	21	Aphids. Soil or irrigation application. See label for application details. Do not use on areas treated with product the previous season. 12-hr restricted entry interval.
Foliar Applications					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5 L/ha (1 L/acre)	5	Cucumber beetles. See label for a complete list of cucurbit crops. Also controls squash bugs. See label for restricted entry intervals.
organophosphate (group 1B)	malathion	Malathion 85E	880 mL/ha (356 mL/acre)	3	Aphids. Cucumbers, squash, pumpkins. Do not apply unless plants are dry. 1-day restricted entry interval.
			1,100–1,345 mL/ha (445–544 mL/acre)	3	Aphids. Melons. Do not apply unless plants are dry. 1-day restricted entry interval.
pyrethroid (group 3A)	fenpropathrin	Danitol	779–1169 mL/ha (315–473 mL/acre)	7	Striped cucumber beetle. Apply when first pest activity is noticed. Use low rate for cucumber. See label for restricted entry intervals.
	lambda- cyhalothrin	Labamba	187–233 mL/ha (76–94 mL/acre)	1	Striped cucumber beetles. Will also control squash bugs. 24-hr restricted entry intervals.
		Matador 120EC			Cucumber beetles. Will also control squash bugs. 24-hr restricted entry interval.
pyrethroid/ diamide (group 3A/28)	lambda- cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	1	Cucumber beetles. Will also control squash bugs. Do not apply following an in-furrow or soil application of any group 28 insecticides. Do not use on areas treated with product the previous season. 24-hr restricted entry interval.

¹ Based on 180-cm (72-in.) row spacing.² Based on 183-cm (73-in.) row spacing.

Table 3–54. Cucurbit Insect Control — Cucumber Beetles, Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUCUMBER BEETLES, APHIDS — Foliar Applications (continued)					
neonicotinoid (group 4A)	clothianidin	Clutch 50 WDG	140 g/ha (57 g/acre)	7	See label for a complete list of cucurbit crops. Suppression of cucumber beetles. Will also suppress squash bug nymphs. Apply when target pest(s) threshold populations are observed. Do not apply after the 4 th true leaf on main stem is unfolded. Do not apply foliar group 4 insecticides in the same season as a seed treatment, soil or transplant application. Do not use on areas treated with product the previous season. 12-hr restricted entry interval.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	1	Aphids. Do not make foliar applications to muskmelon. Do not use on areas treated with product the previous season. Do not apply following a soil or seed treatment application of any group 4D insecticide. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (48–65 g/acre)	0	Aphids. Use high rate on high populations or dense foliage. See label for recropping restrictions. 12-hr restricted entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	1	Aphids. Most effective on young stages of pest development. Slow activity; control may not be apparent for 2–3 weeks. See label for guidance on adjuvant use and recropping restrictions. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	Aphids. Use high rate under heavy pest pressure. Do not apply foliar group 28 insecticides in the same season as a soil application. See label for guidance on adjuvant use. 12-hr restricted entry interval.
		Harvanta	1.2 L/ha (485 mL/acre)	1	Cucumber beetle suppression. Avoid application during bloom. If necessary apply after flower petals are closed. Avoid applying more than 2 times within a 30-day period. 12-hr restricted entry interval.
microbial (group BMO2)	<i>Beauveria bassiana</i> strain ANT-03	Bio Ceres G WP	2–4 g/L of water	0	Cucumber transplants only. Aphids. Reduction in numbers. Begin treatment of crops at the first appearance of the insect pest. Do not mix with fungicide. It takes 5–7 days after the first application to observe control.
not classified (group NC)	kaolin clay	Surround WP	12.5–25 kg/ha (5–10 kg/acre)	0	Cucumber beetle suppression. Use the high rate for the first application and the low rate for subsequent applications. Do not apply close to harvest.
	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water Apply dilute solution at a rate of 700–1,900 L/ha (283–770 L/acre)	0	Aphids. Do not spray when plants are under stress. See label for crop tolerance information. Avoid spraying during full sun.

Table 3–55. Cucurbit Insect Control — Two-Spotted Spider Mite, Cutworms, Brown Marmorated Stink Bug

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
TWO-SPOTTED SPIDER MITE					
avermectins/ diamides (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	385–670 mL/ha (156–271 mL/acre)	7	Tank-mix with a non-ionic surfactant. Apply to foliage when rain is not expected in the next 24 hr. Thorough coverage is important to obtain optimum control. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. 12-hr restricted entry interval.
acequinocyl (group 20B)	acequinocyl	Kanemite 15SC	2,070 mL/ha (838 mL/acre)	1	Summer squash only. 12-hr restricted entry interval.
tetronic and tetramic acid derivatives (group 23)	spiromesifen	Oberon Flowable	500–600 mL/ha (202–243 mL/acre)	1	Apply before mite populations begin to build. Slow activity; control may not be apparent for 2–3 weeks. See label for recropping restrictions. 12-hr restricted entry interval.
not classified (group NC)	canola oil	Vegol	2% solution, applied at 700–1,900 L/ha (283–769 L/acre)	0	Suppression. Apply at first sign of insect presence.
	mineral oil	PureSpray Green Spray Oil 13E	10 L in 1,000 L water/ha (1% solution) to ensure thorough coverage	—	Suppression. Also provides a reduction in damage for aphids. Begin applications when mites appear. See label for crop safety and chemical compatibility precautions. 12-hr restricted entry interval.
		SuffOil-X	12.9 L/1,000 L water	0.5	
	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water Apply dilute solution at a rate of 700–1,900 L/ha (283–770 L/acre).	0	Two-spotted spider mites. Do not spray when plants are under stress. See label for crop tolerance information. Avoid spraying during full sun.

Table 3–55. Cucurbit Insect Control — Two-Spotted Spider Mite, Cutworms, Brown Marmorated Stink Bug

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5 L/ha (1 L/acre)	5	Climbing cutworms. See label for a complete list of cucurbit crops and restricted entry intervals.
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT	1.2–2.4 L/ha (0.48–0.97 L/acre)	60	Cucumbers only. Apply at 2–5-leaf stage. See label for recropping restrictions. 24-hr restricted entry interval.
		Nufos 4E			
		Pyrinex 480 EC			
		Sharphos			
		Warhawk 480 EC			
pyrethroid/diamide (group 3A/28)	lambda-cyhalothrin/chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	1	Black cutworm. Apply to foliage when rain is not expected in the next 24 hr. For optimum control, make application to smaller plants or when lower portion of the plant can receive adequate coverage. Do not apply foliar group 28 insecticides in the same season as a soil application. Do not use on areas treated with product the previous season. 24-hr restricted entry interval.
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	3	Black cutworm only. Also reduction in damage to wireworm (see label for application details). Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
avermectins/diamides (group 6/28)	abamectin/cyantraniliprole	Minecto Pro	385–556 mL/ha (156–225 mL/acre)	7	Tank-mix with a non-ionic surfactant. Apply to foliage when rain is not expected in the next 24 hr. Thorough coverage is important to obtain optimum control. Do not make a foliar application following an in-furrow or soil application of any Group 28 insecticide. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Black cutworm. Apply to small plants when no rain is forecast in next 24 hr. Do not use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	Apply to small plants, when no rain is forecast in next 24 hr. Use high rate under heavy pest pressure. Do not apply foliar group 28 insecticides in the same season as a soil application. See label for guidance on adjuvant use. 12-hr restricted entry interval.
BROWN MARMORATED STINK BUG					
See ontario.ca/stinkbug for the most up-to-date information on registrations and brown marmorated stink bug control measures.					
neonicotinoid (group 4A)	clothianidin	Clutch 50 WDG	210 g/ha (85 g/acre)	7	See label for a complete list of cucurbit crops. Suppression. Apply when target pest(s) threshold populations are observed. Do not apply after the 4 th true leaf on main stem is unfolded. Do not apply foliar group 4 insecticides in the same season as a seed treatment, soil or transplant application. Do not use on areas treated with product the previous season. 12-hr restricted entry interval.

EGGPLANT

In this section:

Table 3-56.	Eggplant Seed Treatment and Transplant Production Disease and Insect Control
Table 3-57.	Activity of Fungicides on Eggplant Diseases
Table 3-58.	Eggplant Disease Control
Table 3-59.	Activity of Insecticides on Eggplant Insects
Table 3-60.	Eggplant Insect Control — Aphids
Table 3-61.	Eggplant Insect Control — Colorado Potato Beetle
Table 3-62.	Eggplant Insect Control — Cutworms, Flea Beetles, Mites
Table 3-63.	Eggplant Insect Control — Stink Bug, Brown Marmorated Stink Bug, Tarnished Plant Bug
Table 3-64.	Eggplant Insect Control — Tomato Fruitworm (Corn Earworm)

This information is provided as a guideline only. Some products are under re-evaluation with the PMRA and may change within the lifetime of this publication. See product labels for complete information.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–56. Eggplant Seed Treatment and Transplant Production Disease and Insect Control

Group Name (Group #)	Common Name	Trade Name	Rate	Notes
SEED AND SEEDLING DISEASE				
Seed Treatments				
phenylamide (group 4)	metalaxyl-M and S-isomer	Apron XL LS	20–40 mL/ 100 kg of seed	Pythium damping-off. For import use only; do not treat seeds in Canada.
QoI (group 11)	azoxystrobin	Dynasty 100FS	25–50 mL/ 100 kg of seed	Seed rot and pre-emergence damping-off caused by <i>Rhizoctonia solani</i>. For import use only; do not treat seeds in Canada.
PP (group 12)	fludioxonil	Maxim 480FS	5.2–10.4 mL/ 100 kg of seed	Seed decay, damping-off and seedling blight caused by fusarium and rhizoctonia. For use in commercial seed treatment facilities.
dithiocarbamate (group M03)	thiram	Thiram 75 WP	65–80 g/ 25 kg of seed	Seed decay, seedling blight, damping-off. Seed box or commercial treatment.
not classified (group NC)	<i>Streptomyces</i>	Mycostop	5 g/1 kg of seed	Fusarium damping-off. Suppression. See label for application details.
Soil Treatments				
pthalamide (group M04)	captan	Maestro 80DF	1.25 kg in 1,000 L of water Apply 50–85 L of solution per 100 m ² .	Damping-off, fungus root rot. 48-hr restricted entry interval.
		Supra Captan 80 WDG		
		Sharda Captan 80 WDG		
CAA (group 40)	mandipropamid	Revus	600 mL/ha (243 mL/acre)	Phytophthora blight. Suppression. Make one application as a drench, immediately before transplanting. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	25–250 g in 100 L water See label for application details.	Phytophthora capsici (soil). Partial suppression. Make preventive applications to transplants in the greenhouse before transplanting. Follow-up applications of 100–500 g/ha (40–202 g/acre) can be made by drip irrigation or directed spray at 2–4-week intervals after transplanting. Re-entry permitted once spray deposit has dried.
microbial (group BM02)	<i>Trichoderma harzianum</i>	RootShield HC	55–110 g/m ³ of loose planting mix, soil or planting beds See label for application instructions.	Root diseases caused by pythium, rhizoctonia and fusarium. Suppression. Potting mix application or drench. 4-hr restricted entry interval.
	<i>Trichoderma harzianum</i> Rifai strain KRL-AG2/ <i>Trichoderma virens</i> strain G-41	RootShield PLUS+ G	600–1,200 g of product per m ³ of soil/potting mixture	Root diseases cause by Pythium, Rhizoctonia, Fusarium and Phytophthora. Suppression. Potting mix application.
	<i>Trichoderma harzianum</i> Rifai strain T22	Triatum P	See label for rate and application instructions.	Fusarium root rot and damping off caused by <i>Pythium ultimum</i> and <i>Rhizoctonia solani</i>. Suppression. 4-hr restricted entry interval.
Foliar Applications				
microbial (group BM02)	<i>Bacillus subtilis</i>	Cease	1–2 L/100 L water	Botrytis gray mold. Suppression.
INSECTS				
Foliar Applications				
not classified (group NC)	<i>Beauveria bassiana</i> strain ANT-03	BioCeres G WP	2–4 g/L water, 500–1,000 L/ha	Aphids. Reduction in numbers. For greenhouse only. Do not mix with fungicide. 4-hr restricted entry interval.
	mineral oil	SuffOil-X	13 L/1,000 L water	Mites. Suppression. Also provides reduction in damage for aphids. 12-hr restricted entry interval.

Table 3–57. Activity of Fungicides on Eggplant Diseases

LEGEND: C = control S = suppression PS = partial suppression
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Greenhouse (transplants)			Field				
		Damping-Off	Phytophthora Blight	Root Disease	Alternaria (Early Blight)	Anthraxnose	Botrytis Gray Mold	Phytophthora Blight	Powdery Mildew
tetraconazole	Mettle				C	—	—	—	C
difenoconazole/benzovindiflupyr	Aprovia Top	—	—	—	C	C	—	—	C
benzovindiflupyr	Aprovia	—	—	—	C	C	—	—	C
boscalid	Cantus WDG	—	—	—	C	—	C	—	—
fluxapyroxad	Sercadis	—	—	—	C	—	—	—	—
penthiopyrad	Fontelis	—	—	—	S	—	C	—	—
pydiflumetofen difenoconazole	Miravis Duo	—	—	—	C	C	S	—	C
pyraclostrobin	Cabrio EG	—	—	—	C	C	—	—	—
azoxystrobin/difenoconazole	Quadris Top	—	—	—	C	C	—	—	C
polyoxin D zinc salt	Diplomat 5SC	—	—	—	S	—	S	—	—
mandipropamid	Revus	—	S ¹	—	—	—	—	S ¹	—
mandipropamid/oxathiapiprolin	Orondis Ultra	—	—	—	—	—	—	C ¹	—
ametoctradin/dimethomorph	Zampro	—	—	—	—	—	—	S ¹	—
metrafenone	Vivando SC	—	—	—	—	—	—	—	C
<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	—	PS	—	S	—	S	PS	—
<i>Bacillus subtilis</i>	Cease	—	—	—	—	—	S	—	—
	Serenade Opti	—	—	—	S	—	S	—	—
	Serenade Soil	—	—	—	—	—	—	S ¹	—
<i>Trichoderma harzianum</i>	RootShield HC	—	—	S ¹	—	—	S	—	—
<i>Trichoderma harzianum</i> Rifai strain KRL-AG2/ <i>Trichoderma virens</i> strain G-41	Rootshield PLUS G	—	S ¹	S ¹	—	—	—	—	—
<i>Trichoderma harzianum</i> Rifai strain T22	Triatum P	—	—	S ¹	—	—	—	—	—
copper sulphate	Copper 53W	—	—	—	C	—	—	—	—
captan	Maestro 80DF	C	—	C	—	—	—	—	—
	Supra Captan 80 WDG	C	—	C	—	—	—	—	—
	Sharda Captan	C	—	C	—	—	—	—	—
mineral oil	Purespray Green Spray Oil 13E	—	—	—	—	—	—	—	S
	Suffoil-X	—	—	—	—	—	—	—	S
<i>Aureobasidium pullulans</i>	Botector	—	—	—	—	—	S	—	—
extract of <i>Reynoutria sachalinensis</i>	Regalia Maxx	—	—	—	—	—	—	—	S
mono- and di-potassium salts of phosphorous acid	Confine Extra	—	—	—	—	—	—	S ¹	—

¹ See label for details.

Table 3–58. Eggplant Disease ControlFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ANTHRACNOSE, ALTERNARIA (EARLY BLIGHT)					
DMI (group 3)	tetraconazole	Mettle	440–584 mL/ha (178–236 mL/acre)	2	Alternaria. Restricted entry intervals: <ul style="list-style-type: none"> • general – 12 hr • hand set irrigation – 7 days • hand harvesting, tying and training – 2 days
DMI/SDHI (group 3/7)	difenoconazole/ benzovindiflupyr	Aprovia Top	643–967 mL/ha (260–391 mL/acre)	1	Alternaria and anthracnose. Do not make sequential applications of any group 3 or group 7 fungicides. 12-hr restricted entry interval.
SDHI (group 7)	benzovindiflupyr	Aprovia	500–750 mL/ha (202–304 mL/acre)	1	Alternaria and anthracnose. Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
	boscalid	Cantus WDG	175–315 g/ha (71–127 g/acre)	0	Alternaria. Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
	fluxapyroxad	Sercadis	167–333 mL/ha (68–135 mL/acre)	7	Alternaria. Use high rate to target black mold (<i>Alternaria alternata</i>) of ripe fruit. Tank-mix with a non-ionic surfactant. Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.51–0.71 L/acre)	0	Alternaria. Suppression. Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.4 L/acre)	0	Alternaria and anthracnose. Do not make more than 2 consecutive applications before switching to a fungicide that is not in group 7 or group 3. 12-hr restricted entry interval.
QoI (group 11)	pyraclostrobin	Cabrio EG	560–840 g/ha (227–340 g/acre)	0	Alternaria and anthracnose. Do not make sequential applications of any group 11 fungicides. 12-hr restricted entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	625 mL/ha (253 mL/acre)	1	Alternaria and anthracnose. Do not apply until 21 days after transplanting. Do not make sequential applications of any group 3 or group 11 fungicides. 12-hr restricted entry interval.
polyoxins (group 19)	polyoxin D zinc salt	Diplomat 5SC	537–926 mL/ha (219–378 mL/acre)	0	Alternaria. Suppression. Re-entry permitted once spray deposit has dried.
microbial (group BM02)	<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	0.5–2 kg/ha (0.2–0.8 kg/acre)	0	Alternaria. Suppression. Re-entry permitted once spray deposit has dried.
	<i>Bacillus subtilis</i>	Serenade Opti	2.5 kg/ha (1.0 kg/acre)	0	Alternaria. Suppression.
inorganic (group M01)	copper sulphate	Copper 53W	4 kg in 1,000 L of water/ha (1.6 kg in 405 L of water/acre)	2	Alternaria. 48-hr restricted entry interval.

Table 3–58. Eggplant Disease ControlFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PHYTOPHTHORA BLIGHT					
CAA (group 40)	mandipropamid	Revus	600 mL/ha (243 mL/acre)	1	Foliar blight. Suppression. Do not make more than 2 consecutive applications before switching to a fungicide that is not group 40. 12-hr restricted entry interval. Root and crown rot. Suppression. Soil application. Do not make more than two consecutive applications before switching to a fungicide that is not group 40. 12-hr restricted entry interval.
CAA/OSBPI (group 40/49)	mandipropamid/ oxathiapiprolin	Orondis Ultra	600 mL/ha (243 mL/acre)	1	Foliar blight. Suppression. Do not make more than two consecutive applications before switching to a fungicide that is not group 49 or group 40 fungicides. 12-hr restricted entry interval.
QoSI/CAA (group 45/40)	ametoctradin/ dimethomorph	Zampro	1 L/ha (0.4 L/acre)	4	Suppression. See label for guidance on adjuvant use. Do not make more than two sequential applications of any group 40 or group 45 fungicides. 12-hr restricted entry interval.
microbial (group BMO2)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Suppression. Soil application. See label for application details.
phosphonate (group P07)	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–10 L/ha (2–4 L/acre)	1	Foliar blight. Do not use more than one in every three applications. Begin applications prior to disease development. Do not make sequential applications of any group 40 or group 49 fungicides. Tank-mix with a non-ionic surfactant. Re-entry permitted once spray deposit has dried.
BOTRYTIS (GRAY MOLD)					
SDHI (group 7)	boscalid	Cantus WDG	420 g/ha (170 g/acre)	0	Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.51–0.71 L/acre)	0	Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.4 L/acre)	0	Suppression. Do not make more than two consecutive applications before switching to a fungicide that is not in group 7 or group 3. 12-hr restricted entry interval.
polyoxins (group 19)	polyoxin D zinc salt	Diplomat 5SC	463–926 mL/ha (25–50 g ai/ha)	0	Suppression. Re-entry permitted once spray deposit has dried.
microbial (group BMO2)	<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	0.9–1 kg/ha (0.39–0.4 kg/acre) or 1.25–3.6 kg/ha (0.5–1.46 kg/acre)	0	Suppression. See label for details on choosing a rate. Re-entry permitted once spray deposit has dried.
	<i>Bacillus subtilis</i>	Serenade Opti	1.7–3.3 kg/ha (0.7–1.3 kg/acre)	0	Suppression.
not classified (group NC)	<i>Aureobasidium pullulans</i>	Botector	1 kg/ha (405 g/acre)	0	Suppression. 4-hr restricted entry interval.
	<i>Trichoderma harzianum</i>	RootShield HC	3.75–7.5 g/L of water Spray to wet, but avoid runoff. Use sufficient volume to thoroughly cover foliage.	—	Suppression. Foliar application.

Table 3–58. Eggplant Disease ControlFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
POWDERY MILDEW					
DMI (group 3)	tetraconazole	Mettle	296–584 mL/ha (120–236 mL/acre)	2	Restricted entry intervals: • general – 12 hr • hand set irrigation – 7 days • hand harvesting, tying and training – 2 days
DMI/SDHI (group 3/7)	difenoconazole/ benzovindiflupyr	Aprovia Top	643–967 mL/ha (260–391 mL/acre)	1	Do not make sequential applications of any group 3 or group 7 fungicides. 12-hr restricted entry interval.
SDHI (group 7)	benzovindiflupyr	Aprovia	500–750 mL/ha (202–304 mL/acre)	1	Do not make sequential applications of group 7 fungicides. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.4 L/acre)	0	Do not make more than 2 consecutive applications before switching to a fungicide that is not in group 7 or group 3. 12-hr restricted entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	625 mL/ha (253 mL/acre)	1	Do not apply until 21 days after transplanting. Do not make sequential applications of any group 3 or group 11 fungicides. 12-hr restricted entry interval.
actin/myosin/ fibrin function (group 50)	metrafenone	Vivando SC	0.75–1.12 L/ha (0.3–0.45 L/acre)	7	Do not make more than two sequential applications. 12-hr restricted entry interval.
not classified (group NC)	mineral oil	PureSpray Green Spray Oil 13E	10 L in 1,000 L water applied in sufficient volume to ensure thorough coverage	—	Suppression. See label for crop safety and chemical compatibility precautions. 12-hr restricted entry interval.
		SuffOil-X	13 L/1,000 L water	0.5	
plant extract (group P05)	extract of <i>Reynoutria sachalinensis</i>	Regalia Maxx	500–1,000 mL in 400 L water	0	Suppression. Re-entry permitted once spray deposit has dried.

Table 3–59. Activity of Insecticides on Eggplant Insects

LEGEND: C = control RD = reduction in damage S = suppression
 N = registered, but not considered effective or resistance is documented
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Field								
		Aphids	Colorado Potato Beetle	Cutworms	Flea Beetle	Mites	Stink Bug	Brown Marmorated Stink Bug	Tarnished Plant Bug	Tomato Fruitworm (Corn Earworm)
carbaryl	Sevin XLR	—	N	C	C	—	N	—	C	C
dimethoate	Cygon 480	—	—	—	—	—	—	—	C	—
	Lagon 480 E	—	—	—	—	—	—	—	C	—
malathion	Malathion 85E	N	—	—	—	N	—	—	—	—
fenpropathrin	Danitol	—	—	—	—	C	C	—	—	C
lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	—	—	C	—	—	—	—	—	C
flupyradifurone	Sivanto Prime	C	C	—	—	—	—	—	—	—
spinosad	Entrust	—	C	—	—	—	—	—	—	—
	Success	—	C	—	—	—	—	—	—	—
	Scorpio Ant and Insect Bait	—	—	C	—	—	—	—	—	—
abamectin/ cyantraniliprole	Minecto Pro	—	C	C	C	C	—	—	—	C
<i>Bacillus thuringiensis</i> , subsp. <i>aizawai</i>	XenTari WG	—	—	—	—	—	—	—	—	S
acequinocyl	Kanemite 15 SC	—	—	—	—	C	—	—	—	—
bifenazate	Acramite 50WS	—	—	—	—	C	—	—	—	—
spiromesifen	Oberon	—	—	—	—	C	—	—	—	—
spirotetramat	Movento 240 SC	C	—	—	—	—	—	—	—	—
chlorantraniliprole	Coragen	—	C	C	—	—	—	—	—	C
cyantraniliprole	Exirel	C	C	C	C	—	—	—	—	C
cyclaniliprole	Harvanta 50SL	—	C	—	—	—	—	—	—	—
tetraniliprole	Vayego 200 SC	S	C	C	—	—	—	—	—	—
flonicamid	Beleaf 50SG	C	—	—	—	—	—	—	—	—
mineral oil	PureSpray Green Spray Oil 13E	—	—	—	—	S	—	—	—	—
	SuffOil-X	RD	—	—	—	S	—	—	—	—
canola oil	Vegol	—	—	—	—	S	—	—	—	—
potassium salts of fatty acids	Kopa Insecticidal Soap	C	—	—	—	C	—	—	—	—
	Opal Insecticidal Soap	C	—	—	—	C	—	—	—	—
<i>Metarhizium anisopliae</i> strain F53	Met52 EC Bioinsecticide	—	—	—	—	RD	—	—	—	—

¹ See label for details.

Table 3–60. Eggplant Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides with different modes of action. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
Soil or Transplant Applications					
butenolides (group 4D)	flupyradifurone	Sivanto Prime	750–1,000 mL/ha (304–405 mL/acre)	45	See label for application details. Do not use subsequent foliar group 4D insecticides in the same season. 12-hr restricted entry interval.
Foliar Applications					
organophosphate (group 1B)	malathion	Malathion 85E	535–1,345 mL/ha (217–544 mL/acre)	3	Less effective below 20°C. Resistance to this group of products has been documented in some areas. 12-hr restricted entry interval.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	1	Do not apply foliar group 4D insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	1	Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. See label for guidance on adjuvant use. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	See label for guidance on adjuvant use. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. See label for crop tolerance information. 12-hr restricted entry interval.
	tetraniliprole	Vayego 200 SC	150 mL/ha (61 mL/acre)	1	Suppression. Do not apply less than 12 days prior to flowering or during flowering. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	0	12-hr restricted entry interval.
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water applied at 700–1,900 L solution/ha (283–770 L/acre)	0	Do not spray when plants are under stress. See label for crop tolerance information. Avoid spraying during full sun.

Table 3–61. Eggplant Insect Control — Colorado Potato Beetle

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides with different modes of action. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
COLORADO POTATO BEETLE					
Foliar Applications					
butenolides (group 4D)	flupyradifurone	Sivanto Prime	750–1,000 mL/ha (304–405 mL/acre)	1	Do not apply foliar group 4D insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
spinosyn (group 5)	spinosad	Entrust	167 mL/ha (68 mL/acre)	1	Use only on small larvae and low infestations. 12-hr restricted entry interval.
		Success	83 mL/ha (34 mL/acre)		
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	556–670 mL/ha (225–271 mL/acre)	7	Tank-mix with a non-ionic surfactant. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. For control of Colorado potato beetle, make the first application after approximately 50% of the egg masses have hatched and larvae are present. If two applications are needed, limit them to a single Colorado potato beetle generation per crop. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Early application on larval stages provides best control. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	750–1,000 mL/ha (304–405 mL/acre)	1	Early application on larval stages provides best control. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. See label for crop tolerance information. 12-hr restricted entry interval.
	cyclaniliprole	Harvanta 50SL	0.8–1.2 L/ha (0.32–0.49 L/acre)	1	Also controls cabbage looper. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
	tetraniliprole	Vayego 200 SC	150 mL/ha (61 mL/acre)	1	Do not apply less than 12 days prior to flowering or during flowering. 12-hr restricted entry interval.

Table 3–62. Eggplant Insect Control — Cutworms, Flea Beetles, Mites

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides with different modes of action. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
carbamate (group 1A)	carbaryl	Sevin XLR	45 mL/100 m of row (14 mL/100 ft of row)	2	Apply in 25–30 cm (10–12 in.) band over row. See label for restricted entry interval.
pyrethroid/ diamide (group 3A/28)	lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	7	Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 24-hr restricted entry interval.
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	1	Black cutworm only. Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	370–566 mL/ha (150–225 mL/acre)	7	Also controls cabbage looper. Tank-mix with a non-ionic surfactant. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Early application on larval stages provides best control. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	Early application on larval stages provides best control. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. See label for crop tolerance information. 12-hr restricted entry interval.
	tetraniliprole	Vayego 200 SC	150 mL/ha (61 mL/acre)	1	Do not apply less than 12 days prior to flowering or during flowering. 12-hr restricted entry interval.
FLEA BEETLES					
Foliar Applications					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5 L/ha (1 L/acre)	2	See label for restricted entry interval.
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	385–741 mL/ha (156–300 mL/acre)	7	Tank-mix with a non-ionic surfactant. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,000 mL/ha (202–405 mL/acre)	1	Early application on larval stages provides best control. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. See label for crop tolerance information. 12-hr restricted entry interval.

Table 3–62. Eggplant Insect Control — Cutworms, Flea Beetles, Mites

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides with different modes of action. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
MITES					
pyrethroid (group 3A)	fenpropathrin	Danitol	779 mL/ha (315 mL/acre)	7	24-hr restricted entry interval.
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	385–670 mL/ha (156–271 mL/acre)	7	Tank-mix with a non-ionic surfactant. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. 12-hr restricted entry interval.
acequinocyl (group 20B)	acequinocyl	Kanemite 15 SC	2.1 L/ha (0.85 L/acre)	1	Apply as a full coverage spray to the foliage to drip. 12-hr restricted entry interval.
bifenazate (group 20D)	bifenazate	Acramite 50WS	851 g/ha (344 g/acre)	3	12-hr restricted entry interval.
tetronic and tetramic acid derivatives (group 23)	spiromesifen	Oberon	500–600 mL/ha (202–243 mL/acre)	1	Effective against egg and nymphal stages. Apply before mite populations begin to build up. Control may not be apparent for 2–3 weeks, especially under cool temperatures. An adjuvant may be used to improve coverage and control. 12-hr restricted entry interval.
not classified (group NC)	mineral oil	PureSpray Green Spray Oil 13E	10 L in 1,000 L water applied in sufficient volume to ensure thorough coverage	—	Suppression. Also provides reduction in damage for aphids. See label for crop safety and chemical compatibility precautions. 12-hr restricted entry interval.
		SuffOil-X	13 L/1,000 L water	0.5	
	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water applied at 700–1,900 L solution/ha (283–770 L/acre)	0	Do not spray when plants are under stress. See label for tank-mix and crop tolerance information. Avoid spraying during full sun.
	<i>Metarhizium anisopliae</i> strain F53	Met52 EC bioinsecticide	0.5–5.0 L/1,000 L water 108 mL/10 L water	0	Reduction in numbers. Re-entry permitted once spray deposit has dried.
	canola oil	Vegol	2% solution, applied at 700–1,900 L/ha	1	Suppression.

Table 3–63. Eggplant Insect Control — Stink Bug, Brown Marmorated Stink Bug, Tarnished Plant Bug

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides with different modes of action. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
STINK BUG AND TARNISHED PLANT BUG					
Foliar Applications					
carbamate (group 1A)	carbaryl	Sevin XLR	5.25–6.4 L/ha (2.12–2.59 L/acre)	2	See label for restricted entry interval.
organophosphate (group 1B)	dimethoate	Cygon 480	500–700 mL/ha (202–283 mL/acre)	7	Tarnished plant bug. 12-hr restricted entry interval.
		Lagon 480 E			
pyrethroid (group 3A)	fenpropathrin	Danitol	779 mL/ha (315 mL/acre)	7	24-hr restricted entry interval.

Table 3–64. Eggplant Insect Control — Tomato Fruitworm (corn earworm)

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides with different modes of action. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
TOMATO FRUITWORM					
pyrethroid (group 3A)	fenpropathrin	Danitol	779 mL/ha (315 mL/acre)	7	24-hr restricted entry interval.
pyrethroid/ diamide (group 3A/28)	lambda- cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	7	Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 24-hr restricted entry interval.
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	556 mL/ha (225 mL/acre)	7	Tank-mix with a non-ionic surfactant. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. 12-hr restricted entry interval.
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i> , subsp. <i>aizawai</i>	XenTari WG	500–1,000 g/ha (203–405 g/acre)	0	Suppression. For best results apply in evening or on cloudy days. 4-hr restricted entry interval or once spray deposit has dried.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Early application on larval stages provides best control. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. See label for crop tolerance information. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	750 mL/ha (304 mL/acre)	1	Early application on larval stages provides best control. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. See label for crop tolerance information. 12-hr restricted entry interval.

GARLIC

In this section:

Table 3–65.	Activity of Fungicides on Garlic Diseases
Table 3–66.	Garlic Disease Control — Downy Mildew, Root Rots, Pink Root
Table 3–67.	Garlic Disease Control — Botrytis Leaf Blight, Purple Blotch, Stemphylium Leaf Blight
Table 3–68.	Activity of Insecticides on Garlic Insects
Table 3–69.	Garlic Insect Control — Onion Maggot, Thrips
Table 3–70.	Garlic Insect Control — Aphids, Leek Moth, Cutworms

This information is provided as a guideline only. See product labels for complete information. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–65. Activity of Fungicides on Garlic Diseases

LEGEND: C = control

S = suppression

— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Garlic Rust	Botrytis Leaf Blight	Botrytis Neck Rot	Downy Mildew	Purple Blotch	Stemphylium Leaf Blight	Root Rots (Pink Root)
penthiopyrad	Fontelis	—	C ¹	—	—	C	—	—
fluxapyroxad	Sercadis	—	C	—	—	C	S	—
benzovindiflupyr	Aprovia	C	—	—	—	C	S	—
fluopyram/pyrimethanil	Luna Tranquility	—	C	—	—	C	S	—
boscalid/pyraclostrobin	Pristine WG	—	C	—	S	C	—	—
pyrimethanil	Scala SC	—	C	C	—	C	—	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	C	—	—	S	—	—
pyraclostrobin	Cabrio EG	—	—	—	C	C	—	—
picoxystrobin	Acapela	—	S	C	—	C	—	—
azoxystrobin/difenoconazole	Quadris Top	—	C	—	C	C	S	—
mono- and dibasic sodium, potassium and ammonium phosphite	Phostrol	—	—	—	S	—	—	—
mandipropamid	Revus	—	—	—	C	—	—	—
dimethomorph	Acrobat 50 WP	—	—	—	S	—	—	—
	Forum	—	—	—	S	—	—	—
mandipropamid/oxathiapiprolin	Orondis Ultra	—	—	—	C	—	—	—
<i>Bacillus subtilis</i>	Serenade Opti	—	S	S	S	—	—	—
	Serenade SOIL	—	—	—	—	—	—	S
ametoctradin/dimethomorph	Zampro	—	—	—	C	—	—	—
copper octanoate	Cueva	—	C	—	C	—	—	—

¹ Also suppresses botrytis fleck caused by *Botrytis cinerea*.

Table 3–66. Garlic Disease Control — Downy Mildew, Root Rots, Pink RootFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DOWNY MILDEW					
SDHI/Qol (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	1.3 kg/ha (0.5 kg/acre)	7	Suppression. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 or group 11 fungicides. See label for restricted entry intervals.
Qol (group 11)	pyraclostrobin	Cabrio EG	0.56–0.84 kg/ha (226–340 g/acre)	7	Do not make sequential applications of any group 11 fungicides. See label for restricted entry intervals.
Qol/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	7	Do not use on areas treated with product the previous season. Do not make sequential applications of any group 11 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
phosphonate (group 33)	mono- and dibasic sodium, potassium, and ammonium phosphite	Phostrol	2.9–4.3 L/ha (1.2–1.7 L/acre)	0	Suppression. 12-hr restricted entry interval.
CAA (group 40)	dimethomorph	Acrobat 50 WP	450 g/ha (182 g/acre)	0	Suppression. Must be applied as a tank-mix with another fungicide active against downy mildew. See label for rotational crop restrictions and restricted entry intervals.
	dimethomorph	Forum	450 mL/ha (182 mL/acre)	0	Suppression. Tank-mix with another fungicide with activity against downy mildew. Do not make more than two sequential applications of any group 40 fungicide. See label for rotational crop restrictions and restricted entry intervals.
	mandipropamid	Revus	400 mL/ha (161 mL/acre)	7	Use a non-ionic adjuvant (0.25% v/v) as per label directions. See label for rotational crop restrictions. 12-hr restricted entry interval.
CAA/OSBPI (group 40/49)	mandipropamid/ oxathiapiprolin	Orondis Ultra	400 mL/ha (162 mL/acre)	7	Do not use on areas treated with product the previous season. Do not make sequential applications of any group 40 or group 49 fungicides. Tank-mix with a non-ionic surfactant. See label for rotational crop restrictions. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade Opti	1.7–3.3 kg/ha (0.7–1.3 kg/acre)	0	Suppression. Begin applications at the first sign of disease or when conditions favour disease development.
QoSI/CAA (group 45/40)	ametoctradin/ dimethomorph	Zampro	1 L/ha (0.4 L/acre)	0	Do not make more than two sequential applications of any group 40 or group 45 fungicides. See label for guidance on adjuvant use. See label for restricted entry intervals.
inorganic (group M1)	copper octanoate	Cueva	0.5%–2% (v/v) solution, applied in 470–940 L solution/ha (190–380 L/acre)	1	Re-apply using 5–10 day intervals. 4-hr restricted entry interval.
ROOT ROTS, PINK ROOT					
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Suppression. Also suppresses root rots caused by <i>Rhizoctonia solani</i> and <i>Pythium</i> spp. and damping-off caused by <i>Rhizoctonia solani</i> . May be applied at planting and/or post-planting. See label for application details.

¹ Botrytis fleck is caused by *Botrytis cinerea*, which is different from botrytis leaf blight (*Botrytis squamosa*).

Table 3–67. Garlic Disease Control —Botrytis Leaf Blight, Purple Blotch, Stemphylium Leaf BlightFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BOTRYTIS LEAF BLIGHT					
SDHI (group 7)	penthioopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	Botrytis diseases including <i>B. cinerea</i> and <i>B. squamosa</i>. Do not make more than two sequential applications of any group 7 fungicide. Use higher rate and shorter interval when disease pressure is high. See label for tank-mix precautions and rotational crop restrictions. 12-hr restricted entry interval.
	fluxapyroxad	Sercadis	333–666 mL/ha (135–269 mL/acre)	7	Do not use on areas treated with product the previous season. Do not make more than two sequential applications of any group 7 fungicide. See label for rotational crop restrictions. 12-hr restricted entry interval.
SDHI/AP (group 7/9)	fluopyram/ pyrimethanil	Luna Tranquility	1.2 L/ha (486 mL/acre)	7	Do not make more than two sequential applications of any group 7 fungicides. See label for rotational crop restrictions and restricted entry intervals.
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	1–1.3 kg/ha (0.4–0.5 kg/acre)	7	Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 or group 11 fungicides. See label for restricted entry intervals.
AP (group 9)	pyrimethanil	Scala SC	2 L/ha (0.8 L/acre)	7	Also controls botrytis neck rot (<i>Botrytis allii</i>). See label for rotational crop restrictions and restricted entry intervals.
AP/PP (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (313–394 g/acre)	7	See label for rotational crop restrictions and restricted entry intervals. 12-hr restricted entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	7	Do not use on areas treated with product the previous season. Do not make sequential applications of any group 11 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade Opti	1.7–2.5 kg/ha (0.7–1 kg/acre)	0	Suppression. Also suppresses botrytis neck rot (<i>Botrytis allii</i>). Begin applications at first sign of disease, or when conditions become conducive for disease development.
PURPLE BLOTCH					
SDHI (group 7)	benzovindiflupyr	Aprovia	750 mL/ha (304 mL/acre)	7	Also controls garlic rust (<i>Puccinia allii</i>). Do not make sequential applications of any group 7 fungicide.
	penthioopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	Do not make more than two sequential applications of any group 7 fungicide. Also suppresses botrytis fleck caused by <i>Botrytis cinerea</i> ¹ . Use higher rate and shorter interval when disease pressure is high. See label for tank-mix precautions and rotational crop restrictions. 12-hr restricted entry interval.
	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	7	Do not use on areas treated with product the previous season. Do not make more than two sequential applications of any group 7 fungicide. See label for rotational crop restrictions. 12-hr restricted entry interval.
SDHI/AP (group 7/9)	fluopyram/ pyrimethanil	Luna Tranquility	1.2 L/ha (486 mL/acre)	7	Do not make more than two sequential applications of any group 7 fungicides. See label for rotational crop restrictions and restricted entry intervals.
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	1–1.3 kg/ha (0.4–0.5 kg/acre)	7	Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 or group 11 fungicides. See label for restricted entry intervals.
AP (group 9)	pyrimethanil	Scala SC	2 L/ha (0.8 L/acre)	7	See label for rotational crop restrictions and restricted entry intervals.
AP/PP (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (313–394 g/acre)	7	Suppression. See label for rotational crop restrictions and restricted entry intervals.
QoI (group 11)	picoxystrobin	Acapela	0.44–0.88 L/ha (0.18–0.36 L/acre)	0	Also controls botrytis neck rot. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.

¹ Botrytis fleck is caused by *Botrytis cinerea*, which is different from botrytis leaf blight (*Botrytis squamosa*).

Table 3–67. Garlic Disease Control —Botrytis Leaf Blight, Purple Blotch, Stemphylium Leaf BlightFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PURPLE BLOTCH (continued)					
Qol (group 11)	pyraclostrobin	Cabrio EG	0.56–0.84 kg/ha (226–340 g/acre)	7	Do not make subsequent applications of any group 11 fungicides. See label for restricted entry intervals.
Qol/DMI (group 11/3)	azoxystrobin/difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	7	Do not use on areas treated with product the previous season. Do not make subsequent applications of any group 11 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
STEMPHYLIUM LEAF BLIGHT					
SDHI (group 7)	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	7	Suppression. Do not use on areas treated with product the previous season. Do not make more than two sequential applications of any group 7 fungicide. See label for rotational crop restrictions. 12-hr restricted entry interval.
	benzovindiflupyr	Aprovia	750 mL/ha (304 mL/acre)	7	Suppression. Do not make sequential applications of any group 7 fungicide.
SDHI/AP (group 7/9)	fluopyram/pyrimethanil	Luna Tranquility	1.2 L/ha (486 mL/acre)	7	Suppression. Do not make more than two sequential applications of any group 7 or group 9 fungicides. See label for rotational crop restrictions and restricted entry intervals.
Qol/DMI (group 11/3)	azoxystrobin/difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	7	Suppression. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 11 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.

¹ Botrytis fleck is caused by *Botrytis cinerea*, which is different from botrytis leaf blight (*Botrytis squamosa*).**Table 3–68. Activity of Insecticides on Garlic Insects****LEGEND:** C = control S = suppression
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Onion Maggot	Thrips	Aphids	Leek Moth	Cutworms
chlorpyrifos	Lorsban 4E/NT	C	—	—	—	C
	Pyrinex 480 EC	C	—	—	—	C
	Nufos 4E	C	—	—	—	C
	Sharphos	C	—	—	—	C
	Warhawk 480 EC	C	—	—	—	C
malathion	Malathion 85E	—	C	C	—	—
lambda-cyhalothrin	Labamba	—	C	—	C	—
	Matador 120EC	—	C	—	C	—
	Silencer 120 EC	—	C	—	—	—
spinetoram	Delegate WG	—	S	—	S	—
spinosad	Entrust	—	S	—	S	—
	Scorpio Ant and Insect Bait	—	—	—	—	C
	Success	—	S	—	S	—
abamectin	Agri-mek SC	—	C	—	—	—
<i>Bacillus thuringiensis</i>	Bioprotec PLUS	—	—	—	S	—
<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i>	XenTari WG	—	—	—	S	—
spirotetramat	Movento 240 SC	—	C	—	—	—
cyantraniliprole	Exirel	—	S	—	—	—

Table 3–69. Garlic Insect Control — Onion Maggot, Thrips

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ONION MAGGOT					
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT	3.5 L in 1,000 L of water/ha (1.4 L in 90 gal of water/acre)	50	Apply as a soil drench over the seedling row. 24-hr restricted entry interval.
		Pyrinex 480 EC			
		Nufos 4E			
		Sharphos			
		Warhawk 480 EC			
THRIPS					
organophosphate (group 1B)	malathion	Malathion 85E	535–1,345 mL/ha (216–544 mL/acre)	3	Do not store for more than 1 year. 12-hr restricted entry interval.
pyrethroid (group 3A)	lambda- cyhalothrin	Labamba	188 mL/ha (76 mL/acre)	14	24-hr restricted entry interval.
		Matador 120EC			
		Silencer 120 EC			
spinosyn (group 5)	spinetoram	Delegate WG	200–336 g/ha (80–136 g/acre)	3	Suppression. Use high rate when pressure is high and/or insects are in advanced growth stages. 12-hr restricted entry interval.
	spinosad	Entrust ¹	437–527 mL/ha (177–213 mL/acre)	3	Suppression. Use high rate when pressure is high and/or insects are in advanced growth stages. Re-entry permitted when dry.
		Success ¹	218–262 mL/ha (88–106 mL/acre)	3	Suppression. Use high rate when pressure is high and/or insects are in advanced growth stages. Re-entry permitted when dry.
avermectin (group 6)	abamectin	Agri-mek SC ²	135–270 mL/ha (55–109 mL/acre)	30	Tank-mix with a non-ionic surfactant. 12-hr restricted entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	365 mL/ha (147 mL/acre)	3	Apply during the first half of the season when adult populations are relatively low or building. Make two applications no more than 2 weeks apart before switching to a product with a different mode of action. Reduction in numbers of thrips larvae may take 3–4 days after application. See label for spray adjuvant and application details. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	1–1.5 L/ha (405–607 mL/acre)	1	Suppression. If thrips populations are high, use a registered insecticide with different mode of action to reduce thrips populations before applying cyantraniliprole. Use a spray adjuvant as listed on the label. Do not make more than two sequential applications of any group 28 insecticide. See label for tank-mix and crop tolerance information, and rotational crop restrictions. 12-hr restricted entry interval.

¹ Maintain a spray water pH of 6 or greater.² This product has been tested in combination with a non-ionic surfactant for safety to some varieties of bulb onions; however, testing has not been conducted on all crops and varieties in the bulb onion sub-group under the range of conditions that may cause crop injury.

Table 3–70. Garlic Insect Control — Aphids, Leek Moth, Cutworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate per Hectare	PHI	Notes
APHIDS					
organophosphate (group 1B)	malathion	Malathion 85E	535–1,345 mL/ha (216–544 mL/acre)	3	Do not store for more than 1 year. 12-hr restricted entry interval.
LEEK MOTH					
pyrethroid (group 3A)	lambda-cyhalothrin	Labamba Matador 120EC	188 mL/ha (76 mL/acre)	14	Apply 7–10 days after peak pheromone trap capture. Maximum three applications per year. 24-hr restricted entry interval.
spinosyn (group 5)	spinetoram	Delegate WG	200–336 g/ha (81–136 g/acre)	3	Suppression. Apply 7–10 days after peak pheromone trap capture. Use higher rates when pressure is high and/or insects are in advanced growth stages. 12-hr restricted entry interval.
	spinosad	Success ¹	218–262 mL/ha (88–106 mL/acre)	3	Suppression. Apply 7–10 days after peak pheromone trap capture. Use higher rates when pressure is high and/or insects are in advanced growth stages. Re-entry permitted when dry.
		Entrust ¹	437–527 mL/ha (177–213 mL/acre)		
Bacillus thuringiensis (group 11)	Bacillus thuringiensis var kurstaki strain EVB-113-19	Bioprotec PLUS	0.9–1.8 L/ha (0.36–0.73 L/acre)	0	Suppression. Apply 7–10 days after peak pheromone capture. For best results apply in evening or on cloudy days.
	Bacillus thuringiensis subsp. aizawai	XenTari WG	500–1,000 g/ha (203–405 g/acre)		
CUTWORMS					
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT Pyrinex 480 EC Nufos 4E Sharphos Warhawk 480 EC	2.4–4.8 L/ha (1–1.9 L/acre)	60	Apply between 2–5-leaf stage. Do not incorporate. 24-hr restricted entry interval.
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha	3	Black cutworm only. Also reduction in damage to wireworm. Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.

¹ Maintain a spray water pH of 6 or greater.

HERBS (FRESH)

balm, basil, cilantro, chive, dillweed, lavender, marjoram/oregano, parsley, rosemary, sage, savory (summer and winter), tarragon, thyme and mint

In this section:

Table 3-71.	Original and Revised Crop Groups for Major Fresh Market Herbs Grown in Ontario
Table 3-72.	Products Registered on Fresh Herbs Grown in Ontario
Table 3-73.	Parsley, Cilantro and Dillweed Disease Control
Table 3-74.	Parsley, Cilantro and Dillweed Insect Control
Table 3-75.	Chive Disease Control
Table 3-76.	Chive Insect Control
Table 3-77.	Balm, Basil, Lavender, Marjoram/Oregano, Rosemary, Sage, Savory, Tarragon and Thyme Disease and Insect Control
Table 3-78.	Mint Disease and Insect Control

Crop Groups for Herbs

This chapter only covers pest control products for the major herbs grown for **fresh market** use in Ontario: balm (or lemon balm), basil, cilantro, chives, dillweed, lavender, marjoram/oregano, parsley, rosemary, sage, savory, tarragon, thyme and mint. Herb seeds, dried leaves and spices have different pest control products that are not covered in this chapter. Consult product labels to determine if they are permitted for use on dried herbs and spices.

All crops are grouped into numbered groups by the Pest Management Regulatory Agency to facilitate registration of pest control products. Crop groups simplify pesticide registrations because residue data can be used for a few representative crops to extend to all crops within the group. Crop groups can also contain smaller and more closely related crop subgroups, usually designated with a letter. These crop group numbers are part of a different system than those used for pesticide resistance grouping. Resistance groups are discussed in Chapter 1 of this publication.

Herb crops are complicated because different species fall into several different crop groups. Because pest control products are registered on each crop group separately, a given pest control product will not necessarily be registered on all herbs. Furthermore, over the last several years, many crop groups have been revised and expanded into new groups. This process has involved moving some herbs (in particular cilantro, dillweed and chives) from one crop group to another, further complicating pesticide registrations for herbs.

A list of the original and revised crop groups applicable to herbs covered in this chapter is given below. This is only a partial list of crops included in each group. For a current, complete list of crops included in all of these crop groups, search “Residue Chemistry Crop Groups” at www.canada.ca.

Table 3–71. Original and Revised Crop Groups for Major Fresh Market Herbs Grown in Ontario

Fresh Herb		Original		Revised	
Common name	Latin name	Crop Group	Crop Subgroup	Crop Group	Crop Subgroup
Balm	<i>Melissa officinalis</i>	19: Herbs and Spices ²	19A: Herbs ²	25: Herbs ³	25A: Herbs, fresh leaves ³
Basil	<i>Ocimum basilicum</i> ¹	19: Herbs and Spices	19A: Herbs	25: Herbs ¹	25A: Herbs, fresh leaves ¹
Chive	<i>Allium schoenoprasum</i>	19: Herbs and Spices	19A: Herbs	3-07: Bulb Vegetables	3-07B: Green onions
Cilantro (leaf)	<i>Coriandrum sativum</i>	19: Herbs and Spices	19A: Herbs	4-13: Leafy Vegetables	4-13A: Leafy Greens
Dillweed	<i>Anethum graveolens</i>	19: Herbs and Spices	19A: Herbs	4-13: Leafy Vegetables	4-13A: Leafy Greens
Lavender	<i>Lavandula officinalis</i>	19: Herbs and Spices	19A: Herbs	25: Herbs	25A: Herbs, fresh leaves
Marjoram	<i>Origanum</i> spp.	19: Herbs and Spices ⁴	19A: Herbs ⁴	25: Herbs ⁴	25A: Herbs, fresh leaves ⁴
Mint	<i>Mentha</i> spp. ¹	Not in a crop group		25: Herbs ¹	25A: Herbs, fresh leaves ¹
Oregano	<i>Origanum vulgare</i> ¹	19: Herbs and Spices ⁴	19A: Herbs ⁴	25: Herbs ⁴	25A: Herbs, fresh leaves ⁴
Parsley (fresh leaf)	<i>Petroselinum crispum</i>	4: Leafy Vegetables	4A: Leafy Greens	4-13: Leafy Vegetables	4-13A: Leafy Greens
Rosemary	<i>Rosemarinus officinalis</i>	19: Herbs and Spices	19A: Herbs	25: Herbs	25A: Herbs, fresh leaves
Sage	<i>Salvia officinalis</i> ¹	19: Herbs and Spices	19A: Herbs	25: Herbs ¹	25A: Herbs, fresh leaves ¹
Savory, summer	<i>Satureja hortensis</i> ⁵	19: Herbs and Spices ⁵	19A: Herbs ⁵	25: Herbs ⁵	25A: Herbs, fresh leaves ⁵
Savory, winter	<i>Satureja montana</i> ⁵	19: Herbs and Spices ⁵	19A: Herbs ⁵	25: Herbs ⁵	25A: Herbs, fresh leaves ⁵
Tarragon	<i>Artemisia dracunculus</i>	19: Herbs and Spices	19A: Herbs	25: Herbs ⁵	25A: Herbs, fresh leaves ⁵
Thyme	<i>Thymus</i> spp. ¹	19: Herbs and Spices	19A: Herbs	25: Herbs ¹	25A: Herbs, fresh leaves ¹

¹ Additional species of this herb have been added to the new crop group 25/25A. See PMRA website for details (www.canada.ca, search “Residue Chemistry Crop Groups”).

² Listed in Crop Group 19 and 19A as “Balm (lemon balm) (*Melissa officinalis*)”

³ Listed in Crop Group 25 and 25A as “Balm, fresh leaves (*Melissa officinalis*)”

⁴ Marjoram and oregano were listed as one combined entry in Crop Group 19/19A but have been split into several different species in the new Crop Group 25/25A. See PMRA website for details (www.canada.ca, search “Residue Chemistry Crop Groups”).

⁵ Savory was listed as one entry (“Savory, summer and winter (*Satureja* spp.)” in Crop Group 19/19A but has been split into two different species in the new Crop Group 25/25A. See PMRA website for details (www.canada.ca, search “Residue Chemistry Crop Groups”).

As of November 2020, the Herb Crop Group (19) was revised into a new, expanded crop group. This will be called Crop Group 25: Herbs, with a Crop Subgroup called 25A: Herbs, fresh leaves. As of November 2020, no pest control product labels are registered on Crop Group 25 or Subgroup 25A, however, in the future, product registrations on herbs are expected to reflect the new crop group. A full list of crops will be posted on the PMRA website once the new Crop Group documents are finalized.

Note that pest control products are sometimes registered on only a subset of crops within a crop group. For example, Intrepid is registered on all members of Crop Group 19A **except** chives, and Rampart is only registered on basil. In order to determine if a product is registered on an herb, it is important to read the full listing of crops on the label to determine if it is permitted.

Table 3–72 outlines which products are registered on commonly grown fresh market herbs in Ontario. Products listed here are not always registered for the same pest or use site (e.g., greenhouse or field) on each herb crop. Always refer to product labels for specific instructions for each product. This table lists only those fresh herbs commonly grown in Ontario. See labels for the full list of herb crops on which each product is registered.

Table 3–72. Products Registered on Fresh Herbs Grown in Ontario

Herbs listed in this table are for fresh market sale only. For products registered on dried herbs or seeds, refer to product labels.

LEGEND: R = registered

— = not registered

Product	Balm	Basil	Cilantro	Chive	Dillweed	Lavender	Marjoram/ Oregano	Mint	Parsley	Rosemary	Sage	Savory	Tarragon	Thyme
FUNGICIDES														
Apron XL	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Aprovia	—	—	—	R	—	—	—	—	—	—	—	—	—	—
Botector	R	R	R	R	—	R	R	R	R	R	R	R	R	R
Cease	R	R	R	R	R	R	R	—	R	R	R	R	R	R
Confine Extra	—	R	—	—	—	—	—	—	—	—	—	—	—	—
Cueva	—	—	—	R	—	—	—	—	R	—	—	—	—	—
Dynasty 100 FS	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Fontelis	—	—	—	R	—	—	—	—	R	—	—	—	—	—
Fungtion	—	—	—	—	—	—	—	R	—	—	—	—	—	—
Luna Sensation	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Luna Tranquility	—	—	—	R	—	—	—	—	—	—	—	—	—	—
Maxim 480 FS	—	R	R	R	R	R	R	—	R	R	R	—	R	R
MilStop	R	R	R	R	R	R	R	R	—	R	R	R	R	R
Miravis Prime	—	—	R	—	—	—	—	—	R	—	—	—	—	—
Mycostop	R	R	R	R	R	R	R	—	R	R	R	R	R	R
Orondis Ultra	—	R	R	R	R	—	—	—	R	—	—	—	—	—
Pen 240 FS	—	—	—	R	—	—	—	—	—	—	—	—	—	—
Phostrol	—	R	—	R	—	—	—	—	—	—	—	—	—	—
Presidio	—	R	—	—	—	—	—	—	—	—	—	—	—	—
Prestop	—	R	—	—	R	—	R	—	R	—	—	—	—	R
Pristine WG	—	—	—	R	—	—	—	—	—	—	—	—	—	—
Quadris	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Quadris Top	—	—	—	R	—	—	—	—	—	—	—	—	—	—
Quilt	—	—	—	—	—	—	—	R	—	—	—	—	—	—
Rampart	—	R	—	—	—	—	—	—	—	—	—	—	—	—
Reason	—	R	—	R	—	—	—	—	—	—	—	—	—	—
Revus	—	R	—	—	—	—	—	—	—	—	—	—	—	—
RootShield HC	R	R	R	R	R	R	R	—	R	R	R	R	R	R
RootShield Plus G	R	R	R	R	R	R	R	—	R	R	R	R	R	R
Scala SC	—	—	—	R	—	—	—	—	—	—	—	—	—	—
Sercadis	—	—	—	R	—	—	—	—	R	—	—	—	—	—
Serenade Opti	R	R	R	R	R	R	—	—	R	R	R	R	—	R
Serenade SOIL	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Switch 62.5 WG	—	—	—	R	—	—	—	—	—	—	—	—	—	—
Torrent 400SC	—	R	—	—	—	—	—	—	—	—	—	—	—	—
Trium P	R	R	R	R	R	R	R	—	R	R	R	R	R	R

Table 3–72. Products Registered on Fresh Herbs Grown in Ontario

Herbs listed in this table are for fresh market sale only. For products registered on dried herbs or seeds, refer to product labels.

LEGEND: R = registered

— = not registered

Product	Balm	Basil	Cilantro	Chive	Dillweed	Lavender	Marjoram/ Oregano	Mint	Parsley	Rosemary	Sage	Savory	Tarragon	Thyme
INSECTICIDES AND MITICIDES														
Acramite	R	R	R	R	R	R	R	R	—	R	R	R	R	R
Actara 25 WG	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Actara 240 SC	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Admire 240	R	R	R	R	R	—	R	—	R	—	R	R	R	R
Assail 70 WP	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Beleaf 50 SG	—	—	—	—	—	—	—	R	R	—	—	—	—	—
BioCeres EC	R	R	R	R	R	R	R	—	—	R	R	R	R	R
Bioprotec Plus — Field	—	R	—	R	R	—	—	R	R	—	—	—	—	—
Bioprotec Plus — Greenhouse	R	R	R	R	R	R	R	—	—	R	R	R	R	R
Botanigard ES	R	R	R	R	R	R	R	—	R	R	R	R	R	R
Citation 75 WP	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Closer	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Coragen	—	—	—	R	—	—	—	R	R	—	—	—	—	—
Delegate	—	R	R	—	R	—	—	R	R	—	—	—	—	—
Dipel 2X DF — Field	—	R	—	—	R	—	—	R	R	—	—	—	—	—
Dipel 2X DF — Greenhouse	R	R	R	R	R	R	R	—	—	R	R	R	R	R
Entrust	—	R	R	R	R	—	—	—	R	—	—	—	—	—
Exirel	—	—	—	R	—	—	—	—	R	—	—	—	—	—
Harvanta	—	—	R	—	R	—	—	—	R	—	—	—	—	—
Intrepid	R	R	R	—	R	R	R	—	R	R	R	R	R	R
Kopa	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Malathion 85E	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Minecto Duo	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Minecto Pro	—	—	R	—	R	—	—	—	R	—	—	—	—	—
Movento 240 SC	—	—	—	R	—	—	—	—	R	—	—	—	—	—
Oberon	—	—	R	—	R	—	—	R	R	—	—	—	—	—
Opal	R	R	R	R	R	R	R	—	R	R	R	R	R	R
Sevin XLR	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Sivanto Prime	—	—	R	—	R	—	—	—	R	—	—	—	—	—
Success	—	R	R	R	R	—	—	—	R	—	—	—	—	—
Surround WP	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Trounce	R	R	R	R	R	R	R	—	R	R	R	R	R	R
Vayego 200 SC	—	—	R	—	R	—	—	—	R	—	—	—	—	—
Versys	—	—	R	—	R	—	—	—	R	—	—	—	—	—
XenTari WG	R	R	R	R	R	R	R	—	R	R	R	R	R	R

This information is provided as a guideline only. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication. Pest control products listed in this section are not necessarily registered on all herbs. See product labels for complete information.

Some products are persistent and may carry over from year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–73. Parsley, Cilantro and Dillweed Disease Control

For resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
SEED TREATMENTS					
phenylamide (group 4)	metalaxyl-M and S-isomer	Apron XL LS	20–40 mL/100 kg seed	n/a	Parsley only. Damping-off due to <i>Pythium</i>. Do not apply to parsley seed destined to be grown in the greenhouse — label treated seed accordingly. For use in commercial seed treatment facilities.
QoI (group 11)	azoxystrobin	Dynasty 100FS	25–50 mL/100 kg seed	n/a	Parsley only. Damping-off due to <i>Pythium</i>. For import use only; do not treat seed in Canada.
PP (group 12)	fludioxonil	Maxim 480FS	5.2–10.4 mL/100 kg seed	n/a	Seed decay, damping-off and seedling blights. For use in commercial seed treatment facilities only.
microbial (group BMO2)	<i>Streptomyces</i>	Mycostop	8 g/kg seed	n/a	Fusarium damping off. Greenhouse use only. Suppression. Do not apply on seed to be planted directly in the field. See label for application instructions.
GREENHOUSE TRANSPLANT DISEASE CONTROL					
microbial (group BMO2)	<i>Aureobasidium pullulans</i>	Botector	1 kg/ha (405 g/acre)	0	Parsley and cilantro only. Suppression of botrytis gray mold. 4-hr restricted entry interval.
	<i>Bacillus subtilis</i>	Cease Biological	1–2 L/100 L water	0	Greenhouse use only. Suppression of botrytis gray mold and sclerotinia white mold.
	<i>Trichoderma harzianum</i> strain KRL-AG2	RootShield HC	55–110 g/m ³ soil	0	Greenhouse use only. Suppression of root rots caused by <i>Pythium</i> spp., <i>Rhizoctonia</i> spp. and <i>Fusarium</i> spp. Drench application to potting soil or mix. 4-hr restricted entry interval or when spray deposits have dried.
	<i>Trichoderma harzianum</i> strain KRL-AG2/ <i>Trichoderma virens</i> strain G-41	RootShield Plus G	600–1,200 g/m ³ soil	0	Greenhouse use only. Suppression of root rots and damping-off caused by <i>Pythium</i> spp., <i>Rhizoctonia</i> spp., <i>Fusarium</i> spp. and <i>Phytophthora</i>. Mix uniformly into potting soil or mix immediately before sowing seed or planting.
	<i>Trichoderma harzianum</i> strain T22	Triatum P	See label for rate and application instructions.	—	Suppression of root rots caused by <i>Fusarium oxysporum</i> and damping-off caused by <i>Pythium ultimum</i> and <i>Rhizoctonia solani</i>. Apply immediately after seeding. 4-hr restricted entry interval.
not classified (group NC)	potassium bicarbonate	MilStop	0.28–0.56 kg/1,000 m ²	0	Dillweed and cilantro only. Suppression of powdery mildew. Not all herbs or herb varieties have been tested for phytotoxicity. 4-hr restricted entry interval.
	<i>Gliocladium catenulatum</i>	Prestop	Refer to label for rates and application instructions.	—	Dillweed and parsley only. Greenhouse use only. Suppression of damping-off caused by <i>Pythium</i> spp. and <i>Rhizoctonia solani</i>. Growing media or soil drench application. Do not tank-mix with any fungicides, insecticides, herbicides or adjuvants. 4-hr restricted entry interval for foliar applications.

Table 3–73. Parsley, Cilantro and Dillweed Disease ControlFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
FUNGICIDES — FIELD					
DAMPING-OFF					
microbial (group BMO2)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Parsley only. Suppression of damping off caused by <i>Rhizoctonia solani</i> and root rots caused by <i>Pythium</i> spp. and <i>Rhizoctonia solani</i>. May be applied at planting and/or post-planting. See label for application details. For broadcast or banded applications, incorporate into the seed zone with rainfall or overhead irrigation within 24 hr.
	<i>Trichoderma harzianum</i> strain T22	Triatum P	After Sowing: 1.5 g/m ² of cultivated area in 1.33 L of water After transplanting: 6 g in 1 L water Apply dilute solution at 500 L/ha.	—	Suppression of damping-off caused by <i>Rhizoctonia solani</i>. Apply immediately after seeding or transplanting. 4-hr restricted entry interval.
POWDERY MILDEW					
not classified (group NC)	potassium bicarbonate	MilStop	2.8–5.6 kg/ha (1.1–2.3 kg/acre)	0	Cilantro and dillweed only. Suppression. Not all herbs or herb varieties have been tested for phytotoxicity. 4-hr restricted entry interval.
SEPTORIA LEAF SPOT					
QoI (group 11)	azoxystrobin	Quadris	0.45–1.12 L/ha (182–453 mL/acre)	1	Parsley only. Will also control alternaria leaf blight. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
Inorganic (group M1)	copper octanoate	Cueva	0.5%–2% solution, applied at 470–940 L water/ha (190–380 L water/acre)	1	Parsley only. May cause leaf spots during excessive moisture and cold. If concerned about sensitivity of plants, apply first to small areas. 4-hr restricted entry interval.
SCLEROTINIA WHITE MOLD AND BOTRYTIS GRAY MOLD					
SDHI (group 7)	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	1	Parsley only. Sclerotinia only. Do not make more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	Parsley only. Botrytis control. Suppression of sclerotinia. Do not make more than two sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
SDHI/QoI (group 7/ group 11)	fluopyram/trifloxystrobin	Luna Sensation	400–600 mL/ha (162–243 mL/acre)	0	Parsley only. Sclerotinia only. Do not make sequential applications of any group 11 or more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
SDHA/PP (group 7/ group 12)	pydiflumetofen/fludioxonil	Miravis Prime	0.8–1.0 L/ha (324–405 mL/acre)	3	Parsley and cilantro only. Sclerotinia control. Suppression of botrytis. Do not make more than two sequential applications before switching to a fungicide that is not in Group 7 or 12. 12-hr restricted entry interval.
microbial (group BMO2)	<i>Bacillus subtilis</i>	Serenade Opti	0.6–1.7 kg/ha (0.2–0.7 kg/acre)	0	Parsley only. Suppression.
			1.7–3.3 kg/ha (0.7–1.3 kg/acre)	0	Cilantro and dillweed only. Suppression.
	<i>Aureobasidium pullulans</i>	Botector	1 kg/ha (405 g/acre)	0	Parsley and cilantro only. Suppression. 4-hr restricted entry interval.

Table 3–74. Parsley, Cilantro and Dillweed Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
GREENHOUSE TRANSPLANT INSECT CONTROL					
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i>	Bioprotec Plus	1.0 L/1,000 L water	0	Cilantro and dillweed only. <i>Duponchelia fovealis</i> only. 4-hr restricted entry interval, or when spray deposits have dried.
		Dipel 2X DF	625 g/1,000 L water		
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water	0	Applying more than three times may cause plant injury. Do not spray when plants are under stress. See label for tank-mix precautions and crop tolerance information. Avoid spraying during full sun.
		Opal Insecticidal Soap	Apply dilute solution at a rate of 700–1,900 L/ha.		
fungus agents of uncertain mode of action (group UNF)	<i>Beauveria bassiana</i>	BioCeres EC	2–4 mL/L water	0	Cilantro and dillweed only. Greenhouse use only. Reduction in numbers of whiteflies, aphids and thrips. Apply 500–1,000 L spray mix/ha. Do not mix with fungicide. Control will not be apparent for 5–7 days. 4-hr restricted entry interval, or when spray deposits have dried.
	<i>Beauveria bassiana</i>	BotaniGard ES	Aphids and whiteflies 0.5–1 L/400 L spray volume Thrips 2 L/400 L spray volume	0	Greenhouse use only. Aphids, whiteflies and thrips. Control may not be apparent for 7–10 days. Do not tank-mix with any other product. May cause injury on some varieties; test on a small area before use on a new variety of plant. 4-hr restricted entry interval.
INSECTICIDES — FIELD					
APHIDS					
Soil and Transplant Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	6 mL/100 m of row (1.8 mL/100 ft of row)	21	Parsley only. May also be applied as a transplant tray plug drench at a rate of 10.2 mL/1,000 plants. See label for application details. Do not use subsequent foliar group 4 insecticides in the same season. Not all herbs or herb varieties have been tested for phytotoxicity. 24-hr restricted entry interval.
				14	Cilantro and dillweed only. See label for application details. This product cannot be applied if the crop will produce any flowers prior to the final harvest. If there is unexpected flowering after this product has been applied, the crop should be removed to prevent damage to pollinators. Do not use subsequent foliar group 4 insecticides in the same season. Not all herbs or herb varieties have been tested for phytotoxicity. 24-hr restricted entry interval.
	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Parsley only. Also suppresses early-season flea beetles. Apply in-furrow or banded at planting. See label for application details. Do not use subsequent foliar group 4 insecticides in the same season. 12-hr restricted entry interval.
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (304 g/acre)	—	Parsley only. Also suppresses early-season flea beetles. Apply in-furrow or banded at planting. See label for application details. Do not use subsequent foliar group 4 or group 28 insecticides in the same season. 12-hr restricted entry interval.

Table 3–74. Parsley, Cilantro and Dillweed Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS — Foliar applications					
organophosphate (group 1B)	malathion	Malathion 85E	1,100–1,345 mL/ha (445–544 mL/acre)	20	Parsley only. Control of aphids with malathion has been inconsistent in many areas. Ensure thorough coverage. Apply when temperature is at or above 20°C and foliage is dry. 1-day restricted entry interval.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Parsley only. Do not apply foliar group 4 insecticides in the same season as a soil or transplant application. Not all herbs or herb varieties have been tested for phytotoxicity. 24-hr restricted entry interval.
			200 mL/ha (81 mL/acre)	7	Cilantro and dillweed only. Apply post-bloom only, and only to crops that will not have any secondary flowering. Pre-bloom applications can only be made to crops that will not produce any flowers at all before the final harvest. If there is unexpected flowering after this product has been applied, the crop should be removed to prevent damage to pollinators.
	acetamiprid	Assail 70 WP	56–86 g/ha (23–35 g/acre)	7	Parsley only. Do not apply foliar group 4 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Parsley only. Do not apply foliar group 4 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	100–150 mL/ha (40–61 mL/acre)	3	Parsley only. 12-hr restricted entry interval.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	1	12-hr restricted entry interval.
pyopene (group 9D)	afidopyropen	Versys	0.1 L/ha (0.04 L/acre)	0	Do not make sequential applications of any group 9 insecticide. 12-hr restricted entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	3	Parsley only. Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. Must be tank-mixed with an adjuvant as per label instructions. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	Parsley only. Use high rate under heavy pest pressure. Do not apply foliar group 28 insecticides in the same season as a soil application. See label for guidance on adjuvant use, tank-mix and crop tolerance precautions. 12-hr restricted entry interval.
	tetraniliprole	Vayego 200 SC	150 mL/ha (61 mL/acre)	1	Suppression. Also controls flea beetles. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (48–65 g/acre)	0	Parsley only. Use high rate on high populations or dense foliage. 12-hr restricted entry interval.

Table 3–74. Parsley, Cilantro and Dillweed Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS — Foliar applications (continued)					
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water Apply dilute solution at a rate of 700–1,900 L/ha (283–769 L/acre).	0	Applying more than three times may cause plant injury. Do not spray when plants are under stress. See label for tank-mix precautions and crop tolerance information. Avoid spraying during full sun.
		Opal Insecticidal Soap			
not classified/ pyrethroid (NC/group 3A)	potassium salts of fatty acids/ pyrethrins	Safer's Trounce	5 L/ha (2 L/acre)	1	Reduction in populations. Also reduces populations of earwigs. See label for application instructions.
THRIPS					
spinosyn (group 5)	spinetoram	Delegate	200–336 g/ha (81–136 g/acre)	1	Suppression of onion thrips. Apply at egg hatch or when larvae are small. Do not make more than two sequential applications of any group 5 insecticide. 12-hr restricted entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	365 mL/ha (148 mL/acre)	3	Parsley only. Onion thrips larvae. Use only when populations are low. Reduction in numbers of thrips larvae may take 3–4 days. Must be tank-mixed with an adjuvant as per label instructions. See label for tank-mixing restrictions. 12-hr restricted entry interval
diamide (group 28)	cyclaniliprole	Harvanta	1.2 L/ha (0.5 L/acre)	1	Suppression. Do not make sequential applications of any group 28 insecticide after 2 consecutive applications within a 30-day period. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
CABBAGE LOOPER					
Soil Applications					
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (304 g/acre)	—	Parsley only. Early-season control. Also suppresses early-season flea beetles and reduces damage caused by beet and fall armyworm and corn earworm. Apply in-furrow or banded at planting. See label for application details. Do not use subsequent foliar group 4 or group 28 insecticides in the same season. 12-hr restricted entry interval.

Table 3–74. Parsley, Cilantro and Dillweed Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE LOOPER — Foliar Applications					
spinosyn (group 5)	spinetoram	Delegate	140–200 g/ha (57–81 g/acre)	1	Apply at egg hatch or when larvae are small. Do not make more than two sequential applications of any group 5 insecticide. 12-hr restricted entry interval.
	spinosad	Entrust	364 mL/ha (147 mL/acre)	1	Apply when larvae are small. Do not make more than two sequential applications of any group 5 insecticide. Re-entry permitted once spray deposit has dried.
		Success	182 mL/ha (74 mL/acre)	1	
avermectins/ diamides (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	370 mL/ha (150 mL/acre)	7	Also controls armyworm and two-spotted spider mite. See label for rates. Tank-mix with a non-ionic surfactant as per label instructions. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. Do not make sequential applications of any group 6 or 28 fungicides. 12-hr restricted entry interval.
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	0.3–0.6 L/ha (0.1–0.2 L/acre)	1	Parsley only. Acts primarily by ingestion. Apply when larvae are small and actively feeding. 12-hr restricted entry interval.
			0.58–1.6 L/ha (0.2–0.6 L/acre)	1	Cilantro and dillweed only. Acts primarily by ingestion. Apply when larvae are small and actively feeding. 12-hr restricted entry interval.
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i>	Dipel 2X DF	275 g/ha (111 g/acre)	0	Parsley only. Apply to small, actively feeding larvae. Use higher rate for higher infestations or larger plants. 4-hr restricted entry interval, or when spray deposits have dried.
			275–550 g/ha (111–222 g/acre)	0	Dillweed only. Apply to small, actively feeding larvae. Use higher rate for higher infestations or larger plants. 4-hr restricted entry interval, or when spray deposits have dried.
		Bioprotec Plus	0.9–1.8 L/ha (0.6–1.1 L/acre)	0	Parsley and dillweed only. Apply to small, actively feeding larvae. Use higher rate for higher infestations or larger plants. 4-hr restricted entry interval, or when spray deposits have dried.
	<i>Bacillus thuringiensis</i> , subsp. <i>aizawai</i>	XenTari WG	500–1,000 g/ha (202–405 g/acre)	0	Also controls armyworm. For best results apply in evening or on cloudy days. 4-hr restricted entry interval, or when spray deposits have dried.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Parsley only. Also controls armyworm — see label for rates. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	250–500 mL/ha (101–202 mL/acre)	1	Parsley only. High rate also controls armyworm. Use high rate under heavy pest pressure. Do not apply foliar group 28 insecticides in the same season as a soil application. See label for guidance on adjuvant use, tank-mix and crop tolerance precautions. 12-hr restricted entry interval.
	cyclaniliprole	Harvanta	0.8–1.2 L/ha (0.32–0.49 L/acre)	1	Also controls armyworm. Do not make sequential applications of any group 28 insecticide after 2 consecutive applications within a 30-day period. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
	tetraniliprole	Vayego 200 SC	225 mL/ha (91 mL/acre)	1	Suppression. Also controls imported cabbageworm, armyworm and flea beetles (see label for rates). Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.

Table 3–74. Parsley, Cilantro and Dillweed Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	1	Black cutworm only. Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
avermectins/ diamides (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	370–556 mL/ha (150–225 mL/acre)	7	Also controls armyworm and spider mites — see label for rates. Tank-mix with a non-ionic surfactant as per label instructions. Apply to smaller plants when rain is not expected within 24 hr. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. Do not make sequential applications of any group 6 or 28 fungicide. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Parsley only. Black cutworms only. Also controls armyworm — see label for rates. Apply to small plants, when no rain is forecast in the next 24 hr. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	Parsley only. Low rate also controls armyworms. Apply to small plants, when no rain is forecast in the next 24 hr. Do not apply foliar group 28 insecticides in the same season as a soil application. See label for guidance on adjuvant use, tank-mix and crop tolerance precautions. 12-hr restricted entry interval.
	tetraniliprole	Vayego 200 SC	150 mL/ha (61 mL/acre)	1	Also controls imported cabbageworm, armyworm and flea beetles. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
LEAFHOPPERS					
Soil Applications					
neonicotinoid (group 4A)	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Parsley only. Also suppresses early-season flea beetles. Apply in-furrow or banded at planting. See label for application details. Do not use subsequent foliar group 4 insecticides in the same season. 12-hr restricted entry interval.
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (304 g/acre)	—	Parsley only. Also suppresses early-season flea beetles. Apply in-furrow or banded at planting. See label for application details. Do not use subsequent foliar group 4 or group 28 insecticides in the same season. 12-hr restricted entry interval.
Foliar Applications					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	21	Parsley only. Use lower rate on young plants. 5-day restricted entry interval for high contact activities (hand harvest/pruning, irrigation), 12-hr restricted entry interval for low contact activities (scouting, hand weeding, thinning).
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Parsley only. Suppression. Do not apply foliar group 4 insecticides in the same season as a soil or transplant application. Not all herbs or herb varieties have been tested for phytotoxicity. 24-hr restricted entry interval.
not classified (group NC)	kaolin clay	Surround WP	12.5–25 kg/ha (5–10 kg/acre)	0	Parsley only. Aster leafhopper only. See label for additional rate and volume information. Surround WP forms a barrier film, which acts as a broad-spectrum protectant that may decrease damage from aster leafhoppers.

Table 3–74. Parsley, Cilantro and Dillweed Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
TARNISHED PLANT BUG					
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	210 g/ha (85 g/acre)	7	Parsley only. Reduction in damage. Do not apply foliar group 4 insecticides in the same season as a soil or transplant application. See label for rotational crop restrictions. 12-hr restricted entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	300 mL/ha (121 mL/acre)	3	Parsley only. Do not apply when crop is flowering. 12-hr restricted entry interval.
DIPTERAN LEAFMINERS					
Soil Applications					
neonicotinoid (group 4A)	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Parsley only. Also suppresses early-season flea beetles. Apply in-furrow or banded at planting. See label for application details. Do not use subsequent foliar group 4 insecticides in the same season. 12-hr restricted entry interval.
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (304 g/acre)	—	Parsley only. Also suppresses early-season flea beetles. Apply in-furrow or banded at planting. See label for application details. Do not use subsequent foliar group 4 or group 28 insecticides in the same season. 12-hr restricted entry interval.
Foliar Applications					
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	86 g/ha (35 g/acre)	7	Parsley only. Pea leafminer only. Reduction in damage. Do not apply foliar group 4 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
cyromazine (group 17)	cyromazine	Citation 75WP	188 g/ha (76 g/acre)	7	Parsley only. Pea leafminer only. Use sufficient water to achieve adequate coverage. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Parsley only. Vegetable and serpentine leafminers only. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	1–1.5 L/ha (0.4–0.6 L/acre)	1	Parsley only. Use high rate under heavy pest pressure. Do not apply foliar group 28 insecticides in the same season as a soil application. See label for guidance on adjuvant use, tank-mix and crop tolerance precautions. 12-hr restricted entry interval.
	cyclaniliprole	Harvanta	1.2 L/ha (0.5 L/acre)	1	Do not make sequential applications of any group 28 insecticide after 2 consecutive applications within a 30-day period. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.

This information is provided as a guideline only. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication. Pest control products listed in this section are not necessarily registered on all herbs. See product labels for complete information.

Some products are persistent and may carry over from year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–75. Chive Disease Control

For resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
SEED TREATMENTS					
SDHI (group 7)	penflufen	Pen 240 FS	1,043 mL/100 kg of seed	n/a	Onion smut, seed decay/damping-off (<i>Rhizoctonia</i> spp.). For import use only; do not treat seeds in Canada.
PP (group 12)	fludioxonil	Maxim 480FS	5.2–10.4 mL/100 kg seed	n/a	Seed decay, damping-off and seedling blights. For use in commercial seed treatment facilities only.
microbial (group BM02)	<i>Streptomyces</i>	Mycostop	8 g/kg seed	n/a	Fusarium damping off. Greenhouse use only. Suppression. Do not apply on seed to be planted directly in the field. See label for application instructions.
GREENHOUSE TRANSPLANT DISEASE CONTROL					
microbial (group BM02)	<i>Aureobasidium pullulans</i>	Botector	1 kg/ha (405 g/acre)	0	Suppression of botrytis gray mold. 4-hr restricted entry interval.
	<i>Bacillus subtilis</i>	Cease Biological	1–2 L/100 L water	0	Greenhouse use only. Suppression of botrytis gray mold and sclerotinia white mold.
	<i>Trichoderma harzianum</i> strain KRL-AG2	RootShield HC	55–110 g/m ³ soil	0	Greenhouse use only. Suppression of root rots caused by <i>Pythium</i> spp., <i>Rhizoctonia</i> spp. and <i>Fusarium</i> spp. Drench application to potting soil or mix. 4-hr restricted entry interval or when spray deposits have dried.
	<i>Trichoderma harzianum</i> strain KRL-AG2/ <i>Trichoderma virens</i> strain G-41	RootShield Plus G	600–1,200 g/m ³ soil	0	Greenhouse use only. Suppression of root rots and damping-off caused by <i>Pythium</i> spp., <i>Rhizoctonia</i> spp., <i>Fusarium</i> spp. and <i>Phytophthora</i>. Mix uniformly into potting soil or mix immediately before sowing seed or planting.
	<i>Trichoderma harzianum</i> strain T22	Trianium P	See label for rate and application instructions.	—	Suppression of root rots caused by <i>Fusarium oxysporum</i> and damping-off caused by <i>Pythium ultimum</i> and <i>Rhizoctonia solani</i>. Apply immediately after seeding. 4-hr restricted entry interval.
not classified (group NC)	potassium bicarbonate	MilStop	0.28–0.56 kg/1,000 m ²	0	Powdery mildew. Suppression. Not all herbs or herb varieties have been tested for phytotoxicity. 4-hr restricted entry interval.
FUNGICIDES — FIELD					
DAMPING-OFF					
microbial (group BM02)	<i>Trichoderma harzianum</i> strain T22	Trianium P	After Sowing: 1.5 g/m ² of cultivated area in 1.33 L of water After transplanting: 6 g in 1 L water Apply dilute solution at 500 L/ha.	—	Suppression of damping-off caused by <i>Rhizoctonia solani</i>. Apply immediately after seeding or transplanting. 4-hr restricted entry interval.
POWDERY MILDEW					
not classified (group NC)	potassium bicarbonate	MilStop	2.8–5.6 kg/ha (1.1–2.3 kg/acre)	0	Suppression. Not all herbs or herb varieties have been tested for phytotoxicity. 4-hr restricted entry interval.

¹ Botrytis fleck is caused by *Botrytis cinerea*, and botrytis neck rot is caused by *Botrytis allii*, which are different from botrytis leaf blight (*Botrytis squamosa*).

Table 3–75. Chive Disease ControlFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
SCLEROTINIA WHITE MOLD					
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade Opti	1.7–3.3 kg/ha (0.7–1.3 kg/acre)	0	Suppression. Sclerotinia.
BOTRYTIS LEAF BLIGHT (<i>Botrytis squamosa</i>)					
SDHI (group 7)	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.71 L/acre)	3	Also suppresses botrytis fleck caused by <i>Botrytis cinerea</i> ¹ . Do not make more than two sequential applications of any group 7 fungicide. See label for tank-mix precautions. 12-hr restricted entry interval.
SDHI/AP (group 7/9)	fluopyram/pyrimethanil	Luna Tranquility	1,200 mL/ha (486 mL/acre)	7	Suppression. Do not make sequential applications of any group 7 or group 9 fungicide. 24-hr restricted entry interval for hand thinning. 12-hr restricted entry interval for all other activities.
SDHI/QoI (group 7/11)	boscalid/pyraclostrobin	Pristine WG	1–1.3 kg/ha (0.4–0.5 kg/acre)	7	Do not make sequential applications of any group 11 fungicide or more than two sequential applications of any group 7 fungicide. 3-day restricted entry interval for thinning; for all other activities re-entry permitted once residues have dried.
AP (group 9)	pyrimethanil	Scala SC	2 L/ha (0.8 L/acre)	7	Also controls botrytis neck rot (<i>Botrytis allii</i>) ¹ . Do not make sequential applications of any group 9 fungicides. 24-hr restricted entry interval for hand thinning; 12-hr restricted entry interval for all other activities.
AP/PP (group 9/12)	cyprodinil/fludioxonil	Switch 62.5 WDG	775–975 g/ha (314–395 g/acre)	7	Do not make sequential applications of any group 9 or group 12 fungicides. 3-day restricted entry interval for hand weeding, 12-hr restricted entry interval for all other activities.
QoI/DMI (group 11/3)	azoxystrobin/difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	7	Do not make sequential applications of any group 11 or group 3 fungicides. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade Opti	1.7–2.5 kg/ha (0.7–1 kg/acre)	0	Suppression. Also suppresses botrytis neck rot (<i>Botrytis allii</i>) and botrytis fleck (<i>Botrytis cinerea</i>) ¹ — see label for rates.
	<i>Aureobasidium pullulans</i>	Botector	1 kg/ha (405 g/acre)	0	Suppression of botrytis fleck (<i>Botrytis cinerea</i>)¹ only. 4-hr restricted entry interval.
inorganic (group M1)	copper octanoate	Cueva	0.5%–2% solution, applied at 470–940 L water/ha (190–380 L/acre)	1	May cause leaf spots during excessive moisture and cold. If concerned about sensitivity of plants, apply first to small areas. 4-hr restricted entry interval.

¹ Botrytis fleck is caused by *Botrytis cinerea*, and botrytis neck rot is caused by *Botrytis allii*, which are different from botrytis leaf blight (*Botrytis squamosa*).

Table 3–75. Chive Disease ControlFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DOWNY MILDEW					
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	1–1.3 kg/ha (0.4–0.5 kg/acre)	7	Suppression. Do not make sequential applications for downy mildew. 3-day restricted entry interval for thinning, for all other activities re-entry permitted once residues have dried.
QoI (group 11)	fenamidone	Reason 500SC	400 mL/ha (162 mL/acre)	7	Suppression. Do not make sequential applications of any group 11 fungicide. Re-entry permitted once residues have dried.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	7	Do not make sequential applications of any group 11 or group 3 fungicides. 12-hr restricted entry interval.
Qil (group 21)	cyazofamid	Torrent 400 SC	200 mL/ha (81 mL/acre)	0	Do not use more than one in every three applications. Do not make sequential applications of any group 21 fungicide. Tank-mix with a non-ionic or organosilicone surfactant as per label instructions. 12-hr restricted entry interval.
phosphonate (group 33)	mono- and dibasic sodium, potassium, and ammonium phosphite	Phostrol	2.9–4.3 L/ha (1.2–1.7 L/acre)	0	Suppression. See label for tank-mix and crop tolerance information. 12-hr restricted entry interval.
Group 40 + Group 49	mandipropamid + oxathiapiprolin	Orondis Ultra	400 mL/ha (162 mL/acre)	7	Do not make more than two sequential applications of any group 40 or group 49 fungicides. Do not use more than one in every three applications. Tank-mix with a penetrating surfactant as per label instructions. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade Opti	1.7–3.3 kg/ha (0.7–1.3 kg/acre)	0	Suppression.
inorganic (group M1)	copper octanoate	Cueva	0.5%–2% solution, applied at 470–940 L solution/ha (190–380 L/acre)	1	May cause leaf spots during excessive moisture and cold. If concerned about sensitivity of plants, apply first to small areas. 4-hr restricted entry interval.

¹ Botrytis fleck is caused by *Botrytis cinerea*, and botrytis neck rot is caused by *Botrytis allii*, which are different from botrytis leaf blight (*Botrytis squamosa*).

Table 3–75. Chive Disease ControlFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PURPLE BLOTCH					
SDHI (group 7)	benzovindiflupyr	Aprovia	750 mL/ha (304 mL/acre)	7	Do not make more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	7	Do not make more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	Do not make more than two sequential applications of group 7 fungicide. See label for tank-mix precautions. 12-hr restricted entry interval.
SDHI/AP (group 7/9)	fluopyram/pyrimethanil	Luna Tranquility	1,200 mL/ha (486 mL/acre)	7	Do not make sequential applications of any group 7 or group 9 fungicides. 24-hr restricted entry interval for hand thinning; 12-hr restricted entry interval for all other activities.
SDHI/QoI (group 7/11)	boscalid/pyraclostrobin	Pristine WG	1–1.3 kg/ha (0.4–0.5 kg/acre)	7	Do not make sequential applications of any group 11 fungicide or more than two sequential applications of any group 7 fungicide. 3-day restricted entry interval for thinning; for all other activities re-entry permitted once residues have dried.
AP (group 9)	pyrimethanil	Scala SC	2 L/ha (0.8 L/acre)	7	Do not make sequential applications of any group 9 fungicides. 24-hr restricted entry interval for hand thinning; 12-hr restricted entry interval for all other activities.
AP/PP (group 9/12)	cyprodinil/fludioxonil	Switch 62.5 WDG	775–975 g/ha (314–395 g/acre)	7	Suppression. Do not make sequential applications of any group 9 or group 12 fungicides. 3-day restricted entry interval for hand weeding; 12-hr restricted entry interval for all other activities.
QoI/DMI (group 11/3)	azoxystrobin/difenoconazole	Quadris Top	710–1,000 mL/ha (287–405 mL/acre)	7	Also suppresses cladosporium leaf blotch. Do not make sequential applications of any group 11 or group 3 fungicides. 12-hr restricted entry interval.
STEMPHYLIUM LEAF BLIGHT					
SDHI (group 7)	benzovindiflupyr	Aprovia	750 mL/ha (304 mL/acre)	7	Suppression. Do not make more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	7	Suppression. Do not make more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
SDHI/AP (group 7/9)	fluopyram/pyrimethanil	Luna Tranquility	1,200 mL/ha (486 mL/acre)	7	Suppression. Do not make sequential applications of any group 7 or group 9 fungicide. 24-hr restricted entry interval for hand thinning; 12-hr restricted entry interval for all other activities.
QoI/DMI (group 11/3)	azoxystrobin/difenoconazole	Quadris Top	710–1,000 mL/ha (287–405 mL/acre)	7	Suppression. Do not make sequential applications of any group 11 or group 3 fungicides. 12-hr restricted entry interval.

¹ Botrytis fleck is caused by *Botrytis cinerea*, and botrytis neck rot is caused by *Botrytis allii*, which are different from botrytis leaf blight (*Botrytis squamosa*).

Table 3–76. Chive Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
GREENHOUSE TRANSPLANT INSECT CONTROL					
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water	0	Applying more than three times may cause plant injury. Do not spray when plants are under stress. See label for tank-mix precautions and crop tolerance information. Avoid spraying during full sun.
		Opal Insecticidal Soap	Apply dilute solution at a rate of 700–1,900 L/ha.		
fungus agents of uncertain mode of action (group UNF)	<i>Beauveria bassiana</i>	BioCeres EC	2–4 mL/L water	0	Greenhouse use only. Reduction in numbers of whiteflies, aphids and thrips. Apply 500–1,000 L spray mix/ha. Do not mix with fungicide. Control will not be apparent for 5–7 days. 4-hr restricted entry interval or when spray deposits have dried.
	<i>Beauveria bassiana</i>	BotaniGard ES	Aphids and whiteflies 0.5–1 L/400 L spray volume Thrips 2 L/400 L spray volume	0	Greenhouse use only. Aphids, whiteflies and thrips. Control may not be apparent for 7–10 days. Do not tank-mix with any other product. May cause injury on some varieties; test on a small area before use on a new variety of plant. 4-hr restricted entry interval.
INSECTICIDES — FIELD					
APHIDS					
Soil and Transplant Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	6 mL/100 m of row (1.8 mL/100 ft of row)	14	See label for application details. This product cannot be applied if the crop will produce any flowers prior to the final harvest. If there is unexpected flowering after this product has been applied, the crop should be removed to prevent damage to pollinators. Do not use subsequent foliar group 4 insecticides in the same season. Not all herbs or herb varieties have been tested for phytotoxicity. 24-hr restricted entry interval.
Foliar Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Apply post-bloom only , and only to crops that will not have any secondary flowering. Pre-bloom applications can only be made to crops that will not produce any flowers at all before the final harvest. If there is unexpected flowering after this product has been applied, the crop should be removed to prevent damage to pollinators. Do not apply foliar group 4 insecticides in the same season as a soil or transplant application. Not all herbs or herb varieties have been tested for phytotoxicity. 24-hr restricted entry interval.
not classified/ pyrethroid (group NC/3A)	potassium salts of fatty acids/ pyrethrins	Safer's Trounce	5 L/ha (2 L/acre)	1	Reduction in populations. Also reduces populations of earwigs. See label for application instructions.
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water	0	Applying more than three times may cause plant injury. Do not spray when plants are under stress. See label for tank-mix precautions and crop tolerance information. Avoid spraying during full sun.
		Opal Insecticidal Soap	Apply dilute solution at a rate of 700–1,900 L/ha (283–769 L/acre).		

Table 3–76. Chive Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
THRIPS					
spinosyn (group 5)	spinosad	Entrust	437–527 mL/ha (177–213 mL/acre)	3	Suppression. Apply at egg hatch or when larvae are small. Ensure spray solution penetrates the leaf axils. Use high rate when pest pressure is high. Do not make more than two sequential applications of any group 5 insecticide. Re-entry permitted when residues have dried.
		Success	218–262 mL/ha (88–106 mL/acre)	3	Suppression. Apply at egg hatch or when larvae are small. Ensure spray solution penetrates the leaf axils. Use high rate when pest pressure is high. Do not make more than two sequential applications of any group 5 insecticide. Re-entry permitted when residues have dried.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	365 mL/ha (148 mL/acre)	7	Onion thrips larvae. Use only when populations are low. Reduction in numbers of thrips larvae may take 3–4 days. Must be tank-mixed with an adjuvant as per label instructions. See label for tank-mix precautions. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	1–1.5 L/ha (0.4–0.6 L/acre)	1	Suppression. Use only when populations are low. Do not apply foliar group 28 insecticides in the same season as a soil application. See label for guidance on adjuvant use, tank-mix and crop tolerance precautions. 12-hr restricted entry interval.
CABBAGE LOOPER, CUTWORM					
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	1	Black cutworm only. Also reduction in damage from wireworm. See label for application details. Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i> , subsp. <i>aizawai</i>	XenTari WG	500–1,000 g/ha (202–405 g/acre)	0	Cabbage looper only. Also controls armyworm. For best results apply in evening or on cloudy days. 4-hr restricted entry interval, or when spray deposits have dried.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Black cutworm only. Apply to small plants, when no rain is forecast in the next 24 hr. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
LEEK MOTH					
spinosyn (group 5)	spinosad	Entrust	437–527 mL/ha (177–213 mL/acre)	3	Suppression. Apply 1 week after peak pheromone trap capture. Ensure spray solution penetrates the leaf axils. Do not make more than two sequential applications of group 5 insecticides. Re-entry permitted when residues have dried.
		Success	218–262 mL/ha (88–106 mL/acre)	3	
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i>	Bioprotec Plus	0.9–1.8 L/ha (0.6–1.1 L/acre)	0	Suppression. Apply 7–10 days after peak pheromone capture. 4-hr restricted entry interval, or when spray deposits have dried.
	<i>Bacillus thuringiensis</i> , subsp. <i>aizawai</i>	XenTari WG	500–1,000 g/ha (203–405 g/acre)	0	For best results apply in evening or on cloudy days. 4-hr restricted entry interval, or when spray deposits have dried.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Suppression. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.

Table 3–76. Chive Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFHOPPERS					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Suppression. Apply post-bloom only , and only to crops that will not have any secondary flowering. Pre-bloom applications can only be made to crops that will not produce any flowers at all before the final harvest. If there is unexpected flowering after this product has been applied, the crop should be removed to prevent damage to pollinators. Do not apply foliar group 4 insecticides in the same season as a soil or transplant application. Not all herbs or herb varieties have been tested for phytotoxicity. 24-hr restricted entry interval.

This information is provided as a guideline only. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication. Pest control products listed in this section are not necessarily registered on all herbs. See product labels for complete information.

Some products are persistent and may carry over from year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–77. Balm, Basil, Lavender, Marjoram/Oregano, Rosemary, Sage, Savory, Tarragon and Thyme Disease and Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between pest control products from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
SEED TREATMENTS					
PP (group 12)	fludioxonil	Maxim 480FS	5.2–10.4 mL/100 kg seed	n/a	Basil, lavender, marjoram, rosemary, sage, tarragon and thyme only. Seed decay, damping-off and seedling blights. For use in commercial seed treatment facilities only.
microbial (group BM02)	<i>Streptomyces</i>	Mycostop	8 g/kg seed	n/a	Fusarium damping off. Greenhouse use only. Suppression. Do not apply on seed to be planted directly in the field. See label for application instructions.
GREENHOUSE TRANSPLANT DISEASE CONTROL					
Oil (group 21)	cyazofamid	Torrent 400SC	0.2–0.22 L/ha (80–89 mL/acre)	0	Basil only. Downy mildew. Tank-mix with a non-ionic surfactant as per label instructions. Do not make sequential applications. Do not use more than one in every three applications. 12-hr restricted entry interval.
phosphonate (group 33)	mono- and di-potassium salts of phosphorous acid	Confine Extra	3–5 L/ha (1.2–2 L/acre)	1	Basil only. Suppression of downy mildew and pythium root rot. See label for tank-mix and crop tolerance information. May be applied as foliar sprays or through sprinkler irrigation. Re-entry to greenhouse permitted after spray mist has cleared and treated surface is dry.
		Rampart	Foliar spray: 3–8 L/ha (1.2–3.2 L/acre) Drench: 5–7 L/ha (2.0–2.8 L/acre)	0	Basil only. Suppression of downy mildew and pythium root rot. Greenhouse use only. May be applied as foliar sprays or drench. Use foliar spray only for downy mildew. Do not apply to plants that are dormant or heat or moisture stressed. Do not apply within 20 days of copper-based compounds. See label for details. 4-hr restricted entry interval.
	mono- and dibasic sodium, potassium and ammonium phosphites	Phostrol	2.9–5.8 L/ha (1.2–2.3 L/acre)	0	Basil only. Suppression of downy mildew and pythium root rot. Greenhouse use only. See label for tank-mix and crop tolerance information. May be applied as foliar sprays or through sprinkler irrigation. 12-hr restricted entry interval.

Table 3–77. Balm, Basil, Lavender, Marjoram/Oregano, Rosemary, Sage, Savory, Tarragon and Thyme Disease and Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between pest control products from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
GREENHOUSE TRANSPLANT DISEASE CONTROL (continued)					
CAA (group 40)	mandipropamid	Revus	583 mL/ha (236 mL/acre)	1	Basil only. Downy mildew. Tank-mix with a non-ionic surfactant as per label instructions. Do not make sequential applications of any group 40 fungicide. 12-hr restricted entry interval.
CAA/OSBPI (group 40/49)	mandipropamid/oxathiapiprolin	Orondis Ultra	600 mL/ha (243 mL/acre)	1	Basil only. Downy mildew. Do not use more than one in every three applications. Do not make sequential applications of group 40 or 49 fungicides. 12-hr restricted entry interval.
benzamide (group 43)	fluopicolide	Presidio	292 mL/ha (118 mL/acre)	1	Basil only. Downy mildew. Must be tank-mixed with another downy mildew fungicide as per label instructions. Do not make sequential applications 12-hr restricted entry interval.
microbial (group BMO2)	<i>Aureobasidium pullulans</i>	Botector	1 kg/ha (405 g/acre)	0	Suppression of botrytis gray mold. 4-hr restricted entry interval.
	<i>Bacillus subtilis</i>	Cease Biological	1–2 L/100 L water	0	Balm, basil, lavender, rosemary, sage, savory and thyme only. Greenhouse use only. Suppression of botrytis gray mold and sclerotinia white mold.
	<i>Trichoderma harzianum</i> strain KRL-AG2	RootShield HC	55–110 g/m ³ soil	0	Greenhouse use only. Suppression of root rots caused by <i>Pythium</i> spp., <i>Rhizoctonia</i> spp. and <i>Fusarium</i> spp. Drench application to potting soil or mix. 4-hr restricted entry interval or when spray deposits have dried.
	<i>Trichoderma harzianum</i> strain KRL-AG2/ <i>Trichoderma virens</i> strain G-41	RootShield Plus G	600–1,200 g/m ³ soil	0	Greenhouse use only. Suppression of root rots and damping-off caused by <i>Pythium</i> spp., <i>Rhizoctonia</i> spp., <i>Fusarium</i> spp. and <i>Phytophthora</i>. Mix uniformly into potting soil or mix immediately before sowing seed or planting.
	<i>Trichoderma harzianum</i> strain T22	Triatum P	See label for rate and application instructions.	—	Suppression of root rots caused by <i>Fusarium oxysporum</i> and damping-off caused by <i>Pythium ultimum</i> and <i>Rhizoctonia solani</i>. Apply immediately after seeding. 4-hr restricted entry interval.
not classified (group NC)	potassium bicarbonate	MilStop	0.28–0.56 kg/1,000 m ²	0	Suppression of powdery mildew. Not all herbs or herb varieties have been tested for phytotoxicity. 4-hr restricted entry interval.
	<i>Gliocladium catenulatum</i>	Prestop	Refer to label for rates and application instructions.	—	Basil and thyme only. Greenhouse use only. Suppression of damping-off caused by <i>Pythium</i> spp. and <i>Rhizoctonia solani</i>. Growing media or soil drench application. Do not tank-mix with any fungicides, insecticides, herbicides or adjuvants. 4-hr restricted entry for foliar applications.

Table 3–77. Balm, Basil, Lavender, Marjoram/Oregano, Rosemary, Sage, Savory, Tarragon and Thyme Disease and Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between pest control products from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
GREENHOUSE TRANSPLANT INSECT CONTROL					
Bacillus thuringiensis (group 11A)	Bacillus thuringiensis	Bioprotec Plus	1 L /1,000 L water	0	Duponchelia fovealis. 4-hr restricted entry interval or when spray deposits have dried.
		Dipel 2X DF	625 g/1,000 L water	0	Duponchelia fovealis. 4-hr restricted entry interval or when spray deposits have dried.
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water	0	Applying more than three times may cause plant injury. Do not spray when plants are under stress. See label for tank-mix precautions and crop tolerance information. Avoid spraying during full sun.
		Opal Insecticidal Soap	Apply dilute solution at a rate of 700–1,900 L/ha.		
fungal agents of uncertain mode of action (group UNF)	Beauveria bassiana	BioCeres EC	2–4 mL/L water	0	Greenhouse use only. Reduction in numbers of whiteflies, aphids and thrips. Apply 500–1,000 L spray mix/ha. Do not mix with fungicide. Control will not be apparent for 5–7 days. 4-hr restricted entry interval or when spray deposits have dried.
		BotaniGard ES	Aphids and whiteflies 0.5–1 L/400 L spray volume Thrips 2 L/400 L spray volume	0	Greenhouse use only. Aphids, whiteflies and thrips. Control may not be apparent for 7–10 days. Do not tank-mix with any other product. May cause injury on some varieties; test on a small area before use on a new variety of plant. 4-hr restricted entry interval.
FUNGICIDES — FIELD					
DAMPING-OFF					
microbial (group BM02)	Trichoderma harzianum strain T22	Trianum P	After Sowing: 1.5 g/m² of cultivated area in 1.33 L of water	—	Suppression of damping-off caused by Rhizoctonia solani. Apply immediately after seeding or transplanting. 4-hr restricted entry interval.
			After transplanting: 6 g in 1 L water Apply dilute solution at 500 L/ha.		
POWDERY MILDEW					
not classified (group NC)	potassium bicarbonate	MilStop	2.8–5.6 kg/ha (1.1–2.3 kg/acre)	0	Suppression. Not all herbs or herb varieties have been tested for phytotoxicity. 4-hr restricted entry interval.
SCLEROTINIA WHITE MOLD AND BOTRYTIS GRAY MOLD					
microbial (group BM02)	Bacillus subtilis	Serenade Opti	1.7–3.3 kg/ha (0.7–1.3 kg/acre)	0	Balm, basil, lavender, rosemary, sage, savory and thyme only. Suppression.
	Aureobasidium pullulans	Botector	1 kg/ha (405 g/acre)	0	Suppression of botrytis only. 4-hr restricted entry interval

Table 3–77. Balm, Basil, Lavender, Marjoram/Oregano, Rosemary, Sage, Savory, Tarragon and Thyme Disease and Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between pest control products from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BASIL DOWNY MILDEW					
Qol (group 11)	fenamidone	Reason 500 SC	400 mL/ha (162 mL/acre)	2	Basil only. Begin applications as soon as crop or environmental conditions favour disease development. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
Qil (group 21)	cyazofamid	Torrent 400SC	0.2–0.22 L/ha (80–89 mL/acre)	0	Basil only. Tank-mix with a non-ionic or organosilicone surfactant as per label instructions. Do not make sequential applications. Do not use more than one in every three applications. 12-hr restricted entry interval.
phosphonate (group 33)	mono- and di-potassium salts of phosphorous acid	Confine Extra	3–5 L/ha (1.2–2 L/acre)	1	Basil only. Suppression. See label for tank-mix and crop tolerance information. May be applied as foliar sprays or through sprinkler irrigation. Re-entry permitted once spray deposits have dried.
CAA (group 40)	mandipropamid	Revus	583 mL/ha (236 mL/acre)	1	Basil only. Tank-mix with a non-ionic surfactant as per label instructions. Do not make sequential applications of any group 40 fungicide. 12-hr restricted entry interval.
CAA/OSBPI (group 40/49)	mandipropamid/oxathiapiprolin	Orondis Ultra	600 mL/ha (243 mL/acre)	1	Basil only. Do not use more than one in every three applications. Do not make sequential applications. 12-hr restricted entry interval.
benzamide (group 43)	fluopicolide	Presidio	292 mL/ha (118 mL/ha)	1	Basil only. Must be tank-mixed with another downy mildew fungicide as per label instructions. Do not make sequential applications. 12-hr restricted entry interval.
INSECTICIDES — FIELD					
APHIDS					
Soil and Transplant Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	6 mL/100 m of row (1.8 mL/100 ft of row)	14	Balm, marjoram/oregano, sage, savory, tarragon and thyme only. See label for application details. This product cannot be applied if the crop will produce any flowers prior to the final harvest. If there is unexpected flowering after this product has been applied, the crop should be removed to prevent damage to pollinators. Do not use subsequent foliar group 4 insecticides in the same season. Not all herbs or herb varieties have been tested for phytotoxicity. 24-hr restricted entry interval.
Foliar Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Balm, basil, marjoram/oregano, sage, savory, tarragon and thyme only. Apply post-bloom only, and only to crops that will not have any secondary flowering. Pre-bloom applications can only be made to crops that will not produce any flowers at all before the final harvest. If there is unexpected flowering after this product has been applied, the crop should be removed to prevent damage to pollinators. Do not apply foliar group 4 insecticides in the same season as a soil or transplant application. Not all herbs or herb varieties have been tested for phytotoxicity. 24-hr restricted entry interval.
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap Opal Insecticidal Soap	8 L in 400 L of water Apply dilute solution at a rate of 700–1,900 L/ha (283–769 L/acre).	0	Applying more than three times may cause plant injury. Do not spray when plants are under stress. See label for tank-mix precautions and crop tolerance information. Avoid spraying during full sun.
not classified/pyrethroid (group NC/3A)	potassium salts of fatty acids/pyrethrins	Safer's Trounce	5 L/ha (2 L/acre)	1	Reduction in populations. Also reduces populations of earwigs. See label for application instructions.

Table 3–77. Balm, Basil, Lavender, Marjoram/Oregano, Rosemary, Sage, Savory, Tarragon and Thyme Disease and Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between pest control products from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
THRIPS					
spinosyn (group 5)	spinetoram	Delegate	200–280 g/ha (81–113 g/acre)	1	Basil only. Suppression. Apply at egg hatch or when larvae are small. Do not make more than two sequential applications of any group 5 insecticide. 12-hr restricted entry interval.
	spinosad	Entrust	364 mL/ha (147 mL/acre)	1	Basil only. Suppression. Apply at egg hatch or when larvae are small. Ensure spray solution penetrates the leaf axils. Use high rate when pest pressure is high. Do not make more than two sequential applications of any group 5 insecticide. Re-entry permitted when residues have dried.
MITES					
bifenazate (group 20D)	bifenazate	Acramite 50WS	851 g/ha (344 g/acre)	3	Basil only. Two-spotted spider mite only. 12-hr restricted entry interval.
			851 g/ha (344 g/acre)	7	Balm, lavender, marjoram/oregano, rosemary, sage, savory, tarragon and thyme only. Two-spotted spider mite only. 12-hr restricted entry interval.
not classified/ pyrethroid (group NC/3A)	potassium salts of fatty acids/ pyrethrins	Safer's Trounce	5 L/ha (2 L/acre)	1	Reduction in populations. Also reduces populations of earwigs. See label for application instructions and rates.
CABBAGE LOOPER					
spinosyn (group 5)	spinetoram	Delegate	140–200 g/ha (57–81 g/acre)	1	Basil only. Apply at egg hatch or when larvae are small. Do not make more than two sequential applications of any group 5 insecticide. 12-hr restricted entry interval.
	spinosad	Entrust	364 mL/ha (147 mL/acre)	1	Basil only. Apply when larvae are small. Do not make more than two sequential applications of any group 5 insecticide. Re-entry permitted once residues have dried.
		Success	182 mL/ha (74 mL/acre)	1	
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	0.58–1.6 L/ha (0.2–0.6 L/acre)	1	Also controls armyworm. Acts primarily by ingestion. Apply when larvae are small and actively feeding. 12-hr restricted entry interval.
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i>	Dipel 2X DF	275–550 g/ha (111–223 g/acre)	0	Basil only. Apply to small, actively feeding larvae. Use higher rate for higher infestations or larger plants. 4-hr restricted entry interval, or when spray deposits have dried.
		Bioprotec Plus	0.9–1.8 L/ha (0.6–1.1 L/acre)	0	Basil only. Apply to small, actively feeding larvae. Use higher rate for higher infestations or larger plants. 4-hr restricted entry interval or when spray deposits have dried.
	<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i>	XenTari WG	500–1,000 g/ha (202–405 g/acre)	0	Also controls armyworm. For best results apply in evening or on cloudy days. 4-hr restricted entry interval or when spray deposits have dried.

This information is provided as a guideline only. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication. Pest control products listed in this section are not necessarily registered on all herbs. See product labels for complete information.

Some products are persistent and may carry over from year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–78. Mint Disease and Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between pest control products from different chemical groups.
See *Resistance Management* in Chapter 1.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
GREENHOUSE TRANSPLANT DISEASE CONTROL					
microbial (group BMO2)	<i>Aureobasidium pullulans</i>	Botector	1 kg/ha (405 g/acre)	0	Suppression of botrytis gray mold. 4-hr restricted entry interval.
not classified (group NC)	potassium bicarbonate	MilStop	0.28–0.56 kg/ 1,000 m ²	0	Suppression of powdery mildew. Not all herbs or herb varieties have been tested for phytotoxicity. 4-hr restricted entry interval.
GREENHOUSE TRANSPLANT INSECT CONTROL					
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water Apply dilute solution at a rate of 700–1,900 L/ha (283–769 L/acre).	0	Applying more than three times may cause plant injury. Do not spray when plants are under stress. See label for tank-mix precautions and crop tolerance information. Avoid spraying during full sun.
FUNGICIDES — FIELD					
POWDERY MILDEW AND RUST					
QoI/DMI (group 11/3)	azoxystrobin/ propiconazole	Quilt Fungtion	1 L/ha (0.4 L/acre)	7	Begin applications when plants are 5–10 cm (2–4 in.) high or conditions favour disease development. Do not make sequential applications of any group 11 or group 3 fungicides. 12-hr restricted entry interval.
not classified (group NC)	potassium bicarbonate	MilStop	2.8–5.6 kg/ha (1.1–2.3 kg/acre)	0	Suppression. Powdery mildew only. Not all herbs or herb varieties have been tested for phytotoxicity. 4-hr restricted entry interval.
BOTRYTIS GRAY MOLD					
microbial (group BMO2)	<i>Aureobasidium pullulans</i>	Botector	1 kg/ha (405 g/acre)	0	Peppermint and spearmint. Suppression of botrytis. 4-hr restricted entry interval.
INSECTICIDES — FIELD					
APHIDS					
Foliar Applications					
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (48–65 g/acre)	7	Peppermint and spearmint. Use high rate on high populations or dense foliage. 12-hr restricted entry interval.
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water Apply dilute solution at a rate of 700–1,900 L/ha (283–769 L/acre).	0	Applying more than three times may cause plant injury. Do not spray when plants are under stress. See label for tank-mix precautions and crop tolerance information. Avoid spraying during full sun.

Table 3–78. Mint Disease and Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
 For resistance management, rotate between pest control products from different chemical groups.
 See *Resistance Management* in Chapter 1.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label n/a = not applicable, seed treatment

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
THRIPS					
spinosyn (group 5)	spinetoram	Delegate	200–280 g/ha (81–113 g/acre)	7	Suppression. Apply at egg hatch or when larvae are small. Do not make more than two sequential applications of any group 5 insecticide. 12-hr restricted entry interval.
MITES					
bifenazate (group 20D)	bifenazate	Acramite 50WS	851 g/ha (344 g/acre)	7	Two-spotted spider mite only. 12-hr restricted entry interval.
tetronic and tetramic acid derivatives (group 23)	spiromesifen	Oberon Flowable	600–880 mL/ha (243–356 mL/acre)	7	Mint bud mite only. Apply before mite populations begin to build. Slow activity; control may not be apparent for 2–3 weeks. An adjuvant may be used to improve coverage. See label for details. 12-hr restricted entry interval.
			500–600 mL/ha (202–243 mL/acre)	7	Two-spotted spider mite only. Apply before mite populations begin to build. Slow activity; control may not be apparent for 2–3 weeks. An adjuvant may be used to improve coverage. See label for details. 12-hr restricted entry interval.
CABBAGE LOOPER					
spinosyn (group 5)	spinetoram	Delegate	140–200 g/ha (57–81 g/acre)	7	Apply at egg hatch or when larvae are small. Do not make more than two sequential applications of any group 5 insecticide. 12-hr restricted entry interval.
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i>	Dipel 2X DF	275–550 g/ha (111–223 g/acre)	0	Apply to small, actively feeding larvae. Use higher rate for higher infestations or larger plants. 4-hr restricted entry interval, or when spray deposits have dried.
		Bioprotec Plus	0.9–1.8 L/ha (0.6–1.1 L/acre)	0	Apply to small, actively feeding larvae. Use higher rate for higher infestations or larger plants. 4-hr restricted entry interval or when spray deposits have dried.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	3	Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.

HORSERADISH

In this section:
Table 3–79. Activity of Fungicides and Insecticides on Horseradish Diseases and Insects

Table 3–80. Horseradish Disease Control

Table 3–81. Horseradish Insect Control — Aphids, Flea Beetles

Table 3–82. Horseradish Insect Control — Leaf-Eating Caterpillars, Cutworms

This information is provided as a guideline only. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication. See product labels for complete information.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–79. Activity of Fungicides and Insecticides on Horseradish Diseases and Insects

LEGEND: C = control S = suppression RD = reduction in damage
 SC = some control of this pest may be expected when the product is used to control labelled pests
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Alternaria	Cercospora	White Rust	Powdery Mildew	Botrytis Gray Mold	Rhizoctonia	Aphids	Flea Beetles	Leaf-Eating Caterpillars	Cutworms	Leafhoppers	Cabbage Maggot
FUNGICIDES													
fluxapyroxad	Sercadis	S	—	—	C	—	—	—	—	—	—	—	—
penthiopyrad	Fontelis	—	—	—	C	C	—	—	—	—	—	—	—
pydiflumetofen/difenoconazole	Miravis Duo	C	—	—	C	—	—	—	—	—	—	—	—
fluopyram/trifloxystrobin	Luna Sensation	C	—	—	C	—	—	—	—	—	—	—	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	—	—	C	—	—	—	—	—	—	—
pyraclostrobin	Cabrio EG	C	C	SC	C	—	—	—	—	—	—	—	—
azoxystrobin	Quadris Flowable	—	—	SC	—	—	C	—	—	—	—	—	—
	Azoshy 250 SC	—	—	SC	—	—	C	—	—	—	—	—	—
trifloxystrobin	Flint	C	—	—	—	—	—	—	—	—	—	—	—
INSECTICIDES													
carbaryl	Sevin XLR	—	—	—	—	—	—	—	C	C	—	C	—
permethrin	Perm-UP	—	—	—	—	—	—	—	C	—	—	—	—
	Pounce 384EC	—	—	—	—	—	—	—	C	—	—	—	—
imidacloprid	Admire 240 F	—	—	—	—	—	—	C	C	—	—	C/S ¹	—
thiamethoxam	Actara 25WG	—	—	—	—	—	—	C	—	—	—	C	—
sulfoxaflor	Closer	—	—	—	—	—	—	C	—	—	—	C	—
flupyradifurone	Sivanto Prime	—	—	—	—	—	—	C	—	—	—	C	—
spinetoram	Delegate WG	—	—	—	—	—	—	—	S	C	—	—	—
spinosad	Entrust	—	—	—	—	—	—	—	S	C	—	—	—
	Scorpio Ant and Insect Bait	—	—	—	—	—	—	—	—	—	C	—	—
	Success	—	—	—	—	—	—	—	S	C	—	—	—
<i>Bacillus thuringiensis</i>	XenTari WG	—	—	—	—	—	—	—	—	C	—	—	—
chlorantraniliprole	Coragen	—	—	—	—	—	—	—	—	C	C	—	—
cyantraniliprole	Exirel	—	—	—	—	—	—	C	C	C	C	—	—
	Verimark	—	—	—	—	—	—	—	RD	—	—	—	C
flonicamid	Beleaf 50SG	—	—	—	—	—	—	C	—	—	—	—	—

¹ Level of control for leafhoppers depends on application method.

Table 3–80. Horseradish Disease ControlFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ALTERNARIA, CERCOSPORA					
SDHI (group 7)	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	7	Suppression. Also controls powdery mildew. Do not make more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.40 L/acre)	7	Also controls powdery mildew. Do not make more than two sequential applications of any group 3 or group 7 fungicide. 12-hr restricted entry interval.
SDHI/QoI (group 7/11)	fluopyram/ trifloxystrobin	Luna Sensation	300–500 mL/ha (121–202 mL/acre)	7	Do not make sequential applications of any group 11 or more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
QoI (group 11)	pyraclostrobin	Cabrio EG	0.56–1.1 kg/ha (226–445 g/acre)	3	Alternaria. Do not make sequential applications of any group 11 fungicide. 3-day restricted entry interval for hand harvesting. 12-hr restricted entry interval for all other activities.
			0.56–0.84 kg/ha (226–340 g/acre)	3	Cercospora. Do not make sequential applications of any group 11 fungicide. 3-day restricted entry interval for hand harvesting. 12-hr restricted entry interval for all other activities.
	trifloxystrobin	Flint	140–210 g/ha (57–85 g/acre)	7	Alternaria. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
BOTRYTIS GRAY MOLD					
SDHI (group 7)	penthiopyrad	Fontelis	1–1.75 L/ha (0.4–0.7 L/acre)	0	Also controls powdery mildew. Do not make more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
AP/PP (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	7	12-hr restricted entry interval.
RHIZOCTONIA — ROOT ROT, CROWN ROT, STEM CANKER					
QoI (group 11)	azoxystrobin	Quadris Flowable	4–6 mL/100 m of row (1.2–1.8 mL/100 ft of row)	40	See label for application details. 12-hr restricted entry interval.
		Azoshy 250 SC			
microbial (group BMO2)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Suppression only. Root rots caused by <i>Rhizoctonia solani</i>, <i>Pythium</i> spp. and <i>Fusarium</i> spp. See label for application details.

Table 3–81. Horseradish Insect Control — Aphids, Flea Beetles

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.

LEGEND: PHI = Pre-Harvest Interval (in days)					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
Soil Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.6 mL/100 ft of row)	21	Do not use subsequent foliar group 4 insecticides in the same season. 24-hr restricted entry interval.
Foliar Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Do not apply a foliar group 4 insecticide in the same season as a soil application. 24-hr restricted entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Do not apply a foliar group 4 insecticide in the same season as a soil application. 12-hr restricted entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–61 mL/acre)	7	Do not apply a foliar group 4 insecticide in the same season as a soil application. 12-hr restricted entry interval.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	7	12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	7	Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	3	12-hr restricted entry interval.
FLEA BEETLES					
Soil Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.6 mL/100 ft of row)	21	Do not use subsequent foliar group 4 insecticides in the same season. 24-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Verimark	6.75–9 mL/100 m of row (2.1–2.7 mL/100 ft of row)	21	Early season damage reduction. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
Foliar Applications					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	7	Also controls leafhoppers. See label for restricted entry intervals.
pyrethroid (group 3A)	permethrin	Perm-UP	180 mL/ha (73 mL/acre)	2	12-hr restricted entry interval.
		Pounce 384EC			
spinosyn (group 5)	spinetoram	Delegate WG	200 g/ha (80 g/acre)	3	Suppression. 12-hr restricted entry interval.
	spinosad	Entrust	364 mL/ha (146 mL/acre)	3	Suppression. Re-entry permitted once spray deposit has dried.
		Success	182 mL/ha (74 mL/acre)	3	
diamide (group 28)	cyantraniliprole	Exirel	500–1,000 mL/ha (202–405 mL/acre)	7	Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.

Table 3–82. Horseradish Insect Control — Leaf-Eating Caterpillars, Cutworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAF-EATING CATERPILLARS (IMPORTED CABBAGEWORM, CABBAGE LOOPER, DIAMONDBACK MOTH)					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5–5.25 L/ha (1–2.1 L/acre)	7	Imported cabbage worm and diamondback moth. See label for restricted entry intervals.
spinosyn (group 5)	spinetoram	Delegate WG	140–200 g/ha (57–81 g/acre)	3	12-hr restricted entry interval.
	spinosad	Entrust	364 mL/ha (147 mL/acre)	3	Re-entry permitted once spray deposit has dried.
		Success	182 mL/ha (74 mL/acre)	3	
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i>	XenTari WG	500–1000 g/ha (202–405 g/acre)	0	12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Also controls swede midge. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	250–500 mL/ha (101–202 mL/acre)	7	Cabbage looper. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
CUTWORMS					
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	3	Black cutworm. Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Black and variegated cutworm. Use low rate for black cutworm. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–306 mL/acre)	7	Variegated cutworm. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.

LETTUCE AND ENDIVE

For information on parsley, see *Herbs* section.

In this section:

Table 3–83.	Lettuce and Endive Seed Treatments
Table 3–84.	Activity of Fungicides on Lettuce and Endive Diseases
Table 3–85.	Lettuce and Endive Disease Control — Damping-Off, Botrytis Gray Mold, Lettuce Drop
Table 3–86.	Lettuce and Endive Disease Control — Downy Mildew
Table 3–87.	Activity of Insecticides on Lettuce and Endive Insects
Table 3–88.	Lettuce and Endive Insect Control — Aphids
Table 3–89.	Lettuce and Endive Insect Control — Cutworms, Tarnished Plant Bug
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Table 3–91.	Lettuce and Endive Insect Control — Leafminers
Table 3–92.	Lettuce and Endive Insect Control — Cabbage Looper

This information is provided as a guideline only. See product labels for complete information.

Listed products are not necessarily registered on head lettuce, leaf lettuce and/or endive.

See the most up-to-date product label to ensure registration on a specific crop.

Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–83. Lettuce and Endive Seed Treatments

Group Name (Group #)	Common Name	Trade Name	Rate	Pests Controlled ¹	Notes
FUNGICIDES					
phenylamide (group 4)	metalaxyl-M and S-isomer	Ridomil Gold 1G	25 kg/treated ha (10 kg/treated acre)	damping-off (<i>Pythium</i>)	Head lettuce only. Apply with seed in-furrow. Use 115 g/100 m of row. Do not use on soils with less than 2% organic matter. Do not use on transplants.
		Apron XL LS	20–40 mL/100 kg seed	damping-off (<i>Pythium</i>)	Head and leaf lettuce and endive. For use in commercial seed treatment facilities. Not for use on greenhouse lettuce.
Qol (group 11)	azoxystrobin	Dynasty 100FS	25–50 mL/100 kg of seed	damping-off (<i>Rhizoctonia solani</i>)	Head and leaf lettuce and endive. For import use only; do not treat seeds in Canada.
dithiocarbamate (group M3)	thiram	Thiram 75 WP	90 g/25 kg of seed	seed decay, seedling blight, damping-off	Lettuce only. Seed box or commercial seed treatment.
INSECTICIDES					
neonicotinoid (group 4A)	clothianidin/imidacloprid	Sepresto 75 WS	1.06 g/1,000 seed	aphids, leafminer	Head and leaf lettuce. Suppression. For import use only; do not treat seeds in Canada. Commercial retail only. Do not use any subsequent soil, transplant or foliar applications of any group 4 insecticide in the same season.

¹ For damping-off and root rots, see also greenhouse applications in Table 3–85. *Lettuce and Endive Disease Control — Damping-Off, Botrytis Gray Mold, Lettuce Drop.*

Table 3–84. Activity of Fungicides on Lettuce and Endive Diseases

LEGEND: C = control S = suppression RD = reduction in damage
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Damping-Off/Root Rot	Botrytis Gray Mold	Downy Mildew	Lettuce Drop	Powdery Mildew
metalaxyl-M and S-isomer/mancozeb	Ridomil Gold MZ 68WG	—	—	C	—	—
boscalid	Cantus WDG	—	C	—	S	—
fluxapyroxad	Sercadis	—	—	—	C	—
penthiopyrad	Fontelis	—	C	—	S	—
fluopyram/trifloxystrobin	Luna Sensation	—	—	—	C	C
pydiflumetofen/fludioxonil	Miravis Prime	—	C	—	C	—
isofetamid	Kenja 400SC	—	—	—	C	—
polyoxin D zinc salt	Diplomat 5SC	—	—	S	—	—
quinoxifen	Quintec	—	—	—	—	C
cyazofamid	Torrent 400SC	C	—	S	—	—
fosetyl-AL	Aliette WDG	—	—	C	—	—
mono- and dibasic sodium, potassium and ammonium phosphites	Phostrol	—	—	C	—	—
mono- and di-potassium salts of phosphorous acid	Confine Extra	—	—	S	—	—
dimethomorph	Acrobat 50 WP	—	—	S	—	—
mandipropamid	Revus	—	—	C	—	—
mandipropamid/oxathiapiprolin	Orondis Ultra	—	—	C	—	—
fluopicolide	Presidio	—	—	C	—	—
<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	—	—	S	S	—
<i>Bacillus subtilis</i>	Serenade Opti	—	S	S	S	S
	Serenade SOIL	S	—	—	—	—
<i>Gliocladium catenulatum</i>	Prestop	S	—	—	—	—
ametoctradin/dimethomorph	Zampro	—	—	C	—	—
ferbam	Ferbam 76 WDG	—	C	—	—	—
hydrogen peroxide/peroxyacetic acid	OxiDate 2.0	—	—	S	—	—
<i>Coniothyrium minitans</i>	Contans WG	—	—	—	S	—
<i>Trichoderma harzianum</i>	Rootshield HC	S	S	—	—	—
<i>Aureobasidium pullulans</i>	Botector	—	S	—	—	—
<i>Bacillus subtilis</i> var. <i>amyloliquefaciens</i> strain FZB26	Taegro 2 Biofungicide	S ¹	—	RD	S	—
<i>Trichoderma harzianum</i> Rifai strain T22	Triatum P	S ¹	—	—	—	—

¹ Post emergence damping off or bottom rot caused by *Rhizoctonia solani*.

Table 3–85. Lettuce and Endive Disease Control — Damping-Off, Botrytis Gray Mold, Lettuce DropFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DAMPING-OFF/ROOT ROT					
Greenhouse Application					
Qil (group 21)	cyazofamid	Torrent 400SC	30 mL/100 L water	40	For use on greenhouse lettuce transplants for field production. Damping-off and root rot caused by <i>Pythium</i> spp. Make a single application as a soil drench to thoroughly wet the growing medium immediately after seeding. Do not use any surfactant with drench applications. 12-hr restricted entry interval.
not classified (group NC)	<i>Gliocladium catenulatum</i>	Lalstop G46 WG	Refer to label for rates and application instructions.	—	For lettuce greenhouse transplants only. Suppression. Damping-off caused by <i>Rhizoctonia</i> spp. and <i>Pythium</i> spp. Do not tank-mix with any fungicides, insecticides, herbicides or adjuvants. Apply as a growing media or soil drench application.
not classified (group NC)	<i>Trichoderma harzianum</i> Rifai strain KRL-AG2 and <i>Trichoderma virens</i> strain G-41	RootShield Plus WP	30–60 g in 100 L of water applied to 10 m ² of soil	—	Head and leaf lettuce and endive. Suppression. Root diseases caused by <i>Rhizoctonia</i> spp., <i>Pythium</i> spp. and <i>Fusarium</i> spp. Drench application to potting mix, soil or planting beds. 4-hr restricted entry interval.
Field Application					
microbial (group BMO2)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Lettuce only. Suppression. Damping-off caused by <i>Rhizoctonia solani</i>. Root rots caused by <i>Rhizoctonia solani</i> and <i>Pythium</i> spp. May be applied at planting and/or post-planting. See label for application instructions. For broadcast or banded applications, incorporate into the seed zone with rainfall or overhead irrigation within 24 hr.
not classified (group NC)	<i>Bacillus subtilis</i> var. <i>amyloliquefaciens</i> strain FZB26	Taegro 2 Biofungicide	190 g/ha (77 g/acre)	0	Lettuce only. Suppression. Drench application. Continue applications at 7-day intervals when conditions are conducive to disease development.
	<i>Trichoderma harzianum</i> Rifai strain T22	Triatum P	1.5 g/m ² of cultivated area, suspended in 2.5–5 L of water	—	Lettuce only. Suppression. Damping-off caused by <i>Rhizoctonia solani</i>. Root rots caused by <i>Rhizoctonia solani</i> and <i>Pythium</i> spp. 4-hr restricted entry interval.

Table 3–85. Lettuce and Endive Disease Control — Damping-Off, Botrytis Gray Mold, Lettuce DropFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BOTRYTIS GRAY MOLD					
Greenhouse-Grown Seedlings					
dithiocarbamate (group M3)	ferbam	Ferbam 76 WDG	2 kg/1,000 L water	—	Lettuce only. Spray seedlings before transplant.
not classified (group NC)	<i>Trichoderma harzianum</i> Rifai strain KRL-AG2 and <i>Trichoderma virens</i> strain G-41	Rootshield PLUS G	600–1,200 g of product per m ³ of potting soil	0	Head and leaf lettuce and endive. Suppression. Root diseases caused by <i>Rhizoctonia</i> spp., <i>Pythium</i> spp. and <i>Fusarium</i> spp. Apply immediately before seeding.
Field Application					
SDHI (group 7)	boscalid	Cantus WDG	285 g/ha (115 g/acre)	14	Head and leaf lettuce. Do not use on areas treated with product the previous season. Do not make more than two sequential applications of any group 7 fungicide. See label for recropping restrictions. 12-hr restricted entry interval.
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	Head and leaf lettuce and endive. Use higher rate and shorter interval when disease pressure is high. Do not make more than two sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
SDHI/ (group 7/12)	pydiflumetofen/ fludioxonil	Miravis Prime	800–1,000 mL/ha (324–405 mL/acre)	3	Head and leaf lettuce and endive. Suppression. Do not make more than two applications before switching to a non group 7 and 12 fungicide. 12-hr restricted entry interval.
microbial (group BMO2)	<i>Bacillus subtilis</i>	Serenade Opti	0.6–1.7 kg/ha (0.2–0.7 kg/acre)	0	Lettuce and endive. Suppression. Begin applications soon after emergence or transplant and continue as necessary.
	<i>Aureobasidium pullulans</i>	Botector	1 kg/ha (405 g/acre)	0	Head and leaf lettuce and endive. Suppression.
not classified (group NC)	<i>Trichoderma harzianum</i> Rifai strain KRL-AG2	Rootshield HC	10 g/1 L water	—	Lettuce only. Suppression. See label for application details.
	<i>Trichoderma harzianum</i> Rifai strain T22	Triatum P	After seeding: 1.5 g/m ² in 1.33 L water After transplant: 6 g/1 L water 500 L/ha	—	Damping off root rots caused by <i>Fusarium</i> spp., <i>Pythium</i> spp., and <i>Rhizoctonia</i> spp. Suppression. Apply immediately before seeding. 4-hr restricted entry interval.
LETTUCE DROP (SCLEROTINIA WHITE MOLD)					
SDHI (group 7)	boscalid	Cantus WDG	385 g/ha (156 g/acre)	14	Head and leaf lettuce. Suppression. Do not use on areas treated with product the previous season. Do not make more than two sequential applications of any group 7 fungicides. See label for recropping restrictions. 12-hr restricted entry interval.
	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	1	Head and leaf lettuce and endive. Do not use on areas treated with product the previous season. Do not make more than two sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.

Table 3–85. Lettuce and Endive Disease Control — Damping-Off, Botrytis Gray Mold, Lettuce DropFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LETTUCE DROP (SCLEROTINIA WHITE MOLD) (continued)					
SDHI (group 7)	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	Head and leaf lettuce and endive. Suppression. Use higher rate and shorter interval when disease pressure is high. Do not make more than two sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
	isofetamid	Kenja 400SC	0.9 L/ha (0.36 L/acre)	14	Head and leaf lettuce. Do not make more than two sequential applications of any group 7 fungicides. See label for recropping restrictions. 12-hr restricted entry interval.
SDHI/QoI (group 7/11)	fluopyram/trifloxystrobin	Luna Sensation	400–600 mL/ha (162–243 mL/acre)	0	Head and leaf lettuce and endive. Do not make sequential applications of any group 11 or more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
SDHI/ (group 7/12)	pydiflumetofen/fludioxonil	Miravis Prime	800–1,000 mL/ha (324–405 mL/acre)	3	Head and leaf lettuce and endive. In direct seeded leafy vegetables, apply immediately after emergence or prior to disease development. If transplanted, apply immediately after transplanting or prior to disease development. Apply a second application after the soil is disturbed by cultivation/thinning, or when conditions are conclusive to disease development. Do not make more than two applications before switching to a non-group 7 and 12 fungicide. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	0.2–2.5 kg/ha (0.08–1 kg/acre)	0	Head and leaf lettuce. Suppression. May be applied to the soil at planting or as a foliar application. See label for details on choosing rate. Re-entry permitted once spray deposit has dried.
	<i>Bacillus subtilis</i>	Serenade Opti	0.6–1.7 kg/ha (0.2–0.7 kg/acre)	0	Lettuce and endive. Suppression. See label for application instructions.
not classified (group NC)	<i>Coniothyrium minitans</i>	Contans WG	2–4 kg/ha (0.8–1.6 kg/acre)	0	Lettuce only. Suppression. Apply to soil prior planting, at least 3 months before the onset of disease. Broadcast and lightly incorporate. If incorporation will displace soil greater than 5 cm (2 in.), increase application rate to 3–6 kg/ha (1.2–2.4 kg/acre). See label for application details and chemical compatibility precautions.

Table 3–86. Lettuce and Endive Disease Control — Downy Mildew

For resistance management, rotate between fungicides from different chemical groups. Avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DOWNY MILDEW					
phenylamide/ dithiocarbamate (group 4/M3)	metalaxyl-M and S-isomer/mancozeb	Ridomil Gold MZ 68WG	2.5 kg/ha (1 kg/acre)	14	Head lettuce only. 24-hr restricted entry interval.
polyoxin (group 19)	polyoxin D zinc salt	Diplomat 5SC	463–926 mL/ha (187–375 mL/ha)	0	Lettuce only. Suppression.
Qil (group 21)	cyazofamid	Torrent 400SC	200 mL/ha (81 mL/acre)	0	Head and leaf lettuce. Suppression. Make first application after seeding/transplanting and the second application when disease appears or when conditions are conducive for disease development. Tank-mix with non-ionic or organosilicone surfactant. 12-hr restricted entry interval.
phosphonate (group 33)	fosetyl-AL	Aliette WDG	2.8 kg/ha (1.1 kg/acre)	7	Lettuce only. 12-hr restricted entry interval.
	mono- and dibasic sodium, potassium and ammonium phosphites	Phostrol	2.9–5.8 L/ha (1.2–2.3 L/acre)	0	Head and leaf lettuce and endive. Begin applications preventively when conditions favour disease development. 12-hr restricted entry interval.
phosphonate (group 33)	mono- and di-potassium salts of phosphorous acid	Confine Extra	3–7 L/ha (1.2–2.8 L/acre)	1	Lettuce and endive. Suppression. Also suppresses bacterial leaf spot (<i>Xanthomonas campestris</i> pv. <i>vitiensis</i>). Begin applications when conditions are favourable to disease development. Use higher rate and shorter spray interval when disease pressure is high. 12-hr restricted entry interval.
CAA (group 40)	dimethomorph	Acrobat 50 WP	450 g/ha (182 g/acre)	0	Head and leaf lettuce. Suppression. Tank-mix with another fungicide with activity against downy mildew. Do not make more than two sequential applications of any group 40 fungicides. See label for restricted entry intervals.
	mandipropamid	Revus	400–600 mL/ha (162–243 mL/acre)	7	Head and leaf lettuce. Tank-mix with a non-ionic surfactant. Do not make sequential applications of any group 40 fungicides. 12-hr restricted entry interval.
CAA/OSBPI (group 40/49)	mandipropamid/ oxathiapiprolin	Orondis Ultra	400–600 mL/ha (162–243 mL/acre)	1	Head and leaf lettuce. No more than two consecutive applications before switching to non-group 49 and 40 fungicides. 12-hr restricted entry interval.
benzamide (group 43)	fluopicolide	Presidio	220–292 mL/ha (89–118 mL/acre)	2	Lettuce only. Tank-mix with Aliette WDG fungicide. Do not make sequential applications. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	1–2.5 kg/ha (0.4–1 kg/acre)	0	Head and leaf lettuce. Suppression. Begin preventive applications when conditions favour disease onset. Repeat every 7–10 days as long as conditions favour disease development. Re-entry permitted once spray deposit has dried.
	<i>Bacillus subtilis</i>	Serenade Opti	1.7–3.3 kg/ha (0.7–1.3 kg/acre)	0	Lettuce only. Suppression. Begin applications at first sign of disease or when conditions become conducive for disease development.
Qxl/CAA (group 45/40)	ametoctradin/ dimethomorph	Zampro	1 L/ha (0.4 L/acre)	0	Head and leaf lettuce and endive. Begin applications prior to disease development. Do not apply with adjuvant. Do not make more than two sequential applications of any group 45 or 40 fungicides. See label for recropping restrictions and restricted entry intervals.
not classified (group NC)	hydrogen peroxide (27%) + peroxyacetic acid (2.5%)	OxiDate 2.0	1.0% (v:v) (100 mL product per 10 L of water)	0	Lettuce only. Suppression. Do not spray during conditions of intense heat, drought or poor plant vigor. 4-hr restricted entry interval.

Table 3–87. Activity of Insecticides on Lettuce and Endive Insects

LEGEND: C = control S = suppression RD = reduction in damage N = registered, but not considered effective or resistance is documented — = not registered for control of this pest, or activity on this pest has not been documented								
Common Name	Trade Name	Aphids	Cutworms	Tamished Plant Bug	Leafhoppers	Aster Leafhopper	Cabbage Looper	Leafminers
carbaryl	Sevin XLR	—	—	C	C	C	—	—
methomyl	Lannate TNG	—	—	—	—	—	C	—
acephate	Orthene 97% SG	C	—	—	—	—	C	—
dimethoate	Cygon 480	C	—	—	C	—	—	—
	Lagon 480 E	C	—	—	C	—	—	—
malathion	Malathion 85E	N	—	—	C	—	C	—
naled	Dibrom	N	—	—	—	—	C	—
cypermethrin	Mako	—	C	—	—	C	—	—
	Ship 250	—	C	—	—	C	—	—
	UP-Cyde 2.5 EC	—	C	—	—	C	—	—
lambda-cyhalothrin	Labamba	—	C	C	—	—	C	—
	Matador 120EC	—	C	C	—	—	C	—
	Silencer 120 EC	—	C	C	—	—	C	—
permethrin	Perm-UP	—	C	—	—	—	—	—
	Pounce 384EC	—	C	—	—	—	—	—
acetamiprid	Aceta 70 WP	C	—	—	—	—	—	RD ¹
	Assail 70 WP	C	—	—	—	—	—	RD ¹
imidacloprid	Admire 240 F	C	—	—	S	—	—	—
	Alias 240 SC	C	—	—	—	—	—	—
thiamethoxam	Actara 25WG	C	—	RD	—	—	—	—
	Actara 240SC	C	—	—	C	—	—	C ²
thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	C	—	—	C	—	C	C
sulfoxaflor	Closer	C	—	C	—	—	—	—
spinetoram	Delegate WG	—	—	—	—	—	C	—
spinosad	Entrust	—	—	—	—	—	C	—
	Scorpio Ant and Insect Bait	—	C	—	—	—	—	—
	Success	—	—	—	—	—	C	—
abamectin/ cyantraniliprole	Minecto Pro	—	C	—	—	—	C	—
afidopyropen	Versys	C	—	—	—	—	—	—
<i>Bacillus thuringiensis</i>	Bioprotec PLUS	—	—	—	—	—	C	—
	Dipel 2X DF	—	—	—	—	—	C	—
	Thuricide-HPC	—	—	—	—	—	C	—
	XenTari WG	—	—	—	—	—	S	—
cyromazine	Citation 75WP	—	—	—	—	—	—	C ¹
methoxyfenozide	Intrepid	—	—	—	—	—	C	—
spirotetramat	Movento 240 SC	C	—	—	—	—	—	—
chlorantraniliprole	Coragen	—	C	—	—	—	C	C ³
cyantraniliprole	Exirel	C	C	—	—	—	C	C ²
cyclaniliprole	Harvanta 50SL	—	—	—	—	—	C	C ¹
flonicamid	Beleaf 50SG	C	—	—	—	—	—	—
kaolin clay	Surround WP	—	—	—	—	RD	—	—
mineral oil	SuffOil-X	RD	—	—	—	—	—	—
<i>Beauveria bassiana</i> strain ANT-03	BioCeres G WP	RD	—	RD	—	—	—	—

¹ Pea leafminer only.² Dipteran leafminers only.³ Vegetable and serpentine leafminers only.

Table 3–88. Lettuce and Endive Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
Soil and Transplant Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	See label for rates and application information.	21	Head and leaf lettuce and endive. Apply as a transplant tray plug drench or soil application. Do not use on areas treated with the product in the previous season. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. See label for rotational crop restrictions and restricted entry intervals. Gloves must be worn at transplanting.
		Alias 240 SC	See label for rates and application information.	21	Head and leaf lettuce. Apply as a transplant tray plug drench or soil application. Do not use on areas treated with the product in the previous season. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. See label for rotational crop restrictions and restricted entry intervals. Gloves must be worn at transplanting.
	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Head and leaf lettuce and endive. Apply at or shortly following seeding or transplanting. Also suppresses early-season flea beetles. Use sufficient water volume or supplemental irrigation to ensure coverage at seeding or transplanting depth. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. See label for rotational crop restrictions. 12-hr restricted entry interval.
neonicotinoid/diamide (group 4A/28)	thiamethoxam/cytraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	Head and leaf lettuce and endive. Also suppresses early-season flea beetles. See label for application details. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 or group 28 insecticides in the same season. See label for rotational crop restrictions. 12-hr restricted entry interval.
Foliar Applications					
organophosphate (group 1B) ¹	acephate	Orthene 97% SG	580–850 g/ha (235–344 g/acre)	7	Head lettuce only. See label for restricted entry intervals.
	dimethoate	Cygon 480	700 mL/ha (283 mL/acre)	7	Leaf lettuce only. Do not use on head lettuce. 3-day restricted entry interval.
		Lagon 480 E			
	naled	Dibrom	1.05–1.6 L/ha (0.4–0.65 L/acre)	4	Lettuce only. 48-hr restricted entry interval.

¹ Resistance to this group of products has been documented in some regions.

Table 3–88. Lettuce and Endive Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Foliar Applications (continued)					
neonicotinoid (group 4A)	acetamiprid	Aceta 70 WP	56–86 g/ha (23–35 g/acre)	7	Head and leaf lettuce and endive. Also helps reduce damage caused by pea leafminer. Do not apply foliar group 4 insecticides in the same season as a seed treatment, soil or transplant application. 12-hr restricted entry interval.
		Assail 70 WP			
	imidacloprid	Alias 240 SC	200 mL/ha (81 mL/acre)	7	Head and leaf lettuce and endive. Do not use on areas treated with the product in the previous season. Do not apply foliar group 4 insecticides in the same season as a seed treatment, soil or transplant application. See label for rotational crop restrictions. 24-hr restricted entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Head and leaf lettuce and endive. Apply in sufficient water volume to ensure adequate coverage. Do not apply foliar group 4 insecticides in the same season as a seed treatment, soil or transplant application. See label for rotational crop restrictions. 12-hr restricted entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	100–150 mL/ha (40–61 mL/acre)	3	Head and leaf lettuce and endive. See label for recropping restrictions. 12-hr restricted entry interval.
pyropene (group 9D)	afidopyropen	Versys	0.1 L/ha (0.04 L/acre)	0	Head and leaf lettuce and endive. Also controls green peach aphid, potato aphid, lettuce aphid and whiteflies. Monitor pest populations and reapply if necessary if thresholds are reached. Do not make sequential applications of any group 9 insecticide.
tetrionic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	3	Head and leaf lettuce and endive. Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. See label for guidance on adjuvant use and recropping restrictions. 12-hr restricted entry interval.
diamide (group 28)	cyantranilprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	Head and leaf lettuce and endive. Use high rate under heavy pest pressure. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. See label for guidance on adjuvant use, tank-mix and crop tolerance information, and rotational crop restrictions. 12-hr restricted entry interval.
	tetranilprole	Vayego 200 SC	150 mL/ha (61 mL/acre)	1	Head and leaf lettuce. Suppression. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (48–65 g/acre)	0	Head and leaf lettuce and endive. Use higher rates for high pest populations or dense foliage. See label for recropping restrictions. 12-hr restricted entry interval.
not classified (group NC)	mineral oil	SuffOil-X	13 L/1,000 L water	0	See label for complete list of crops. Reduction in damage. Also suppresses spider mites. 12-hr restricted entry interval.
not classified (group NC)	<i>Beauveria bassiana</i> strain ANT-03	BioCeres G WP	2–4 g/L	0	Head and leaf lettuce and endive. Also a reduction in thrips and whitefly. See label for application details. 4-hr restricted entry interval.

¹ Resistance to this group of products has been documented in some regions.

Table 3–89. Lettuce and Endive Insect Control — Cutworms, Tarnished Plant Bug

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
pyrethroid (group 3A)	cypermethrin	Mako	175 mL/ha (71 mL/acre)	21	Lettuce only. Do not disturb soil surface for 5 days after application. 12-hr restricted entry interval.
		UP-Cyde 2.5 EC	285 mL/ha (115 mL/acre)		
	lambda-cyhalothrin	Labamba	83 mL/ha (34 mL/acre)	3	Head lettuce only. Dark-sided and white cutworms. 24-hr restricted entry interval.
		Matador 120EC			
		Silencer 120 EC			
	permethrin	Pounce 384EC	180–390 mL/ha (73–158 mL/acre)	—	Lettuce only. Apply to moist soils up to 5-leaf stage. Do not disturb soil for 5 days after application. Use high rate on large larvae, dry soils or muck soils. Re-entry permitted as soon as the spray deposit has dried.
		Perm-UP	180–390 mL/ha (73–158 mL/acre)	—	Lettuce only. Apply to moist soils up to 5-leaf stage. Do not disturb soil for 5 days after application. Use high rate on large larvae, dry soils or muck soils. 12-hr restricted entry interval.
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	1	Black cutworm. Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Head and leaf lettuce and endive. Black cutworm. Apply to small plants, when no rain is forecast in next 24 hr. Do not use on areas treated with product in the previous season. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	Head and leaf lettuce and endive. Apply to small plants, when no rain is forecast in next 24 hr. Use high rate under heavy pest pressure. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. See label for tank-mix and crop tolerance information, and rotational crop restrictions. 12-hr restricted entry interval.
	tetraniliprole	Vayego 200 SC	150 mL/ha (61 mL/acre)	1	Head and leaf lettuce and endive. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
TARNISHED PLANT BUG					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5–5.25 L/ha (1–2.1 L/acre)	5	Head lettuce only. See label for restricted entry intervals.
pyrethroid (group 3A)	lambda-cyhalothrin	Labamba	83 mL/ha (34 mL/acre)	3	Head and leaf lettuce. 24-hr restricted entry interval.
		Matador 120EC			
		Silencer 120 EC			
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	210 g/ha (85 g/acre)	7	Head and leaf lettuce and endive. Reduction in damage. Apply in sufficient water volume to ensure adequate coverage. Do not apply foliar group 4 insecticides in the same season as a seed, soil or transplant application. See label for rotational crop restrictions. 12-hr restricted entry interval.
sulfoximine (group 4C)	sulfoxaflor	Closer	300 mL/ha (121 mL/acre)	7	Head and leaf lettuce and endive. 12-hr restricted entry interval.
not classified (group NC)	<i>Beauveria bassiana</i> strain ANT-03	BioCeres G WP	4–8 g/L	0	Head and leaf lettuce and endive. See label for application details. 4-hr restricted entry interval.

Table 3–90. Lettuce and Endive Insect Control — Leafhoppers

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFHOPPERS					
Soil and Transplant Applications					
neonicotinoid (group 4A)	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Head and leaf lettuce and endive. Apply at or shortly following seeding or transplanting. Also suppresses early-season flea beetles. Use sufficient water volume or supplemental irrigation to ensure coverage at seeding or transplanting depth. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. See label for rotational crop restrictions. 12-hr restricted entry interval.
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	Head and leaf lettuce and endive. Also suppresses early-season flea beetles. See label for application details. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 or group 28 insecticides in the same season. See label for rotational crop restrictions. 12-hr restricted entry interval.
Foliar Applications					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	5	Head lettuce. Leafhoppers and aster leafhoppers. See label for restricted entry intervals.
				21	Leaf lettuce, endive. Leafhoppers and aster leafhoppers. See label for restricted entry intervals.
organophosphate (group 1B)	dimethoate	Cygon 480 Lagon 480 E	700 mL/ha (283 mL/acre)	7	Leaf lettuce only. Do not use on head lettuce. 3-day restricted entry interval.
	malathion	Malathion 85E	735–1,345 mL/ha (297–544 mL/acre)	3	Head lettuce. 1-day restricted entry interval.
pyrethroid (group 3A)	cypermethrin	Mako	125 mL/ha (51 mL/acre)	14	Lettuce only. Aster leafhoppers. 12-hr restricted entry interval.
		Ship 250	200 mL/ha (81 mL/acre)	14	Lettuce only. Aster leafhoppers. 12-hr restricted entry interval.
		UP-Cyde 2.5 EC			
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Head and leaf lettuce and endive. Suppression. Do not use on areas treated with the product in the previous season. Do not apply foliar group 4 insecticides in the same season as a seed treatment, soil or transplant application. See label for rotational crop restrictions. 24-hr restricted entry interval.
not classified (group NC)	kaolin clay	Surround WP	12.5–25 kg/ha (5–10 kg/acre)	0	Lettuce only. See label for additional rate and volume information. Surround WP forms a barrier film, which acts as a broad-spectrum protectant that may decrease damage from aster leafhoppers.

Table 3–91. Lettuce and Endive Insect Control — Leafminers

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFMINERS					
Soil and Transplant Applications					
neonicotinoid (group 4A)	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Head and leaf lettuce and endive. Dipteran leafminers. Apply at or shortly following seeding or transplanting. Also suppresses early-season flea beetles. Use sufficient water volume or supplemental irrigation to ensure coverage at seeding or transplanting depth. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. See label for rotational crop restrictions. 12-hr restricted entry interval.
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	Head and leaf lettuce and endive. Dipteran leafminers. Also suppresses early-season flea beetles. See label for application details. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 or group 28 insecticides in the same season. See label for rotational crop restrictions. 12-hr restricted entry interval.
Foliar Applications					
neonicotinoid (group 4A)	acetamiprid	Aceta 70 WP	86 g/ha (35 g/acre)	7	Head and leaf lettuce and endive. Pea leafminer. Reduction in damage. Do not apply foliar group 4 insecticides in the same season as a seed treatment, soil or transplant application. 12-hr restricted entry interval.
		Assail 70 WP			
cyromazine (group 17)	cyromazine	Citation 75WP	188 g/ha (76 g/acre)	7	Head and leaf lettuce and endive. Pea leafminer. Use sufficient water to achieve adequate coverage. See label for rotational crop restrictions. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Head and leaf lettuce and endive. Vegetable and serpentine leafminers. Do not use on areas treated with product in the previous season. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	1–1.5 L/ha (405–607 mL/acre)	1	Head and leaf lettuce and endive. Dipteran leafminers. Use high rate under heavy pest pressure. See label for guidance on adjuvant use, tank-mix and crop tolerance information, and rotational crop restrictions. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	cyclaniliprole	Harvanta 50SL	1.2 L/ha (0.49 L/acre)	1	Head and leaf lettuce and endive. Vegetable and serpentine leafminers. Do not apply foliar group 28 insecticides in the same season as a soil application.

Table 3–92. Lettuce and Endive Insect Control — Cabbage Looper

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE LOOPER					
Soil and Transplant Applications					
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	Head and leaf lettuce and endive. Early-season control. Also suppresses early-season flea beetles. See label for application details. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 or group 28 insecticides in the same season. See label for rotational crop restrictions. 12-hr restricted entry interval.
Foliar Applications					
organophosphate (group 1B)	acephate	Orthene 97% SG	580–850 g/ha (235–344 g/acre)	7	Head lettuce only. See label for restricted entry intervals.
	naled	Dibrom	1.05–1.6 L/ha (0.4–0.65 L/acre)	4	Lettuce only. 48-hr restricted entry interval.
pyrethroid (group 3A)	lambda- cyhalothrin	Labamba Matador 120 EC Silencer 120 EC	83 mL/ha (34 mL/acre)	3	Head lettuce only. 24-hr restricted entry interval.
spinosyn (group 5)	spinetoram	Delegate WG	140–200 g/ha (57–80 g/acre)	1	Head and leaf lettuce and endive. Use high rate for heavy infestations or large larvae. 12-hr restricted entry interval.
	spinosad	Entrust	364 mL/ha (147 mL/acre)	1	Head and leaf lettuce and endive. Maintain a spray pH of 6 or greater. Re-entry permitted once spray deposit has dried.
		Success	182 mL/ha (74 mL/acre)		
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	370–566 mL/ha (150–225 mL/acre)	7	Head and leaf lettuce and endive. Tank-mix with a non-ionic surfactant. Do not make sequential applications of any group 6 or group 28 insecticides. 12-hr restricted entry interval.
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i>	Bioprotec PLUS	0.9–1.8 L/ha (0.36–0.73 L/acre)	0	Lettuce only. Treat when larvae are young (early instars) before the crop is damaged.
		Dipel 2X DF	275–550 g/ha (111–223 g/acre)	0	
		Thuricide HPC	2–4.25 L/ha (0.8–1.7 L/acre)	0	
	<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i>	XenTari WG	500–1,000 g/ha (203–405 g/acre)	0	Head and leaf lettuce and endive. Suppression. For best results apply in evening or on cloudy days.
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	1	Head and leaf lettuce and endive. Apply at first sign of feeding damage. Use high rate for heavy infestations, advanced pest growth stages or larger crops. Do not use on areas treated with product the previous season. See label for rotational crop restrictions. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Head and leaf lettuce and endive. Do not use on areas treated with product in the previous season. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	250–500 mL/ha (101–202 mL/acre)	1	Head and leaf lettuce and endive. Use high rate under heavy pest pressure. See label for tank-mix and crop tolerance information, and rotational crop restrictions. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	cyclaniliprole	Harvanta 50SL	0.8–1.2 L/ha (0.32–0.49 L/acre)	1	Do not make sequential applications of any group 28 insecticide after 2 consecutive applications within a 30-day period. Do not apply foliar group 28 insecticides in the same season as a soil application.
	tetraniliprole	Vayego 200 SC	225 mL/ha (91 mL/acre)	1	Head and leaf lettuce. Suppression. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.

ONIONS, LEEKS AND SHALLOTS

In this section:

Table 3-93.	Onion, Leek and Shallot Seed Treatments and Transplant Disease Control
Table 3-94.	Activity of Fungicides on Onion, Leek and Shallot Diseases
Table 3-95.	Onion, Leek and Shallot Disease Control — Botrytis Leaf Blight
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Table 3-97.	Onion, Leek and Shallot Disease Control — Stemphylium Leaf Blight, Purple Blotch
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Table 3-99.	Activity of Insecticides on Onion, Leek and Shallot Insects
Table 3-100.	Onion, Leek and Shallot Insect Control — Onion Maggot
Table 3-101.	Onion, Leek and Shallot Insect Control — Thrips
Table 3-102.	Onion, Leek and Shallot Insect Control — Leek Moth, Cutworms

Pest control products listed in these tables are not necessarily registered on all allium crops.

This information is provided as a guideline only. See product labels for complete information.

See the most up-to-date product label to ensure registration on a specific crop. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3-93. Onion, Leek and Shallot Seed Treatments and Transplant Disease Control

LEGEND: RP = registered pest S = suppression

— = not registered for control of this pest or activity on this pest has not been documented.

Active Ingredient	Trade Name	Rate	Insects and Diseases			Notes
			Onion Maggot	Damping-Off	Onion Smut	
SEED TREATMENTS						
cyromazine	Governor 75WP	66.7 g/ 1 kg of seed	RP	—	—	Dry bulb and green onions. Muck soils only. For import use only; do not treat seed in Canada. Do not plant treated seed in the same field in consecutive years. See label for rotational crop restrictions. Pre-harvest interval for green onions is 60 days; 100 days for dry onions.
clothianidin/ imidacloprid	Sepresto 75 WS	See label for rates.	RP	—	—	Onions, leeks and shallots. For import use only; do not treat seed in Canada.
metalaxyl-M and S-isomer	Apron XL LS	20 mL/ 100 kg of seed	—	RP	—	Dry and bunching onions. Damping-off caused by <i>Pythium</i>. For use in commercial seed treatment facilities.
carbathiin/ thiram	Pro-Gro	25 g/ 1 kg seed	—	—	RP	Onions only. Pro-Gro treated seed may be stored for up to 4 months.
azoxystrobin	Dynasty 100FS	25–50 mL/ 100 kg of seed	—	RP	—	Onions, leeks and shallots. Damping-off caused by <i>Rhizoctonia</i>. For import use only; do not treat seed in Canada.
penflufen	Pen 240	1,043 mL/ 100 kg of seed	—	RP	RP	Dry bulb onions and green onion subgroups. For import use only; do not treat seed in Canada.
fludioxonil	Maxim 480FS	5.2–10.4 mL/ 100 kg of seed	—	RP	—	Onions, leeks and shallots. For use in commercial seed treatment facilities.
thiram	Thiram 75 WP	65–80 g/ 25 kg of seed	—	RP	—	Onions only. Seed box or commercial seed treatment.

Table 3–93. Onion, Leek and Shallot Seed Treatments and Transplant Disease Control

LEGEND: RP = registered pest S = suppression
 — = not registered for control of this pest or activity on this pest has not been documented.

— Not registered for control of this pest or activity on this pest has not been documented.						
Active Ingredient	Trade Name	Rate	Insects and Diseases			Notes
			Onion Maggot	Damping-Off	Onion Smut	
GREENHOUSE TREATMENTS						
<i>Trichoderma harzianum</i> and <i>Trichoderma virens</i>	Rootshield Plus WP	30–60 g in 100 L of water applied to 10 m ² of soil	—	S	—	Onions, leeks and shallots. Root diseases caused by <i>Rhizoctonia</i> spp., <i>Pythium</i> spp. and <i>Fusarium</i> spp. Suppression. Drench application to potting mix, soil or planting beds. 4-hr restricted entry interval for greenhouse applications.
<i>Trichoderma harzianum</i> Rifai strain T22	Trianum P	After seeding: 1.5 g/m ² in 1.33 L water After transplant: 6 g/1 L water 500 L/ha	—	S	—	Onions, leeks and shallots. Root diseases caused by <i>Rhizoctonia</i> spp., <i>Pythium</i> spp. and <i>Fusarium</i> spp. Suppression. Apply immediately before seeding. 4-hr restricted entry interval.

Table 3–94. Activity of Fungicides on Onion, Leek and Shallot Diseases

Listed pest control products are not necessarily registered on all *Allium* crops.
 See the most up-to-date labels to ensure registration on your crop of interest.

LEGEND: C = control S = suppression
 — = not registered for control of this pest, or activity on this pest has not been documented

Active Ingredient	Trade Name	Onion Smut	Botrytis Leaf Blight	Botrytis Neck Rot	Downy Mildew	Purple Blotch	Stemphyllium Leaf Blight
metalaxyl-M and S-isomer/mancozeb	Ridomil Gold MZ 68WG	—	—	—	C	—	—
boscalid	Cantus WDG	—	C	—	—	C	—
fluxapyroxad	Sercadis	—	C	—	—	C	S
benzovindiflupyr	Aprovia	—	—	—	—	C	S
penthiopyrad	Fontelis	—	C	—	—	C	—
pydiflumetofen/difenoconazole	Miravis Duo	—	S	—	—	C	S
fluopyram/pyrimethanil	Luna Tranquility	—	C	—	—	C	S
boscalid/pyraclostrobin	Pristine WG	—	C	—	S	C	—
pyrimethanil	Scala SC	—	C	C	—	C	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	C	—	—	S	—
pyraclostrobin	Cabrio EG	—	—	—	C	C	—
fenamidone	Reason 500SC	—	—	—	S	—	—
picoxystrobin	Acapela	—	S	C	—	C	—
azoxystrobin/difenoconazole	Quadris Top	—	C	—	C	C	S
zoxamide/mancozeb	Gavel DF	—	—	C	S	—	—
fosetyl-AL	Aliette WDG	—	—	—	C	C	—
mono- and dibasic sodium, potassium, and ammonium phosphite	Phostrol	—	—	—	S	—	—
dimethomorph	Acrobat 50 WP	—	—	—	S	—	—
	Forum	—	—	—	S	—	—
mandipropamid	Revus	—	—	—	C	—	—
mandipropamid/oxathiapiprolin	Orondis Ultra	—	—	—	C	—	—
<i>Bacillus subtilis</i>	Serenade Opti	—	S	S	S	—	—
ametoctradin/dimethomorph	Zampro	—	—	—	C	—	—
copper oxychloride	Copper Spray	—	—	—	C	—	—
copper octanoate	Cueva	—	C	—	C	—	—
mancozeb	Dithane Rainshield	C	C	—	—	—	—
	Penncozeb 75 DF Raincoat	—	C	—	—	—	—
	Manzate Pro-Stick	C	C	C	C	C	—
chlorothalonil	Bravo ZN/ZNC	—	C ¹	—	—	—	—
	Echo 720	—	C	—	—	—	—

¹ When in a tank-mix of Scala SC and Bravo ZN.

Table 3–95. Onion, Leek and Shallot Disease Control — Botrytis Leaf BlightFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BOTRYTIS LEAF BLIGHT					
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	7	Onions, leeks and shallots. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 11 or group 3 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
SDHI (group 7)	boscalid	Cantus WDG	475 g/ha (192 g/acre)	7	Onions, leeks and shallots. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
	fluxapyroxad	Sercadis	333–666 mL/ha (135–259 mL/acre)		
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.4 L/acre)	7	Onions, leeks and shallots. Suppression. Do not make sequential applications of any group 3 or group 7 fungicide. 12-hr restricted entry interval.
SDHI/AP (group 7/9)	fluopyram/ pyrimethanil	Luna Tranquility	1,200 mL/ha (486 mL/acre)	7	Onions, leeks and shallots. Do not make sequential applications of group 7 or group 9 fungicides. See label for rotational crop restrictions. See label for restricted entry intervals.
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	1–1.3 kg/ha (0.4–0.5 kg/acre)	7	Onions, leeks and shallots. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 or group 11 fungicides. See label for restricted entry intervals.
AP (group 9)	pyrimethanil	Scala SC	2 L/ha (0.8 L/acre)	7	Onions, leeks and shallots. Also controls botrytis neck rot (<i>Botrytis allii</i>). See label for rotational crop restrictions. See label for restricted entry intervals.
AP/PP (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (313–394 g/acre)	7	Onions, leeks and shallots. See label for rotational crop restrictions and restricted entry intervals.
QoI (group 11)	picoxystrobin	Acapela	0.6–0.88 L/ha (0.24–0.36 L/acre)	0	Also controls botrytis neck rot. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade Opti	1.7–2.5 kg/ha (0.7–1 kg/acre)	0	Onions, leeks and shallots. Suppression. Also suppresses botrytis neck rot (<i>Botrytis allii</i>). See label for application details.
inorganic (group M1)	copper octanoate	Cueva	0.5%–2% (v/v) solution, applied in 470–940 L solution/ha (190–380 L/acre)	1	Onions, leeks and shallots. See label for application details. 4-hr restricted entry interval.
dithiocarbamate (group M3)	mancozeb	Dithane Rainshield	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	10	Dry bulb onions only. 24-hr restricted entry interval.
		Manzate Pro-Stick			
		Penncozeb 75 DF Raincoat			
chloronitrile (group M5)	chlorothalonil	Bravo ZN/ZNC	2.4–4.8 L/ha (1–1.9 L/acre)	7	Dry bulb onions. Maximum two applications per year. Restricted entry intervals: hand weeding – 6 days; scouting – 1 day; all other activities – 12 hr
				14	Green onions. Maximum two applications per year. Restricted entry intervals: hand weeding – 6 days; scouting – 1 day; all other activities – 12 hr
		Echo 720	1.7–3.3 L/ha (0.7–1.3 L/acre)	7	Dry bulb onions. Maximum two applications per year. Restricted entry intervals: hand weeding – 6 days; scouting – 1 day; all other activities – 12 hr
				14	Green onions. Maximum two applications per year. Restricted entry intervals: hand weeding – 6 days; scouting – 1 day; all other activities – 12 hr

Table 3–96. Onion, Leek and Shallot Disease Control — Downy Mildew

Begin applications when weather conditions favour downy mildew, or if downy mildew is identified in the local area.

Consult local downy mildew forecasting information to apply preventive sprays.

For resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DOWNY MILDEW					
phenylamide/dithiocarbamate (group 4/M3)	metalaxyl-M and S-isomer/mancozeb	Ridomil Gold MZ 68WG	2.5 kg/ha (1 kg/acre)	7	Onions only. 24-hr restricted entry interval.
SDHI/QoI (group 7/11)	boscalid/pyraclostrobin	Pristine WG	1.3 kg/ha (0.5 kg/acre)	7	Onions, leeks and shallots. Suppression. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 or group 11 fungicides. See label for restricted entry intervals.
QoI (group 11)	pyraclostrobin	Cabrio EG	560–840 g/ha (226–340 g/acre)	7	Onions, leeks and shallots. Do not make sequential applications of any group 11 fungicides. See label for restricted entry intervals.
	fenamidone	Reason 500SC	400 mL/ha (162 mL/acre)	7	Onions, leeks and shallots. Suppression. Do not make sequential applications of any group 11 fungicides. Re-entry permitted when spray deposit has dried.
QoI/DMI (group 11/3)	azoxystrobin/difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	7	Onions, leeks and shallots. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 11 or group 3 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
benzamide/dithiocarbamate (group 22/M3)	zoxamide/mancozeb	Gavel DF	1.7–2.25 kg/ha (0.7–0.9 kg/acre)	10	Bulb onion only. Suppression. Also controls botrytis neck rot (<i>Botrytis allii</i>). See label for rotational crop restrictions. 48-hr restricted entry interval.
phosphonate (group 33)	fosetyl-AL	Aliette WDG	2.8 kg/ha (1.1 kg/acre)	7	Onions only. 12-hr restricted entry interval.
	mono- and dibasic sodium, potassium, and ammonium phosphite	Phostrol	2.9–4.3 L/ha (1.2–1.7 L/acre)	0	Onions, leeks and shallots. Suppression. 12-hr restricted entry interval.
CAA (group 40)	dimethomorph	Forum	450 mL/ha (182 mL/acre)	0	Onions, leeks and shallots. Suppression. Must be applied as a tank-mix with another fungicide active against downy mildew. Do not make sequential applications of any group 40 fungicide. See label for rotational crop restrictions. See label for restricted entry intervals.
		Acrobat 50 WP	450 g/ha (182 g/acre)		
	mandipropamid	Revus	400 mL/ha (161 mL/acre)	7	Dry bulb onions and shallots. Tank-mix with a non-ionic surfactant. Do not make more than two sequential applications of any group 40 fungicide. See label for rotational crop restrictions. 12-hr restricted entry interval.
CAA/OSBPI (group 40/49)	mandipropamid/oxathiapiprolin	Orondis Ultra	400 mL/ha (162 mL/acre)	7	Onions, leeks and shallots. Do not use on areas treated with product the previous season. Do not make more than two sequential applications of any group 40 or 49 fungicides. Tank-mix with a non-ionic surfactant. See label for rotational crop restrictions. 12-hr restricted entry interval.
microbial (group BMO2)	<i>Bacillus subtilis</i>	Serenade Opti	1.7–2.5 kg/ha (0.7–1 kg/acre)	0	Onions, leeks and shallots. Suppression. See label for application details.
QoSI/CAA (group 45/40)	ametoctradin/dimethomorph	Zampro	1 L/ha (0.4 L/acre)	0	Onions, leeks and shallots. Do not make sequential applications of any group 45 or group 40 fungicides. See label for restricted entry intervals. 12-hr restricted entry interval for all other activities.

Table 3–96. Onion, Leek and Shallot Disease Control — Downy Mildew

Begin applications when weather conditions favour downy mildew, or if downy mildew is identified in the local area.

Consult local downy mildew forecasting information to apply preventive sprays.

For resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DOWNY MILDEW (continued)					
inorganic (group M1)	copper oxychloride	Copper Spray	3 kg/ha (1.2 kg/acre)	2	Onions only. See label for application details. 48-hr restricted entry interval.
	copper octanoate	Cueva	0.5%–2% (v/v) solution, applied in 470–940 L solution/ha (190–380 L/acre)	1	Onions, leeks and shallots. See label for application details. 4-hr restricted entry interval.
dithiocarbamate (group M3)	mancozeb	Manzate Pro-Stick	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	10	Dry bulb onions only. 24-hr restricted entry interval.

Table 3–97. Onion, Leek and Shallot Disease Control — Stemphylium Leaf Blight, Purple Blotch

For resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
STEMPHYLIUM LEAF BLIGHT					
SDHI (group 7)	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	7	Onions, leeks and shallots. Suppression. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
	benzovindiflupyr	Aprovia	750 mL/ha (304 mL/acre)	7	Suppression. Do not make sequential applications of any group 7 fungicide.
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.4 L/acre)	7	Bulb onion. Suppression. Do not make sequential applications of any group 3 or group 7 fungicide. 12-hr restricted entry interval.
SDHI/AP (group 7/9)	fluopyram/ pyrimethanil	Luna Tranquility	1,200 mL/ha (486 mL/acre)	7	Onions, leeks and shallots. Suppression. Do not make sequential applications of any group 7 or group 9 fungicides. See label for restricted entry intervals.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	7	Onions, leeks and shallots. Suppression. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 3 or group 11 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
PURPLE BLOTCH					
SDHI (group 7)	boscalid	Cantus WDG	475 g/ha (192 g/acre)	7	Onions, leeks and shallots. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	7	
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	Onions, leeks and shallots. Do not make sequential applications of any group 7 fungicides. See label for tank-mix precautions and rotational crop restrictions. 12-hr restricted entry interval.
	benzovindiflupyr	Aprovia	750 mL/ha (304 mL/acre)	7	Do not make sequential applications of any group 7 fungicide.
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.4 L/acre)	7	Do not make sequential applications of any group 3 or group 7 fungicide. 12-hr restricted entry interval.

Table 3–97. Onion, Leek and Shallot Disease Control — Stemphylium Leaf Blight, Purple BlotchFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PURPLE BLOTCH (continued)					
SDHI/AP (group 7/9)	fluopyram/pyrimethanil	Luna Tranquility	1,200 mL/ha (486 mL/acre)	7	Onions, leeks and shallots. Do not make sequential applications of any group 7 or group 9 fungicides. See label for restricted entry intervals.
SDHI/QoI (group 7/11)	boscalid/pyraclostrobin	Pristine WG	1–1.3 kg/ha (0.4–0.5 kg/acre)	7	Onions, leeks and shallots. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 or group 11 fungicides. See label for restricted entry intervals.
AP (group 9)	pyrimethanil	Scala SC	2 L/ha (0.8 L/acre)	7	Onions, leeks and shallots. Also controls botrytis neck rot (<i>Botrytis allii</i>). May be tank-mixed with Bravo fungicide. See label for rotational crop restrictions and restricted entry intervals.
AP/PP (group 9/12)	cyprodinil/fludioxonil	Switch 62.5 WG	775–975 g/ha (313–394 g/acre)	7	Bulb onions, green onions, leeks and shallots. Suppression. See label for rotational crop restrictions and restricted entry intervals.
QoI (group 11)	pyraclostrobin	Cabrio EG	560–840 g/ha (226–340 g/acre)	7	Onions, leeks and shallots. Do not make sequential applications of any group 11 fungicides. See label for restricted entry intervals.
	picoxystrobin	Acapela	0.44–0.88 L/ha (0.18–0.36 mL/acre)	0	Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
QoI/DMI (group 11/3)	azoxystrobin/difenoconazole	Quadris Top	710–1,000 mL/ha (287–404 mL/acre)	7	Onions, leeks and shallots. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 11 or group 3 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
phosphonate (group 33)	fosetyl-AL	Aliette WDG	2.8 kg/ha (1.1 kg/acre)	7	Onions only. 12-hr restricted entry interval.
dithiocarbamate (group M3)	mancozeb	Manzate Pro-Stick	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	10	Dry bulb onions only. 24-hr restricted entry interval.

Table 3–98. Onion, Leek and Shallot Disease Control — Onion Smut, Bacterial Soft Rot, Pink RootFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ONION SMUT					
dithiocarbamate (group M3)	mancozeb	Dithane Rainshield	4.4–8.8 kg/ha (1.8–3.5 kg/acre)	100	Dry bulb onions only. Apply in-furrow at seeding time. Use high rate only where smut pressure is high. 24-hr restricted entry interval.
		Manzate Pro-Stick			
BACTERIAL SOFT ROT					
inorganic (group M1)	copper octanoate	Cueva	0.5%–2% (v/v) solution, applied in 470–940 L solution/ha (190–380 L/acre)	1	Onions, leeks and shallots. See label for application details. 4-hr restricted entry interval.
PINK ROOT					
microbial (group BM02)	Bacillus subtilis	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Onion, leeks and shallots. Suppression. Also suppresses root rots caused by Rhizoctonia solani and Pythium spp., and damping-off caused by Rhizoctonia solani. May be applied at planting and/or post-planting. See label for application details.

Table 3–99. Activity of Insecticides on Onion, Leek and Shallot Insects

Listed pest control products are not necessarily registered on all allium crops.

See the most up-to-date labels to ensure registration on your crop of interest.

LEGEND: C = control S = suppression RD = reduction in damage
 N = registered, but not considered effective or resistance is documented
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Onion Maggot Larvae	Onion Maggot Adult Flies	Onion Thrips	Leek Moth	Cutworms
chlorpyrifos	Lorsban 15G	C	—	—	—	—
	Pyrifos 15G	C	—	—	—	—
	Lorsban 4E	C ¹	—	—	—	C
	Lorsban NT	—	—	—	—	C
	Pyrinex 480 EC	—	—	—	—	C
	Nufos 4E	—	—	—	—	C
	Sharphos	—	—	—	—	C
	Warhawk 480 EC	—	—	—	—	C
diazinon	Diazinon 500 E	C	—	—	—	—
malathion	Malathion 85E	—	—	C	—	—
naled	Dibrom	—	C	C	—	—
cypermethrin	Mako	—	C	N ²	—	C
	Ship 250	—	C	N ²	—	—
	UP-Cyde 2.5 EC	—	C	N ²	—	—
deltamethrin	Decis 5 EC	—	—	N ²	—	—
	Decis 100 EC	—	—	N ²	—	—
	Poleci 2.5 EC	—	—	N ²	—	—
lambda-cyhalothrin	Labamba	—	—	N ²	C	—
	Matador 120EC	—	—	N ²	C	—
	Silencer 120 EC	—	—	N ²	—	—
permethrin	Pounce 384EC	—	—	—	—	C
	Perm-UP	—	—	—	—	C
spinetoram	Delegate WG	—	—	S	S	—
spinosad	Success	—	—	S	S	—
	Entrust	—	—	S	S	—
	Scorpio Ant and Insect Bait	—	—	—	—	C
abamectin	Agri-mek SC	—	—	C	—	—
<i>Bacillus thuringiensis</i>	Bioprotec PLUS	—	—	—	S	—
<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i>	XenTari WG	—	—	—	S	—
spirotetramat	Movento 240 SC	—	—	C	—	—
cyantraniliprole	Exirel	—	—	S	—	—
chlorantraniliprole	Coragen	—	—	—	S	C
<i>Beauveria bassiana</i> strain ANT-03	BioCeres G WP	—	—	RD	—	—

¹ Green onions only.² Resistance to these insecticides in onion thrips has been observed in Ontario muck soils.

Table 3–100. Onion, Leek and Shallot Insect Control — Onion Maggot

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ONION MAGGOT					
Soil Applications					
organophosphate (group 1B)	chlorpyrifos	Lorsban 15G	7.9–15.7 kg/ha (3.2–6.3 kg/acre)	97	Pickling onions. See label for spacing and planter specifications. 24-hr restricted entry interval.
				109	Dry bulb onions and shallots. See label for spacing and planter specifications. 24-hr restricted entry interval.
		Pyrifos 15G		97	Pickling onions. See label for spacing and planter specifications. 24-hr restricted entry interval.
				109	Onions. See label for spacing and planter specifications. 24-hr restricted entry interval.
		Lorsban 4E	150 mL/1,000 m of row 3.9–4.9 L of product/ha (1.6–1.9 L product/acre) ¹	30	Green onions only. Apply at time of set planting or 7–10 days after seeding as drench banded over row. See label for rotational crop restrictions.
	diazinon	Diazinon 500 E	2.2–4.4 L/ha (0.9–1.8 L/acre)	10	Bulb and green onions. Apply as a soil drench application at planting only. 3-day restricted entry interval.
FOLIAR SPRAYS FOR ONION MAGGOT FLIES					
organophosphate (group 1B)	naled	Dibrom	530 mL/ha (214 mL/acre)	4	Dry bulb onions only. Foliar insecticide applications of adult flies have shown to not be effective. 48-hr restricted entry interval.
pyrethroid (group 3A)	cypermethrin	Mako	175 mL/ha (71 mL/acre)	3	Onions only. Foliar insecticide applications of adult flies have shown to not be effective. 12-hr restricted entry interval.
		Ship 250	280 mL/ha (113 mL/acre)	3	
		UP-Cyde 2.5 EC			

¹ Based on 30–38-cm (12–15-in.) row spacing.

Table 3–101. Onion, Leek and Shallot Insect Control — Thrips

For resistance management, apply two applications of the same insecticide no more than

2 weeks apart before switching to a product from a different group.

Insecticide efficacy may be reduced when tank-mixed with another product containing a spreader sticker such as Bravo.

Apply insecticides with a penetrating non-ionic surfactant where labelled.

For dry bulb onions and leeks, observe a spray threshold of 1 thrips/leaf.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
THRIPS					
organophosphate (group 1B)	malathion	Malathion 85E	1,100 mL/ha (445 mL/acre)	3	Dry bulb and green onions. Do not store for more than 1 year. 12-hr restricted entry interval.
			1,100–1,345 mL/ha (445–544 mL/acre)	3	Leeks and shallots. Do not store for more than 1 year. 12-hr restricted entry interval.
	naled	Dibrom	530 mL/ha (214 mL/acre)	4	Dry bulb onions only. 48-hr restricted entry interval.
pyrethroid ¹ (group 3A)	lambda-cyhalothrin	Matador 120EC	188 mL/ha (76 mL/acre)	14	Onions, leeks and shallots. Resistance has been documented on muck soils in Ontario. See label for restricted entry intervals.
		Silencer 120 EC			
	cypermethrin	Mako	175 mL/ha (71 mL/acre)	3	Onions only. Resistance has been documented on muck soils in Ontario. 12-hr restricted entry interval.
		Ship 250	280 mL/ha		
		UP-Cyde 2.5 EC	(113 mL/acre)		
	deltamethrin	Decis 5 EC	200 mL/ha (81 mL/acre)	5	Onions only. Resistance has been documented on muck soils in Ontario. 12-hr restricted entry interval.
		Decis 100 EC	100 mL/ha (40 mL/acre)		
		Poleci 2.5 EC	400 mL/ha (162 mL/acre)		
spinosyn (group 5)	spinetoram	Delegate WG	200–336 g/ha (81–136 g/acre)	3	Onions, leeks and shallots. Suppression. Use high rate when pest pressure is high and/or insects are in advanced growth stages. 12-hr restricted entry interval.
		Entrust	437–527 mL/ha (177–213 mL/acre)	3	Onions, leeks and shallots. Suppression. Re-entry permitted once spray deposit has dried.
	spinosad	Success ²	218–262 mL/ha (88–106 mL/acre)		
avermectin (group 6)	abamectin	Agri-Mek SC ³	135–270 mL/ha (55–109 mL/acre)	7	Green onions and leeks. Tank-mix with a non-ionic surfactant. See label for restricted entry intervals.
				30	Bulb onions and shallots. Tank-mix with a non-ionic surfactant. 12-hr restricted entry interval.

¹ Resistance to these insecticides has been observed in Ontario muck soils.

² Maintain a spray water pH of 6 or greater.

³ This product has been tested in combination with a non-ionic surfactant for safety to some varieties of bulb onions; however, testing has not been conducted on all crops and varieties in the bulb onion sub-group under the range of conditions that may cause crop injury.

Table 3–101. Onion, Leek and Shallot Insect Control — Thrips

For resistance management, apply two applications of the same insecticide no more than

2 weeks apart before switching to a product from a different group.

Insecticide efficacy may be reduced when tank-mixed with another product containing a spreader sticker such as Bravo.

Apply insecticides with a penetrating non-ionic surfactant where labelled.

For dry bulb onions and leeks, observe a spray threshold of 1 thrips/leaf.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
THRIPS (continued)					
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	365 mL/ha (148 mL/acre)	3	Dry bulb onions and shallots. Apply during the first half of the season when adult populations are relatively low or building. Make two applications no more than 2 weeks apart before switching to a product with a different mode of action. Reduction in numbers of thrips larvae may take 3–4 days after application. See label for spray adjuvant and application details. 12-hr restricted entry interval.
				7	Green onions and leeks. Apply during the first half of the season when adult populations are relatively low or building. Make two applications no more than 2 weeks apart before switching to a product with a different mode of action. Reduction in numbers of thrips larvae may take 3–4 days after application. See label for spray adjuvant and application details. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	1–1.5 L/ha (405–607 mL/acre)	1	Onions, leeks and shallots. Suppression. If thrips populations are high, use a registered insecticide with different mode of action to reduce thrips populations before applying cyantraniliprole. Use a spray adjuvant as listed on the label. See label for tank-mix and crop tolerance information, and rotational crop restrictions. Do not apply more than two sequential applications of any group 28 insecticide. 12-hr restricted entry interval.
not classified (group NC)	<i>Beauveria bassiana</i> strain ANT-03	BioCeres G WP	2–4 g/L	0	Greenhouse use only. Also a reduction in aphids and whitefly. See label for application details. 4-hr restricted entry interval.

¹ Resistance to these insecticides has been observed in Ontario muck soils.

² Maintain a spray water pH of 6 or greater.

³ This product has been tested in combination with a non-ionic surfactant for safety to some varieties of bulb onions; however, testing has not been conducted on all crops and varieties in the bulb onion sub-group under the range of conditions that may cause crop injury.

Table 3–102. Onion, Leek and Shallot Insect Control — Leek Moth, Cutworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.
For resistance management, rotate between insecticides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEEK MOTH					
pyrethroid (group 3A)	lambda- cyhalothrin	Labamba	188 mL/ha (76 mL/acre)	14	Apply 7–10 days after peak pheromone trap capture. Maximum three applications per year. 24-hr restricted entry interval.
		Matador 120EC			
spinosyn (group 5)	spinetoram	Delegate WG	200–336 g/ha (81–136 g/acre)	3	Suppression. Apply 7–10 days after peak pheromone trap capture. 12-hr restricted entry interval.
	spinosad	Entrust	437–527 mL/ha (177–213 mL/acre)	3	Suppression. Apply 7–10 days after peak pheromone trap capture. Re-entry permitted once spray deposit has dried.
		Success ¹	218–262 mL/ha (88–106 mL/acre)		
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i>	Bioprotec PLUS	0.9–1.8 L/ha (0.36–0.73 L/acre)	0	Suppression. Apply 7–10 days after peak pheromone capture. For best results apply in evening or on cloudy days.
	<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i>	XenTari WG	500–1000 g/ha (202–405 g/acre)		
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Green onions and leeks only. Suppression. Apply 7–10 days after peak pheromone trap capture. 12-hr restricted entry interval.
CUTWORMS					
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT	2.4–4.8 L/ha (1–1.9 L/acre)	60	Bulb and pickling onions. Apply between 2–5-leaf stage. Do not incorporate on muck soil. 24-hr restricted entry interval.
		Pyrinex 480 EC			
		Nufos 4E	2.4–4.8 L/ha (1–1.9 L/acre)	60	Dry bulb onions only. Apply between 2–5-leaf stage. See label for rotational crop restrictions. 24-hr restricted entry interval.
		Sharphos			
		Warhawk 480 EC			
pyrethroid (group 3A)	cypermethrin	Mako	175 mL/ha (71 mL/acre)	21	Onions only. Do not disturb soil surface for 5 days after application. 12-hr restricted entry interval.
	permethrin	Pounce 384EC	180–390 mL/ha (73–158 mL/acre)	1	Onions only. Apply to moist soils up to 5-leaf stage. Do not disturb soil for 5 days after application. Use high rate on large larvae, dry soils or muck soils. 12-hr restricted entry interval.
		Perm-UP			
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	3	Black cutworm only. Also, reduction in damage to wireworm (See label for application details). Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Green onions and leeks. Do not use on areas treated with product the previous season. Do not apply more than two sequential applications of any group 28 insecticides. 12-hr restricted entry interval.

¹ Maintain a spray water pH of 6 or greater.

PARSNIPS

In this section:

Table 3–103.	Parsnip Seed Treatments
Table 3–104.	Activity of Fungicides on Parsnip Diseases
Table 3–105.	Parsnip Disease Control
Table 3–106.	Activity of Insecticides on Parsnip Insects
Table 3–107.	Parsnip Insect Control — Aphids, Leafhoppers
Table 3–108.	Parsnip Insect Control — Cutworms, Carrot Weevil, Flea Beetles, European Chafer Grubs

This information is provided as a guideline only. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication. See product labels for complete information.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–103. Parsnip Seed Treatments

Trade Name	Active Ingredient	Rate	Pests Controlled	Notes
FUNGICIDES				
Apron XL LS	metalaxyl-M and S-isomer	20–40 mL/100 kg seed	damping-off (pythium)	For use in commercial seed treatment facilities.
Apron Maxx	fludioxonil + metalaxyl-m	665 mL/100 kg seed	seed rot, damping-off (<i>Fusarium</i> spp. <i>Rhizoctonia</i> spp., <i>Pythium</i> spp.)	For use in commercial seed treatment facilities.
Dynasty 100FS	azoxystrobin	25–50 mL/100 kg seed	damping-off (<i>Rhizoctonia solani</i>)	For import use only; do not treat seed in Canada.
Maxim 480FS	fludioxonil	5.2–10.4 mL/100 kg of seed	seed decay, damping off	For use in commercial seed treatment facilities.

Table 3–104. Activity of Fungicides on Parsnip Diseases

LEGEND: C = control S = suppression
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Phoma Canker	<i>Alternaria</i> spp.	Botrytis Gray Mold	Root Rots
fluxapyroxad	Sercadis	—	C	—	—
penthiopyrad	Fontelis	—	—	C	—
pydiflumetofen/difenoconazole	Miravis Duo	—	C	—	—
fluopyram/trifloxystrobin	Luna Sensation	—	C	—	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	C	—
trifloxystrobin	Flint	—	C	—	—
<i>Bacillus subtilis</i>	Serenade SOIL	—	—	—	S
chlorothalonil	Bravo ZN/ZNC	C	—	—	—
	Echo 720	C	—	—	—

Table 3–105. Parsnip Disease ControlFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PHOMA CANKER					
chloronitrile (group M5)	chlorothalonil	Bravo ZN/ZNC	2.8 L/ha (1.1 L/acre)	7	5-day restricted entry interval for scouting. 21-day restricted entry interval for hand harvesting.
		Echo 720	1.9 L/ha (0.76 L/acre)	7	12-hr restricted entry interval.
ALTERNARIA SPP.					
SDHI (group 7)	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	7	Do not make more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.40 L/acre)	7	Do not make more than two sequential applications of any group 3 or group 7 fungicide. 12-hr restricted entry interval.
SDHI/QoI (group 7/11)	fluopyram/ trifloxystrobin	Luna Sensation	300–500 mL/ha (121–202 mL/acre)	7	Do not make sequential applications of any group 11 or more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
QoI (group 11)	trifloxystrobin	Flint	140–210 g/ha (56–85 g/acre)	7	Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
BOTRYTIS GRAY MOLD					
SDHI (group 7)	penthiopyrad	Fontelis	1–1.75 L/ha (0.4–0.7 L/acre)	0	Also controls powdery mildew. Do not make more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
AP/PP (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	7	12-hr restricted entry interval.

Table 3–106. Activity of Insecticides on Parsnip Insects

LEGEND: C = control
 N = registered, but not considered effective, or resistance is documented
 S = suppression
 RD = reduction in damage
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Aphids	Leafhoppers	Aster Leafhopper	Cutworms	European Chafer Grubs	Flea Beetle	Carrot Weevil
carbaryl	Sevin XLR	—	C	—	—	—	C	—
malathion	Malathion 85E	N	—	—	—	—	—	—
imidacloprid	Admire 240 F	C	C or S ¹	—	—	RD	C	—
thiamethoxam	Actara 25WG	C	—	C	—	—	—	—
sulfoxaflor	Closer	C	C	—	—	—	—	—
flupyradifurone	Sivanto Prime	C	C	—	—	—	—	—
spinosad	Scorpio Ant and Insect Bait	—	—	—	C	—	—	—
chlorantraniliprole	Coragen	—	—	—	C	—	—	—
cyantraniliprole	Exirel	C	—	—	C	—	C	C
	Verimark	—	—	—	—	—	RD	—
flonicamid	Beleaf 50SG	C	—	—	—	—	—	—

¹ Level of control for leafhoppers depends on application method.

Table 3–107. Parsnip Insect Control — Aphids, Leafhoppers

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
SOIL APPLICATIONS					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.6 mL/100 ft of row)	21	See label for application details. Do not use subsequent foliar group 4 insecticides in the same season. 24-hr restricted entry interval.
FOLIAR APPLICATIONS					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	14	Leafhoppers. See label for restricted entry intervals.
organophosphate (group 1B)	malathion	Malathion 85E	535–1,345 mL/ha (216–544 mL/acre)	7	Aphids. Control of aphids with malathion has been inconsistent in many areas. Apply when temperature is at or above 20°C. 24-hr restricted entry interval.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Aphids. Leafhopper suppression. Do not apply foliar group 4 insecticides in the same season as a soil application. 24-hr restricted entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Aphids and aster leafhoppers. Do not apply foliar group 4 insecticides in the same season as a soil application. 12-hr restricted entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–60 mL/acre)	7	Aphids. Do not apply a foliar group 4 insecticide in the same season as a soil application. 12-hr restricted entry interval.
			300 mL/ha (121 mL/acre)		Leafhoppers. Do not apply a foliar group 4 insecticide in the same season as a soil application. 12-hr restricted entry interval.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	7	12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	7	Aphids. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	3	Aphids. Use higher rates for greater pest populations and/or dense foliage. 12-hr restricted entry interval.

Table 3–108. Parsnip Insect Control — Cutworms, Carrot Weevil, Flea Beetles, European Chafer Grubs

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	3	Black cutworm only. Also, reduction in damage to wireworm (see label for application details). Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Black and variegated cutworm. Use low rate for black cutworm. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	7	Variegated cutworm. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
CARROT WEEVIL					
diamide (group 28)	cyantraniliprole	Exirel	1,000–1,500 mL/ha (400–600 mL/acre)	1	Begin applications at the 2–3-leaf stage or when scouting indicates the presence of weevils. Do not make a foliar application for a minimum of 60 days following an in-furrow or soil application with any group 28 insecticide. 12-hr restricted entry interval.
FLEA BEETLES					
Soil Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.6 mL/100 ft of row)	21	See label for application details. Do not use subsequent foliar group 4 insecticides in the same season. 24-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Verimark	6.75–9 mL/ 100 m of row (2.1–2.7 mL/ 100 ft of row)	21	Early-season damage reduction. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
Foliar Applications					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	14	See label for restricted entry intervals.
diamide (group 28)	cyantraniliprole	Exirel	500–1,000 mL/ha (202–405 mL/acre)	7	Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.

PEAS

In this section:

Table 3–109.	Pea In-Furrow and Seed Treatments
Table 3–110.	Activity of Fungicides and Insecticides on Pea Diseases and Insects
Table 3–111.	Pea Disease Control
Table 3–112.	Pea Insect Control

This information is provided as a guideline only. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication. See product labels for complete information.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–109. Pea In-Furrow and Seed Treatments

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

LEGEND: C = control S = suppression — = not registered for control of this pest, or activity on this pest has not been documented

LEGEND: C = control; S = suppression; — = not registered for control of this pest; or, active on this pest has not been documented								
Active Ingredient(s)	Trade Name	Insects		Diseases				Notes
		Seedcorn Maggots	Wireworm	Ascochyta ¹	Pythium	Fusarium	Rhizoctonia	
FUNGICIDES ONLY								
metalaxyl-M and S-isomer	Apron XL LS	—	—	—	C	—	—	For use in commercial seed treatment facilities. See the product label for rates.
metalaxyl	Allegiance FL	—	—	—	C	—	—	Peas for processing only. For use in commercial or on-farm seed treatment equipment. Use 32–110 mL/100 kg of seed.
fludioxonil/metalaxyl-M and S-isomer	Apron Maxx RFC	—	—	C	C	C	C	For use in commercial or on-farm seed treatment equipment. Use 100 mL/100 kg of seed. See label for recropping restrictions.
carbathiin/thiram	Vitaflo 280	—	—	C	C	C	C	For use in commercial seed treatment facilities only. See the product label for rates. Do not store treated seed.
<i>Bacillus subtilis</i>	Serenade SOIL	—	—	—	S	S	S	In-furrow treatment. See label for rates and application instructions. For broadcast or banded applications, incorporate into the seed zone with rainfall or overhead irrigation within 24 hours, if required.
<i>Trichoderma harzianum</i>	Rootshield HC	—	—	—	S	S	S	Seed box treatment. 60–125 g/50 kg of seed.
thiram	Thiram 75 WP	—	—	—	C	C	C	Seed box or commercial seed treatment. Use 25–35 g/25 kg of seed.
INSECTICIDES ONLY								
thiamethoxam	Cruiser 5FS ²	C	C	—	—	—	—	For use in commercial seed treatment facilities. See product label for rates. Request the high rate for wireworm control and early-season soybean aphids. Do not use any subsequent soil or foliar applications of a group 4 insecticide in the same season.
FUNGICIDES + INSECTICIDES								
thiamethoxam + metalaxyl-M and S-isomer/fludioxonil	Cruiser 5FS ² + Apron Maxx RFC	C	C	C	C	C	C	For use in commercial seed treatment facilities. See the product labels for rates. Request the high rate of Cruiser for wireworm control and early-season soybean aphids. See Apron Maxx RFC label for recropping restrictions. Do not use any subsequent soil or foliar applications of a group 4 insecticide in the same season.

¹ Seed-borne.

² Dust generated during the planting of treated seed may be harmful to bees and other pollinators. Bees can be exposed to product residues on flowers, leaves, pollen and/or nectar resulting from seed treatments.

Table 3–110. Activity of Fungicides and Insecticides on Pea Diseases and InsectsFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.

LEGEND: C = control S = suppression
 SC = some control may be expected when the product is used to control labelled pests and diseases
 PS = partial suppression
 N = registered, but not considered effective or resistance is documented
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Ascochyta (Mycosphaerella) Blight	White Mold (Sclerotinia)	Powdery Mildew	Slugs	Brown Marmorated Stink Bug	Aphids	Cutworms	Western Bean Cutworm
FUNGICIDES									
boscalid	Lance WDG	C	C	—	—	—	—	—	—
penthiopyrad	Fontelis	C	—	—	—	—	—	—	—
azoxystrobin	Azoshy 250 SC	C	—	C	—	—	—	—	—
	Quadris Flowable	C	—	C	—	—	—	—	—
pyraclostrobin	Headline EC	C	—	SC	—	—	—	—	—
azoxystrobin/propiconazole	Fungtion	C	—	C	—	—	—	—	—
	Quilt	C	—	C	—	—	—	—	—
<i>Bacillus subtilis</i>	Serenade Opti	—	S	—	—	—	—	—	—
<i>Bacillus amyloliquefaciens</i> strain F727	Stargus	—	PS	—	—	—	—	—	—
copper octanoate	Cueva	C	—	C	—	—	—	—	—
sulphur	Microthiol Disperss	—	—	C	—	—	—	—	—
	Cosavet DF Edge	—	—	C	—	—	—	—	—
INSECTICIDES									
methomyl	Lannate TNG	—	—	—	—	S	C	—	—
dimethoate	Cygon 480	—	—	—	—	—	C	—	—
	Lagon 480 E	—	—	—	—	—	C	—	—
naled	Dibrom	—	—	—	—	—	N	—	—
malathion	Malathion 85E	—	—	—	—	—	N	—	—
lambda-cyhalothrin	Matador 120EC	—	—	—	—	—	C	C	C
	Silencer 120 EC	—	—	—	—	—	C	C	C
	Labamba	—	—	—	—	—	C	C	C
permethrin	Ambush 500EC	—	—	—	—	—	—	C	—
	Perm-UP	—	—	—	—	—	—	C	—
	Pounce 384EC	—	—	—	—	—	—	C	—
deltamethrin	Decis 100EC	—	—	—	—	—	—	C	—
lambda-cyhalothrin/chlorantraniliprole	Voliam Xpress	—	—	—	—	—	C	—	C
acetamiprid	Assail 70 WP	—	—	—	—	—	C	—	—
flupyradifurone	Sivanto Prime	—	—	—	—	—	C	—	—
spinosad	Scorpio Ant and Insect Bait	—	—	—	—	—	—	C	—
chlorantraniliprole	Coragen	—	—	—	—	—	—	C	C
cyantraniliprole	Exirel	—	—	—	—	—	C	C	C
flonicamid	Beleaf	—	—	—	—	—	C	—	—
ferric phosphate	Sluggo Professional	—	—	—	C	—	—	—	—
potassium salts of fatty acids	Kopa Insecticidal Soap	—	—	—	—	—	C	—	—

Table 3–111. Pea Disease ControlFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ASCOCHYTA (MYCOSPHAERELLA) BLIGHT					
SDHI (group 7)	boscalid	Lance WDG	420 g/ha (170 g/acre)	7	Do not use on areas treated with product the previous season. Do not make more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
	penthiopyrad	Fontelis	1–1.5 L/ha (0.4–0.6 L/acre)	0	Also controls botrytis gray mold and alternaria blight at rates between 1–2.25 L/ha (0.4–0.9 L/acre). Do not make more than two sequential applications of any group 7 fungicide. 12-hr re-entry interval.
QoI (group 11)	azoxystrobin	Azoshy 250 SC	500 mL/ha (202 mL/acre)	15	Do not use on areas treated with product the previous season. Do not make sequential applications of any group 11 fungicide. See label for recropping restrictions. 12-hr restricted entry interval.
		Quadris Flowable			
	pyraclostrobin	Headline EC	400–600 mL/ha (162–243 mL/acre)	7	Do not make sequential applications of any group 11 fungicide. See label for recropping restrictions. 12-hr restricted entry interval.
QoI/DMI (group 11/3)	azoxystrobin/propiconazole	Fungtion	1–1.5 L/ha (0.4–0.6 L/acre)	15	Do not use on areas treated with product the previous season. Do not make sequential applications of any group 11 or group 3 fungicides. 12-hr restricted entry interval.
		Quilt			
inorganic (group M1)	copper octanoate	Cueva	0.5%–2% solution, applied at 470–940 L/ha (190–380 L/acre)	1	4-hr restricted entry interval.
WHITE MOLD (SCLEROTINIA), POWDERY MILDEW					
SDHI (group 7)	boscalid	Lance WDG	560–770 g/ha (227–312 g/acre)	7	White mold. Do not use on areas treated with product the previous season. Do not make more than two sequential applications of any group 7 fungicide. See label for recropping restrictions. 12-hr restricted entry interval.
QoI (group 11)	azoxystrobin	Azoshy 250 SC	500 mL/ha (202 mL/acre)	15	Powdery mildew. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 11 fungicide. See label for recropping restrictions. 12-hr restricted entry interval.
		Quadris Flowable			
QoI/DMI (group 11/3)	azoxystrobin/propiconazole	Fungtion	1 L/ha (0.4 L/acre)	15	Powdery mildew. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 11 or group 3 fungicides. 12-hr restricted entry interval.
		Quilt			
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade Opti	1.7–3.3 kg/ha (0.7–1.3 kg/acre)	0	White mold. Suppression. Make the first application at planting or prior to crop emergence.
	<i>Bacillus amyloliquefaciens</i> strain F727	Stargus	4–8 L/ha (1.62–3.24 L/acre)	0	White Mold. Partial suppression only. Apply preventively when conditions favour white mold development or when symptoms first appear. A second application 7–10 days later may improve control and protect yield potential. Ensure good coverage. 4-hr restricted entry interval.
inorganic (group M1)	copper octanoate	Cueva	0.5%–2% solution, applied at 470–940 L/ha (190–380 L/acre)	1	Powdery mildew. 4-hr restricted entry interval.
inorganic (group M2)	sulphur	Cosavet DF Edge	1.5 kg/ha (0.6 kg/acre)	1	Powdery mildew. 24-hr restricted entry interval.
		Microthiol Disperss			

Table 3–112. Pea Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
Foliar Applications					
carbamate (group 1A)	methomyl	Lannate TNG	510 g/ha (206 g/acre)	1	12-hr restricted entry interval.
organophosphate (group 1B)	dimethoate	Cygon 480	275–380 mL/ha (111–172 mL/acre)	3	Processing only. Do not feed or graze vines within 21 days of last application. 12-hr restricted entry interval.
		Lagon 480 E			
	malathion	Malathion 85E	1.1 L/ha 0.44 L/acre	3	Less effective below 20°C. Control of aphids with malathion has been inconsistent in many areas. 1-day restricted entry interval.
	naled	Dibrom	1.05–2.1 L/ha (0.42–0.85 L/acre)	4	Processing only. Do not apply when temperature is above 32°C. 48-hr restricted entry interval.
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	83–233 mL/ha (34–94 mL/acre)	7	May also control lygus bugs. Do not feed or graze treated vines. 24-hr restricted entry interval.
		Silencer 120 EC	83–233 mL/ha (34–94 mL/acre)	14	
		Labamba	83–233 mL/ha (34–94 mL/acre)	7	
pyrethroid/ diamide (group 3A/28)	lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	225–500 mL/ha (91–202 mL/acre)	7	Do not use on areas treated with product the previous season. Do not graze or harvest for livestock feed. 24-hr restricted entry interval.
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	56–86 g/ha (23–35 g/acre)	7	Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 12-hr restricted entry interval.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	7	Do not use on areas treated with product the previous season. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	750–1,500 mL/ha (304–607 mL/acre)	1	Soybean aphid. See label for crop tolerance information. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf	120–160 g/ha (49–65 g/acre)	7	Use high rate on high populations or dense foliage. See label for lygus bug control and recropping restrictions. 12-hr restricted entry interval.
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water Apply dilute solution at a rate of 700–1,900 L/ha (283–770 L/acre)	0	Do not spray when plants are under stress. See label for crop tolerance information. Avoid spraying during full sun.

Table 3-112. Pea Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
SLUGS					
not classified (group NC)	ferric phosphate	Sluggo Professional	12–50 kg/ha (4.8–20 kg/acre)	0	Apply to moist soils. Use higher rates on severe infestations.
WESTERN BEAN CUTWORM					
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	83–187 mL/ha (34–76 mL/acre)	7	May also control lygus bugs. Do not feed or graze treated vines. 24-hr restricted entry interval.
		Silencer 120 EC	83–187 mL/ha (34–76 mL/acre)	14	
		Labamba	83–233 mL/ha (34–94 mL/acre)	7	
pyrethroid/diamide (group 3A/28)	lambda-cyhalothrin/chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	7	Do not use on areas treated with product the previous season. Do not graze or harvest for livestock feed. 24-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Do not use on areas treated with product the previous season. 12-hr restricted entry interval.
CUTWORMS					
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	7	May also control lygus bugs. Apply in the late evening or at night. Do not feed or graze treated vines. 24-hr restricted entry interval.
		Silencer 120 EC	83 mL/ha (34 mL/acre)	14	
		Labamba	83–233 mL/ha (34–94 mL/acre)	7	
	permethrin	Ambush 500EC	140–300 mL/ha (57–121 mL/acre)	—	Apply in the late evening or at night. Apply up to 5-leaf stage. Use high rates on dry soils and/or large cutworms. Do not disturb soil for 5 days after treating. Re-entry permitted when dry.
		Perm-UP	180–390 mL/ha (73–158 mL/acre)	—	Apply in the late evening or at night. Apply up to 5-leaf stage. Use high rates on dry soils and/or large cutworms. Do not disturb soil for 5 days after treating. 12-hr restricted entry interval.
		Pounce 384EC	180–390 mL/ha (73–158 mL/acre)	—	Apply in the late evening or at night. Apply up to 5-leaf stage. Use high rates on dry soils and/or large cutworms. Do not disturb soil for 5 days after treating. Re-entry permitted when dry.
	deltamethrin	Decis 100 EC	100 mL/ha (40 mL/acre)	7	Do not disturb the soil after application. Also controls grasshoppers, TPB and pea leaf weevil. 12-hr restricted entry interval.
Group 5	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	3	Black cutworm. Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Apply to small plants when no rain is forecast in the next 24 hr. Do not use on areas treated with product the previous season. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	Apply to small plants when no rain is forecast in the next 24 hr. See label for crop tolerance information. 12-hr restricted entry interval.
BROWN MARMORATED STINK BUG					
See ontario.ca/stinkbug for the most up-to-date information on registrations and brown marmorated stink bug control measures.					
carbamate (group 1A)	methomyl	Lannate TNG	510 g/ha (206 g/acre)	1	Suppression. Apply when insect first appears. 12-hr restricted entry interval.

PEPPERS

In this section:

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This information is provided as a guideline only. Some products are under re-evaluation with the PMRA and may change within the lifetime of this publication. See product labels for complete information.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–113. Pepper Transplant Production Disease and Insect Control (Greenhouse)

Group Name (Group #)	Common Name	Trade Name	Rate	Notes
SEED AND SEEDLING FUNGAL DISEASES				
Seed Treatments				
phenylamide (group 4)	metalaxyl-M and S-isomer	Apron XL LS	20–40 mL/100 kg of seed	Pythium damping-off. For import use only; do not treat seeds in Canada.
QoI (group 11)	azoxystrobin	Dynasty 100FS	25–50 mL/100 kg of seed	Seed rot and pre-emergence damping-off caused by <i>Rhizoctonia solani</i>. For import use only; do not treat seeds in Canada.
PP (group 12)	fludioxonil	Maxim 480FS	5.2–10.4 mL/100 kg of seed	Seed decay, damping-off and seedling blight caused by fusarium and rhizoctonia. For use in commercial seed treatment facilities.
dithiocarbamate (group M03)	thiram	Thiram 75 WP	90 g/25 kg of seed	Seed decay, seedling blight, and damping-off. Seed box or commercial seed treatment.
Soil Applications				
Qil (group 21)	cyazofamid	Torrent 400SC	30 mL in 100 L of water/ha Apply as a soil drench to thoroughly wet the growing medium immediately after seeding.	Pythium damping-off and root rot. Apply Immediately after seeding. Do not use any surfactant with drench application. Do not make sequential applications of any group 21 fungicides. 60-day pre-harvest interval. 12-hr restricted entry interval.
CAA (group 40)	mandipropamid	Revus	600 mL/ha (243 mL/acre)	Phytophthora blight. Suppression. Make one application as a drench, immediately before transplanting. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	25–250 g in 100 L of water See label for application details.	Phytophthora capsici (soil). Partial suppression. Make preventive applications to transplants in the greenhouse before transplanting. Follow up applications of 100–500 g/ha (40–202 g/acre) can be made by drip irrigation or directed spray at 2–4-week intervals after transplanting. Re-entry permitted once spray deposit has dried.

Table 3–113. Pepper Transplant Production Disease and Insect Control (Greenhouse)

Group Name (Group #)	Common Name	Trade Name	Rate	Notes
SEED AND SEEDLING FUNGAL DISEASES — Soil Applications (continued)				
phthalamide (group M04)	captan	Maestro 80DF	1.25 kg in 1,000 L of water Apply 50–85 L of solution/100 m².	Damping-off and fungus root rot. Soil drench treatment. 48-hr restricted entry interval.
		Supra Captan 80 WDG		
		Sharda Captan 80 WDG		
not classified (group NC)	<i>Gliocladium catenulatum</i>	Prestop WG	Refer to label for rates and application details.	Damping-off caused by <i>Pythium</i> sp. and <i>Rhizoctonia solani</i>. Suppression. Growing media or drench application. Do not tank-mix with any fungicides, insecticides, herbicides or adjuvants.
	<i>Streptomyces</i> strain K611	Mycostop	Refer to label for rates and application details.	Fusarium and phytophthora. Suppression. Drench or soil spray application. Apply first spray after emergence using lower rate.
	<i>Trichoderma harzianum</i>	RootShield Granules	600–750 g/m of loose planting mix or soil	Root diseases caused by pythium, rhizoctonia, and fusarium. Suppression.
	<i>Trichoderma harzianum</i> Rifai strain T22	Trianum P	See label for rate and application instructions.	Fusarium root rot and damping off caused by <i>Pythium ultimum</i> and <i>Rhizoctonia solani</i>. Suppression. 4-hr restricted entry interval.
Foliar Applications				
microbial (group BM02)	<i>Bacillus subtilis</i>	Cease	1–2 L/100 L water	Botrytis gray mold. Suppression.
not classified (group NC)	<i>Gliocladium catenulatum</i>	Prestop WG	Refer to label for rates and application details.	Botrytis stem canker. Suppression. Do not tank-mix with any fungicides, insecticides, herbicides or adjuvants. 4-hr restricted entry interval after foliar applications.
BACTERIAL DISEASES				
microbial (group BM02)	<i>Bacillus subtilis</i>	Cease	1–2 L/100 L water	Bacterial speck. Suppression.
inorganic (group M01)	copper hydroxide	Coppercide WP	2.25 kg/ha (0.9 kg/acre)	Bacterial spot. 24-hr restricted entry interval.
		Kocide 2000	3.2 kg/ha (1.3 kg/acre)	
INSECTS				
Seed Treatments				
neonicotinoid (group 4A)	clothianidin/ imidacloprid	Sepresto 75 WS	0.44 g/1,000 seeds	Aphids and thrips. For import use only; do not treat seeds in Canada. Do not use any subsequent soil, transplant or foliar applications of a group 4 insecticide in the same season.
Foliar Applications				
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i> var. <i>kurstaki</i> strain EVB-113-19	Bioprotec PLUS	1 L in 1,000 L of water See label for application instructions.	<i>Duponchelia fovealis</i>. 4-hr restricted entry interval or once spray deposit has dried.

Table 3–114. Activity of Fungicides on Pepper Diseases

LEGEND: C = control S = suppression PS = partial suppression
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Greenhouse (Transplants)				Field					
		Bacterial Spot	Damping-Off (Seedlings)	Phytophthora Blight	Root Disease	Alternaria (Early Blight)	Anthraxnose	Bacterial Spot	Botrytis Gray Mold	Phytophthora Blight	Powdery Mildew
tetraconazole	Mettle	—	—	—	—	C	—	—	—	—	C
difenoconazole/benzovindiflupyr	Aprovia Top	—	—	—	—	C	C	—	—	—	C
benzovindiflupyr	Aprovia	—	—	—	—	C	C	—	—	—	C
boscalid	Cantus WDG	—	—	—	—	C	—	—	C	—	—
fluxapyroxad	Sercadis	—	—	—	—	C	—	—	—	—	—
penthiopyrad	Fontelis	—	—	—	—	S	—	—	C	—	—
pydiflumetofen/difenoconazole	Miravis Duo	—	—	—	—	C	C	—	S	—	C
cyprodinil/fludioxinol	Switch 62.5 WG	—	—	—	—	—	C	—	C	—	—
pyraclostrobin	Cabrio EG	—	—	—	—	C	C	—	—	—	—
azoxystrobin/difenoconazole	Quadris Top	—	—	—	—	C	C	—	—	—	C
polyoxin D zinc salt	Diplomat 5SC	—	—	—	—	S	—	—	S	—	—
cyazofamid	Torrent 400SC	—	C	—	C	—	—	—	—	—	—
kasugamycin	Kasumin 2L	—	—	—	—	—	—	S	—	—	—
fluazinam	Allegro 500F	—	—	—	—	—	—	—	—	S	—
dimethomorph	Forum	—	—	—	—	—	—	—	—	S	—
mandipropamid	Revus	—	—	S ¹	—	—	—	—	—	S ¹	—
ametoctradin/dimethomorph	Zampro	—	—	—	—	—	—	—	—	S	—
mandipropamid/oxathiapiprolin	Orondis Ultra	—	—	—	—	—	—	—	—	S ¹	—
fluopicolide	Presidio	—	—	—	—	—	—	—	—	S	—
tea tree oil	Timorex Gold	—	—	—	—	—	—	—	—	—	C
metrafenone	Vivando SC	—	—	—	—	—	—	—	—	—	C
<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	—	—	PS	—	S	—	—	S	PS	—
<i>Bacillus subtilis</i>	Cease	S	—	—	—	—	—	—	—	—	—
	Serenade Opti	—	—	—	—	S	—	S	S	—	S
	Serenade SOIL	—	—	—	—	—	—	—	—	S ¹	—
<i>Gliocladium catenulatum</i>	Prestop WG	—	S	—	S	—	—	—	—	—	—
<i>Streptomyces</i> strain K611	Mycostop	—	S	—	S	—	—	—	—	—	—
<i>Streptomyces lydicus</i>	Actinovate SP	—	—	—	—	—	—	—	—	—	S
<i>Trichoderma harzianum</i>	RootShield Granules	—	—	—	S	—	—	—	—	—	—
	RootShield HC	—	—	—	S	—	—	—	S	—	—
<i>Trichoderma harzianum</i> Rifai strain T22	Trianum P	—	—	—	S	—	—	—	—	—	—
copper hydroxide	Coppercide WP	C	—	—	—	—	—	C	—	—	—
	Cueva	C	—	—	—	—	—	C	—	—	—
	Kocide 2000	C	—	—	—	—	—	C	—	—	—
	Parasol WG	—	—	—	—	—	—	C	—	—	—
copper sulphate	Copper 53W	—	—	—	—	C	C	—	—	—	—
captan	Maestro 80DF	—	C	—	C	—	—	—	—	—	—
	Supra Captan 80 WDG	—	C	—	C	—	—	—	—	—	—
	Sharda Captan 80 WDG	—	C	—	C	—	—	—	—	—	—
mineral oil	PureSpray Green Spray Oil 13E	—	—	—	—	—	—	—	—	—	S
	Suffoil-X	—	—	—	—	—	—	—	—	—	S
potassium bicarbonate	MilStop	—	—	—	—	—	—	—	—	—	C
<i>Aureobasidium pullulans</i>	Botector	—	—	—	—	—	—	—	S	—	—
extract of <i>Reynoutria sachalinensis</i>	Regalia Maxx	—	—	—	—	—	—	S	—	—	S
mono- and di-potassium salts of phosphorous acid	Confine Extra	—	—	—	—	—	—	—	—	S ¹	—

¹ See label for details.

Table 3–115. Pepper Disease Control — Bacterial Spot, Alternaria, AnthracnoseFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BACTERIAL SPOT					
hexopyranosyl antibiotic (group 24)	kasugamycin	Kasumin 2L	0.5 L in 100 L of water. Applied in sufficient volume to ensure thorough coverage. Maximum 1.2 L/ha (0.5 L/acre) of product or 240 L/ha (97 L/acre) solution.	1	Suppression. May be tank-mixed with Kocide 2000. Do not make more than two sequential applications. 12-hr restricted entry interval.
microbial (group BMO2)	<i>Bacillus subtilis</i>	Serenade Opti	0.6–1.7 kg/ha (0.24–0.69 kg/ha)	0	Suppression. Rotate with bactericides with a different mode of action.
inorganic (group M01)	copper hydroxide	Coppercide WP	2.25–3.25 kg/ha (0.91–1.32 kg/acre)	1	No additional information.
		Kocide 2000	2.52–3.2 kg/ha (1–1.3 kg/acre)	2	48-hr restricted entry interval.
		Parasol WG	2.25–3.25 kg/ha (0.91–1.32 kg/acre)		
	copper octanoate	Cueva	0.5%–2% (v/v) solution, applied in 470–940 L solution/ha (190–380 L/acre)	1	4-hr restricted entry interval.
plant extract (group P05)	extract of <i>Reynoutria sachalinensis</i>	Regalia Maxx	0.125–0.25% (v/v) in 400–1,000 L/ha (161–404 L/acre) water	0	Suppression. Re-entry permitted once spray deposit has dried.
ALTERNARIA, ANTHRACNOSE					
DMI (group 3)	tetraconazole	Mettle	440–584 mL/ha (178–236 mL/acre)	2	Alternaria. Restricted entry intervals: • general – 12 hr • hand set irrigation – 7 days • hand harvesting, tying and training – 2 days
DMI/SDHI (group 3/7)	difenoconazole/ benzovindiflupyr	Aprovia Top	643–967 mL/ha (260–391 mL/acre)	1	Do not make sequential applications of any group 3 or group 7 fungicides. 12-hr restricted entry interval.
SDHI (group 7)	benzovindiflupyr	Aprovia	500–750 mL/ha (202–304 mL/acre)	1	Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
	boscalid	Cantus WDG	175–315 g/ha (71–127 g/acre)	0	Alternaria. Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
	fluxapyroxad	Sercadis	167–333 mL/ha (68–135 mL/acre)	7	Alternaria. Use high rate to target black mold (<i>Alternaria alternata</i>) of ripe fruit. Tank-mix with a non-ionic surfactant. Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.51–0.71 L/acre)	0	Alternaria. Suppression. Do not make more than two sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.40 L/acre)	0	Also controls black mold (<i>Alternaria alternata</i>). Two consecutive applications can be made before switching to non-Group 7 and Group 3 fungicides. 12-hr restricted entry interval.

Table 3–115. Pepper Disease Control — Bacterial Spot, Alternaria, AnthracnoseFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ALTERNARIA, ANTHRACNOSE (continued)					
AP/PP (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	0	Anthracnose. Do not make more than two sequential applications of any group 9 or group 12 fungicides. 12-hr restricted entry interval.
Qol (group 11)	pyraclostrobin	Cabrio EG	560–840 g/ha (227–340 g/acre)	0	Do not make sequential applications of any group 11 fungicides. 12-hr restricted entry interval.
Qol/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	625 mL/ha (253 mL/acre)	1	Do not apply until 21 days after transplanting. Do not make sequential applications of any group 11 or group 3 fungicides. 12-hr restricted entry interval.
polyoxins (group 19)	polyoxin D zinc salt	Diplomat 5SC	537–926 mL/ha (217–375 mL/acre)	0	Alternaria. Suppression. Begin as a preventive application when conditions favour disease development. Re-entry permitted once spray deposit has dried.
microbial (group BM02)	<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	0.5–2 kg/ha (0.2–0.8 kg/acre)	0	Alternaria. Suppression. See label for details on choosing a rate. Re-entry permitted once spray deposit has dried.
	<i>Bacillus subtilis</i>	Serenade Opti	2.5 kg/ha (1 kg/acre)	0	Alternaria. Suppression.
inorganic (group M01)	copper sulphate	Copper 53W	4 kg/ha (1.6 kg/acre)	2	48-hr restricted entry interval.

Table 3–116. Pepper Disease Control — Botrytis Gray Mold, Phytophthora Blight, Powdery MildewFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BOTRYTIS GRAY MOLD					
SDHI (group 7)	boscalid	Cantus WDG	420 g/ha (170 g/acre)	0	Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	0	Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/difenoconazole	Miravis Duo	1 L/ha (0.40 L/acre)	0	Suppression. Do not make more than two consecutive applications before switching to non-group 7 and group 3 fungicides. 12-hr restricted entry interval.
AP/PP (group 9/12)	cyprodinil/fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	0	Do not make more than two sequential applications of any group 9 or group 12 fungicides. 12-hr restricted entry interval.
polyoxins (group 19)	polyoxin D zinc salt	Diplomat 5SC	463–926 mL/ha (187–375 mL/acre)	0	Suppression. Begin as a preventive application when conditions favour disease development. Re-entry permitted once spray deposit has dried.
microbial (group BM02)	<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	0.9–1 kg/ha or 1.25–3.6 kg/ha (0.39–0.4 kg/acre or 0.5–1.46 kg/acre)	0	Suppression. See label for details on choosing a rate. Re-entry permitted once spray deposit has dried.
	<i>Bacillus subtilis</i>	Serenade Opti	1.7–3.3 kg/ha (0.7–1.3 kg/acre)	0	Suppression.
not classified (group NC)	<i>Trichoderma harzianum</i>	RootShield HC	3.75–7.5 g/L of water Spray to wet, but avoid runoff.	—	Suppression.
	<i>Aureobasidium pullulans</i>	Botector	1 kg/ha (405 g/acre)	0	Suppression. 4-hr restricted entry interval.
PHYTOPHTHORA BLIGHT					
uncouplers of oxidative phosphorylation (group 29)	fluazinam	Allegro 500F	1.75 L/ha (708 mL/acre)	30	Suppression. Do not make more than 3 consecutive applications before switching to a non-group 29 fungicide. 24-hr restricted entry interval.
CAA (group 40)	dimethomorph	Forum	450 mL/ha (182 mL/acre)	0	Suppression. Do not make sequential applications of any group 40 fungicides. 12-hr restricted entry interval.
	mandipropamid	Revus	600 mL/ha (243 mL/acre)	1	Foliar blight. Suppression. Do not make more than 2 consecutive applications before switching to a non-group 40 fungicide. 12-hr restricted entry interval. Root and crown rot. Suppression. Soil application. Do not make more than 2 consecutive applications before switching to a non-group 40 fungicide. 12-hr restricted entry interval.
CAA/OSBPI (group 40/49)	mandipropamid/oxathiapiprolin	Orondis Ultra	600 mL/ha (243 mL/acre)	1	Foliar blight. Suppression. Do not make more than 2 consecutive applications before switching to non-group 49 and group 40 fungicides. 12-hr restricted entry interval. Root and crown rot. Suppression. Soil application. See label for application rates methods. 12-hr restricted entry interval.
benzamide (group 43)	fluopicolide	Presidio	220–292 mL/ha (89–118 mL/acre)	2	Suppression. Tank-mix with another fungicide registered for phytophthora blight, but from a different group. Do not make more than two sequential applications of any group 43 fungicides. 12-hr restricted entry interval.
QoSI/CAA (group 45/40)	ametoctradin/dimethomorph	Zampro	1 L/ha (0.4 L/acre)	4	Suppression. Use of a spreading/penetrating adjuvant may improve performance. Do not make sequential applications of any group 40 or group 45 fungicides. 12-hr restricted entry interval.

Table 3–116. Pepper Disease Control — Botrytis Gray Mold, Phytophthora Blight, Powdery MildewFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PHYTOPHTHORA BLIGHT (continued)					
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Suppression. Soil application. See label for application details.
phosphonate (group P07)	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–10 L/ha (2–4 L/acre)	1	Foliar blight. Suppression. May be applied as foliar sprays or through sprinkler chemigation. Re-entry permitted once spray deposit has dried.
POWDERY MILDEW					
DMI (group 3)	tetraconazole	Mettle	296–584 mL/ha (120–236 mL/acre)	2	Restricted entry intervals: • general – 12 hr • hand set irrigation – 7 days • hand harvesting, tying and training – 2 days
DMI/SDHI (group 3/7)	difenoconazole/ benzovindiflupyr	Aprovia Top	643–967 mL/ha (260–391 mL/acre)	1	Do not make sequential applications of any group 3 or group 7 fungicides. 12-hr restricted entry interval.
SDHI (group 7)	benzovindiflupyr	Aprovia	500–750 mL/ha (202–304 mL/acre)	1	Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.40 L/acre)	0	Two consecutive applications can be made before switching to non-group 7 and group 3 fungicides. 12-hr restricted entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	625 mL/ha (253 mL/acre)	1	Do not apply until 21 days after transplanting or 35 days after seeding. Do not make sequential applications of any group 11 or group 3 fungicides. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade Opti	1.7–3.3 kg/ha (0.7–1.3 kg/acre)	0	Suppression.
terpene hydrocarbons and terpene alcohols (group 46)	tea tree oil	Timorex Gold	1.0–1.5 L/ha (0.40–0.61 mL/acre)	2	Do not spray during the warm hours of the day and in hot seasons with temperatures above 35°C. 4-hr restricted entry interval.
actin/myosin/fibrin function (group 50)	metrafenone	Vivando SC	0.75–1.12 L/ha (0.3–0.45 L/acre)	7	Do not make more than two sequential applications. 12-hr restricted entry interval.
not classified (group NC)	mineral oil	PureSpray Green Spray Oil 13E	10 L in 1,000 L water applied in sufficient volume to ensure thorough coverage	—	Suppression. See label for crop safety and chemical compatibility precautions. 12-hr restricted entry interval.
		SuffOil-X	13 L/1,000 L water	0.5	
	potassium bicarbonate	MilStop	2.8–5.6 kg in 1,000 L of water/ha (1.1–2.3 kg in 400 L of water/acre)	0	See label for water volumes and chemical compatibility precautions. 4-hr restricted entry interval.
	<i>Streptomyces lydicus</i>	Actinovate SP	425 g in 1,100 L of water/ha (172 g in 445 L of water/acre) Spray to wet, but avoid runoff.	—	Suppression. 1-hr restricted entry interval or until spray deposit has dried.
plant extract (group P05)	extract of <i>Reynoutria sachalinensis</i>	Regalia Maxx	0.125–0.25% (v/v) in 400–1,000 L/ha (161–404 L/acre) water	0	Suppression. Re-entry permitted once spray deposit has dried.

Table 3–117. Activity of Insecticides on Pepper Insects

LEGEND: C = control RD = reduction in damage only N = registered, but not considered effective or resistance is documented
 — = not registered for control of this pest, or activity on this pest has not been documented S = suppression

Common Name	Trade Name	Greenhouse (Transplant)	Field									
		<i>Duponchella fovealis</i>	Aphids	Cutworms/ Armyworms	European Corn Borer	Flea Beetle	Mites	Pepper Maggot	Pepper Weevil	Stink Bug	Brown Marmorated Stink Bug	Tarnished Plant Bug
acephate	Orthene 97% SG	—	C	—	C	—	—	C	—	—	—	—
chlorpyrifos	Lorsban NT	—	—	C	—	—	—	—	—	—	—	—
	Nufos 4E	—	—	C	—	—	—	—	—	—	—	—
	Pyrinex 480 EC	—	—	C	—	—	—	—	—	—	—	—
	Warhawk 480 EC	—	—	C	—	—	—	—	—	—	—	—
	Sharphos	—	—	C	—	—	—	—	—	—	—	—
dimethoate	Cygon 480	—	C	—	—	—	—	C	—	—	—	—
	Lagon 480 E	—	C	—	—	—	—	C	—	—	—	—
malathion	Malathion 85E	—	N	—	—	—	—	C	S	—	—	—
deltamethrin	Decis 100 EC	—	—	—	C	—	—	—	—	—	—	—
	Poleci 2.5 EC	—	—	—	C	—	—	—	—	—	—	—
Fenpropathrin	Danitol	—	—	C	—	—	C	—	—	C	—	—
permethrin	Perm-UP	—	—	C	C	—	—	—	—	—	—	—
	Pounce 384EC	—	—	C	C	—	—	—	—	—	—	—
lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	—	—	C	C	—	—	—	—	—	—	—
acetamiprid	Assail 70 WP	—	C	—	—	—	—	—	—	—	—	—
	Aceta 70 WP	—	C	—	—	—	—	—	—	—	—	—
acetamiprid/novaluron	Cormoran	—	C	—	C	—	—	—	—	—	—	—
flupyradifurone	Sivanto Prime	—	C	—	—	—	—	—	—	—	—	—
spinosad	Entrust	—	—	—	C	—	—	—	—	—	—	—
	Success	—	—	—	C	—	—	—	—	—	—	—
	Scorpio Ant and Insect Bait	—	—	C	—	—	—	—	—	—	—	—
abamectin/cyantraniliprole	Minecto Pro	—	—	C	C	C	C	—	—	—	—	—
<i>Bacillus thuringiensis</i> var <i>kurstaki</i> strain EVB-113-19	Bioprotec PLUS	C	—	—	C	—	—	—	—	—	—	—
novaluron	Rimon 10 EC	—	—	—	C	—	—	—	S	—	—	—
methoxyfenozide	Intrepid	—	—	—	C	—	—	—	—	—	—	—
bifenazate	Acramite 50WS	—	—	—	—	—	C	—	—	—	—	—
spiromesifen	Oberon	—	—	—	—	—	C	—	—	—	—	—
spirotetramat	Movento 240 SC	—	C	—	—	—	—	—	—	—	—	—
chlorantraniliprole	Coragen	—	—	C	C	—	—	—	—	—	—	—
cyantraniliprole	Exirel	—	C	C	C	C	—	C	S	—	—	—
cyclaniliprole	Harvanta 50SL	—	—	C	—	—	—	—	—	—	—	—
tetraniliprole	Vayego	—	S	C	—	—	—	—	—	—	—	—
flonicamid	Beleaf 50SG	—	C	—	—	—	—	—	—	—	—	—
canola oil	Vegol	—	—	—	—	—	S	—	—	—	—	—
mineral oil	PureSpray Green Spray Oil 13E	—	—	—	—	—	S	—	—	—	—	—
	Suffoil-X	—	RD	—	—	—	S	—	—	—	—	—
potassium salts of fatty acids	Kopa Insecticidal Soap	—	C	—	—	—	C	—	—	—	—	—
	Opal Insecticidal Soap	—	C	—	—	—	C	—	—	—	—	—
<i>Beauveria bassiana</i> strain ANT-03	Bio Ceres G WP	—	RD	—	—	—	—	—	—	—	—	—
<i>Metarhizium anisopliae</i> strain F53	Met52 EC bioinsecticide	—	—	—	—	—	RD	—	—	—	—	—

¹ See label for details.

Table 3–118. Pepper Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
Soil and Transplant Applications					
butenolide (group 4D)	flupyradifurone	Sivanto Prime	750–1,000 mL/ha (304–405 mL/acre)	45	See label for application details. Do not use subsequent foliar group 4D insecticides in the same season. 12-hr restricted entry interval.
Foliar Applications					
organophosphate (group 1B)	acephate	Orthene 97% SG	562 g/ha (228 g/acre)	7	Sweet bell pepper only. 1-day restricted entry interval.
	dimethoate	Cygon 480	0.7–1.0 L/ha (0.3–0.4 L/acre)	7	12-hr restricted entry interval.
		Lagon 480 E	0.7–1.0 L/ha (0.3–0.4 L/acre)	3	
	malathion	Malathion 85E	610–1,345 mL/ha (247–544 mL/acre)	3	Less effective below 20°C. Resistance to this group of products has been documented in some areas. 12-hr restricted entry interval.
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP Aceta 70 WP	56–86 g/ha (23–35 g/acre)	7	Do not apply foliar group 4 insecticides in the same season as a seed treatment, soil or transplant application. 12-hr restricted entry interval.
butenolide (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	1	Do not apply foliar group 4D insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
neonicotinoid/benzoylurea (group 4A/15)	acetamiprid/ novaluron	Cormoran	490 mL/ha (200 mL/acre)	7	Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 12-hr restricted entry interval.
tetronic and tetramic acid derivative (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	1	Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. See label for guidance on adjuvant use. 12-hr restricted entry interval.
diamide (group 28)	cyantranilprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. See label for guidance on adjuvant use. 12-hr restricted entry interval.
	tetranilprole	Vayego 200 SC	150 mL/ha (61 mL/acre)	1	Suppression. Do not apply during less than 12 days prior to bloom or during bloom. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	0	12-hr restricted entry interval.
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water applied at 700–1,900 L solution/ha (283–770 L/acre)	0	Do not spray when plants are under stress. Avoid spraying during full sun.
UNF	<i>Beauveria bassiana</i> strain ANT-03	Bio Ceres G WP	2–4 g/L in 500 to 1,000 L/ha water	0	Reduction in numbers. For greenhouse transplants only. Begin treatment of crops at the first appearance of the insect pest. Do not mix with fungicide. It takes 5–7 days after the first application to observe control. 4-hr restricted entry interval.

Table 3–119. Pepper Insect Control — Cutworms and Armyworms, European Corn Borer

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS AND ARMYWORMS					
Soil Applications					
organophosphate (group 1B)	chlorpyrifos	Lorsban NT	2.4 L/ha (1 L/acre)	40	Cutworms. Green pepper only. Apply as a soil treatment 3–7 days before transplanting. 24-hr restricted entry interval.
		Nufos 4E			
		Pyrinex 480 EC			
		Warhawk 80 EC			
		Sharphos			
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	2	Black cutworm only. Also, reduction in damage to wireworm (see label for application details). Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
Foliar Applications					
organophosphate (group 1B)	chlorpyrifos	Lorsban NT	1.2–2.4 L/ha (0.5–1 L/acre)	40	Cutworms. Green pepper only. 24-hr restricted entry interval.
		Pyrinex 480 EC			
		Warhawk 80 EC			
		Sharphos			
pyrethroid (group 3A)	fenpropathrin	Danitol	779 mL/ha (315 mL/acre)	7	Armyworm. 24-hr restricted entry interval.
	permethrin	Perm-UP	180–390 mL/ha (73–158 mL/acre)		Cutworms. See label for application details. 12-hr restricted entry interval.
		Pounce 384EC	180–390 mL/ha (73–158 mL/acre)		Cutworms. See label for application details. Re-entry permitted once spray deposit has dried.
pyrethroid/ diamide (group 3A/28)	lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	7	Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 24-hr restricted entry interval.
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	370–566 mL/ha (150–225 mL/acre)	7	Tank-mix with a non-ionic surfactant. Apply to foliage when rain is not expected in the next 24 hr. Do not make a foliar application following an infurrow or soil application of any group 28 insecticide. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Early application on larval stages provides best control. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	Early application on larval stages provides best control. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	cyclaniliprole	Harvanta 50SL	0.8–1.2 L/ha (0.32–0.49 L/acre)	1	Armyworms. No more than 2 consecutive applications of any group 28 insecticides within a 30-day period. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
	tetraniliprole	Vayego 200 SC	150 mL/ha (61 mL/acre)	1	Do not apply during less than 12 days prior to bloom or during bloom. 12-hr restricted entry interval.

Table 3–119. Pepper Insect Control — Cutworms and Armyworms, European Corn Borer

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
EUROPEAN CORN BORER					
organophosphate (group 1B)	acephate	Orthene 97% SG	825 g/ha (334 g/acre)	7	Sweet bell pepper only. 1-day restricted entry interval.
pyrethroid (group 3A)	deltamethrin	Decis 100 EC	125–150 mL/ha (51–61 mL/acre)	3	12-hr restricted entry interval.
		Poleci 2.5 EC	500–600 mL/ha		
	permethrin	Perm-UP	180 mL/ha (73 mL/acre)	1	12-hr restricted entry interval.
		Pounce 384EC	180 mL/ha (73 mL/acre)		Re-entry permitted once spray deposit has dried.
pyrethroid/ diamide (group 3A/28)	lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	7	Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 24-hr restricted entry interval.
neonicotinoid/ benzoylurea (group 4A/15)	acetamiprid/ novaluron	Cormoran	650–750 mL/ha (265–306 mL/acre)	7	Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 12-hr restricted entry interval.
spinosyn (group 5)	spinosad	Entrust	167 mL/ha (68 mL/acre)	1	Use only on small larvae and low infestations. 12-hr restricted entry interval.
		Success	83 mL/ha (34 mL/acre)		
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	370–566 mL/ha (150–225 mL/acre)	7	Also controls cabbage looper. Tank-mix with a non-ionic surfactant. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. For European corn borer control, time the application to coincide with peak egg hatch. 12-hr restricted entry interval.
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i> var. <i>kurstaki</i> strain EVB-113-19	Bioprotec PLUS	1.8 L/ha (0.73 L/acre)	1	Sweet pepper only. Apply to young larvae at first signs of infestation. 4-hr restricted entry interval or when spray deposit has dried.
benzoylurea (group 15)	novaluron	Rimon 10 EC	410–820 mL/ha (166–332 mL/acre)	1	Must be absorbed by eggs or ingested by insect larvae. 12-hr restricted entry interval.
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	1	12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Early application on larval stages provides best control. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	Early application on larval stages provides best control. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.

Table 3–120. Pepper Insect Control — Mites, Pepper Maggot, Pepper Weevil

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
MITES					
pyrethroid (group 3A)	fenpropathrin	Danitol	779 mL/ha (315 mL/acre)	7	24-hr restricted entry interval.
avermectin/ diamide (group 6/28)	abamectin/ cyantranilprole	Minecto Pro	385–670 mL/ha (156–271 mL/acre)	7	Tank-mix with a non-ionic surfactant. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. 12-hr restricted entry interval.
bifenazate (group 20D)	bifenazate	Acramite 50WS	851 g/ha (344 g/acre)	3	12-hr restricted entry interval.
tetronic and tetramic acid derivative (group 23)	spiromesifen	Oberon	500–600 mL/ha (202–243 mL/acre)	1	Effective against egg and nymphal stages. Apply before mite populations begin to build up. Control may not be apparent for 2–3 weeks, especially under cool temperatures. An adjuvant may be used to improve coverage and control. 12-hr restricted entry interval.
not classified (group NC)	mineral oil	PureSpray Green Spray Oil 13E	10 L in 1,000 L water applied in sufficient volume to ensure thorough coverage	—	Suppression. Also provides reduction in damage for aphids. See label for crop safety and chemical compatibility precautions. 12-hr restricted entry interval.
		SuffOil-X	13 L/1,000 L water	0.5	
	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water applied at 700–1,900 L solution/ha (283–770 L/acre)	0	Do not spray when plants are under stress. See label for tank-mix and crop tolerance information. Avoid spraying during full sun.
	canola oil	Vegol	2% solution, applied at 700–1,900 L/ha (283–769 L/acre)	1	Suppression. Begin when pest appears.
UNF	<i>Metarhizium anisopliae</i> strain F53	Met52 EC bioinsecticide	0.5–5.0 L/1,000 L 108 mL/10 L	0	Reduction in numbers. Use higher application concentration when pest pressure is high. Re-entry permitted once spray deposit has dried.
PEPPER MAGGOT					
organophosphate (group 1B)	acephate	Orthene 97% SG	562 g/ha (227 g/acre)	7	Sweet bell pepper only. 1-day restricted entry interval.
	dimethoate	Cygon 480	0.7–1.0 L/ha (0.28–0.40 L/acre)	7	12-hr restricted entry interval.
		Lagon 480 E	0.7–1.0 L/ha (0.28–0.40 L/acre)	3	
diamide (group 28)	cyantranilprole	Exirel	1,000–1,500 mL/ha (404–606 mL/acre)	1	Do not make a foliar application for a minimum of 60 days following a soil application of any group 28 insecticide. See label for guidance on adjuvant use. 12-hr restricted entry interval.

Table 3–120. Pepper Insect Control — Mites, Pepper Maggot, Pepper Weevil

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PEPPER WEEVIL					
organophosphate (group 1B)	malathion	Malathion 85E	610–1,345 mL/ha (247–544 mL/acre)	3	Suppression. Less effective below 20°C. 12-hr restricted entry interval.
benzoylurea (group 15)	novaluron	Rimon	820 mL/ha (332 mL/acre)	1	Suppression. Re-application may be required when monitoring indicates the need.
diamide (group 28)	cyantraniliprole	Exirel	1,000–1,500 mL/ha (404–606 mL/acre)	1	Suppression. Do not make a foliar application for a minimum of 60 days following a soil application of any group 28 insecticide. See label for guidance on adjuvant. 12-hr restricted entry interval.

Table 3–121. Pepper Insect Control — Stink Bug, Brown Marmorated Stink Bug, Tarnished Plant Bug

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
STINK BUG¹ AND TARNISHED PLANT BUG					
Foliar Applications					
pyrethroid (group 3A)	fenpropathrin	Danitol	779 mL/ha (315 mL/acre)	7	24-hr restricted entry interval.

BROWN MARMORATED STINK BUGSee ontario.ca/stinkbug for the most up-to-date information on registrations and brown marmorated stink bug control measures.¹ Does not include brown marmorated stink bug.

POTATOES

In this section:

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Table 3–123.	Activity of Fungicides on Potato Diseases
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Table 3–125.	Potato Disease Control — Early Blight Fungicides
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Table 3–129.	Potato Disease Control — Nematodes and Verticillium Wilt
Table 3–130.	Activity of Insecticides on Potato Insects
Table 3–131.	Potato Insect Control — Colorado Potato Beetle
Table 3–132.	Potato Insect Control — Potato Leafhopper, Flea Beetle, Tarnished Plant Bug
Table 3–133.	Potato Insect Control — Cutworms, European Corn Borer, Cabbage Looper, Armyworms, Tomato Hornworm
Table 3–134.	Potato Insect Control — Aphids, Spider Mites, Wireworms, Potato Psyllid

This information is provided as a guideline only. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication. See product labels for complete information.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–122. Potato Seed Treatments

Group Name (Group #)	Common Name	Trade Name	Rate	Diseases or Insects Controlled
FUNGICIDES				
MBC (group 1)	thiophanate-methyl	Senator PSPT	500 g/ 100 kg seed	Fusarium seed piece decay, seed-borne verticillium and seed-borne silver scurf.
DMI/SDHI/CAA (group 3/7/40)	difenoconazole/ sedaxane/ mandipropamid	Vibrance Ultra Potato	32 mL/ 100 kg seed	Seed borne late blight, seed borne silver scurf, seed borne rhizoctonia (black scurf, stem and stolon canker), fusarium dry rot. Suppression of pink rot.
QoI (group 11)	fenamidone	Reason 500SC	10 mL/ 100 kg seed	Seed-borne late blight.
PP (group 12)	fludioxonil	Maxim PSP ¹	500 g/ 100 kg seed	Fusarium dry rot and seed-borne rhizoctonia.
		Maxim Liquid PSP ¹	5.2 mL/ 100 kg seed	
PP/dithiocarbamate (group 12/M3)	fludioxonil/ mancozeb	Maxim MZ PSP ¹	500 g/ 100 kg seed	Fusarium dry rot and seed-borne rhizoctonia.
PP/DMI (group 12/3)	fludioxonil/ difenoconazole	Maxim D ¹	65–130 mL/ 100 kg seed	Fusarium dry rot. Do not exceed a maximum slurry volume of 260 mL/100 kg seed. See label for further application details.
			130 mL/ 100 kg seed	Black scurf, stem and stolon canker (rhizoctonia) and silver scurf.
CAA (group 40)	mandipropamid	Revus	13–26 mL/ 100 kg seed	Seed-borne late blight. Suppression of pink rot.
dithiocarbamate (group M3)	mancozeb	Tuberseal	500 g/ 100 kg seed	Fusarium seed piece decay. Potatoes must be dry when treated with mancozeb. Apply thoroughly to coat the surface of whole or cut seed pieces with dust. Plant as soon as possible after treatment. Do not use surplus treated seed for food or feed.
		Solan MZ Potato ST Fungicide	500 g/ 100 kg seed	
		PSPT 16%	500 g/ 100 kg seed	

¹ Maxim treatments may increase the number of stems, leading to smaller tuber size.

Table 3–122. Potato Seed Treatments

Group Name (Group #)	Common Name	Trade Name	Rate	Diseases or Insects Controlled
INSECTICIDES				
neonicotinoid (group 4A)	clothianidin	Titan ST	10.4–20.8 mL/100 kg seed	Colorado potato beetle, potato flea beetle, potato leafhopper, aphids. For extended control, use the higher rate. Do not use any subsequent soil or foliar applications of a group 4 insecticide in the same season.
			20.8 mL/100 kg seed	Wireworms. Suppression. Do not dilute with any more than 6 parts water to 1 part Titan ST insecticide. Plant seed pieces as soon as possible after cutting and treating. Do not use any subsequent soil or foliar applications of a group 4 insecticide in the same season.
	imidacloprid	Admire 240 F	26–39 mL/100 kg seed	Colorado potato beetle, potato flea beetle, potato leafhopper, aphids. Do not use any subsequent soil or foliar applications of a group 4 insecticide in the same season.
		Alias 240 SC		
	thiamethoxam	Actara 240 SC	Rates based on seed spacing.	Colorado potato beetle, potato leafhoppers, aphids. See label for application details. Maximum rate cannot exceed 488 mL/ha or 195 mL/acre. Do not use any subsequent soil or foliar applications of a group 4 insecticide in the same season.
diamide (group 28)	cyantraniliprole	Verimark	45 mL/100 kg seed	Colorado potato beetle and flea beetle spring adults. Following application of Verimark insecticide, application of a fungicide potato seed treatment or inert dust is recommended. See label for information on worker safety protocols. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil or seed piece application. 12-hr restricted entry interval.
INSECTICIDE + FUNGICIDE				
neonicotinoid (group 4A) + SDHI/DMI (group 7/3)	clothianidin + penflufen/prothioconazole	Titan ST + Emesto Silver	10.4–20.8 mL + 20 mL/100 kg seed	Insects — Colorado potato beetle, potato flea beetle, potato leafhopper, aphids. High rate of Titan ST for suppression of wireworms. Diseases — Fusarium tuber rot, seed-borne rhizoctonia, silver scurf. Do not use any subsequent soil or foliar applications of a group 4 insecticide in the same season.
neonicotinoid (group 4A) + DMI/PP (group 3/12)	thiamethoxam + difenoconazole/fludioxonil	Cruiser Maxx Potato Extreme	20 mL/100 kg seed	Insects — Colorado potato beetle, aphids, potato leafhopper. Diseases — Stem and stolon canker (<i>Rhizoctonia solani</i>), fusarium dry rot, silver scurf (<i>Helminthosporium solani</i>). Suppression of black scurf. Do not use any subsequent soil or foliar applications of a group 4 insecticide in the same season.
GROWTH REGULATOR				
carboxylic acid	giberellic acid	Falgro Tablet	1 tablet in 75 L of water (treats 61,000 kg seed)	For increased tuber set and smaller tuber profile for seed, table and processing potatoes.

Table 3–123. Activity of Fungicides on Potato Diseases

LEGEND: C = control S = suppression N = registered, but not considered effective or resistance is documented
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Pythium Leak	Pink Rot	Rhizoctonia	Silver Scurf	Fusarium Dry Rot	Early Blight	Late Blight	Botrytis Gray Mold	Brown Spot	Black Dot	White Mold	Verticillium Wilt	Nematodes
metconazole	Quash Fungicide	—	—	—	—	—	C	—	—	—	—	S	—	—
difenoconazole/benzovindiflupyr	Aprovia Top	—	—	—	—	—	C	—	—	S	—	—	—	—
fludioxonil/difenoconazole/azoxystrobin	Stadium	—	—	—	S	C	—	—	—	—	—	—	—	—
metalaxyl-M/mancozeb	Ridomil Gold MZ 68WG	S	N	—	—	—	C ¹	N ²	—	—	—	—	—	—
metalaxyl-M and S-isomer	Ridomil Gold 480 SL	S	N	—	—	—	C ¹	N ²	C ¹	—	—	—	—	—
benzovindiflupyr	Aprovia	—	—	S	S	—	—	—	—	—	—	—	S	—
boscalid	Cantus WDG	—	—	—	—	—	C	—	—	—	—	—	—	—
fluxapyroxad	Sercadis	—	—	C	—	—	C	—	—	—	—	S	—	—
penthiopyrad	Vertisan	—	—	S	—	—	S	—	C	—	—	—	—	—
fluopyram	Velum Prime	—	—	—	—	—	S	—	—	—	S	—	—	S
pydiflumetofen/difenoconazole	Miravis Duo	—	—	—	—	—	C	—	C	C	—	S	—	—
fluopyram/pyrimethanil	Luna Tranquility	—	—	—	—	—	C	—	—	C	S	C	—	—
pyrimethanil	Scala SC	—	—	—	—	—	C ¹	—	—	—	—	—	—	—
azoxystrobin	Quadris Flowable	—	—	C	C	—	C ¹	C	—	—	C	—	—	—
	Azoshy 250 SC	—	—	C	C	—	C ¹	C	—	—	C	—	—	—
azoxystrobin/difenoconazole	Quadris Top	—	—	—	—	—	C	—	—	S	S	S	—	—
azoxystrobin + benzovindiflupyr	Elatus A + Elatus B	—	—	C	C	—	—	—	—	—	—	—	S	—
picoxystrobin	Acapela	—	—	—	—	—	C	C	—	—	—	C	—	—
pyraclostrobin	Headline EC	—	—	—	—	—	C	C ³	—	—	—	—	—	—
pyraclostrobin/metiram	Cabrio Plus ⁴	—	—	—	—	—	C	C	—	—	—	—	—	—
fenamidone	Reason 500SC	—	—	—	—	—	C ⁵	C ⁵	—	—	—	—	—	—
famoxadone/cymoxanil	Tanos 50 DF	—	—	—	—	—	C	C	—	—	—	—	—	—
polyoxin D zinc salt	Diplomat 5SC	—	—	—	—	—	S	—	—	—	—	—	—	—
cyazofamid	Ranman 400SC	—	—	—	—	—	—	C	—	—	—	—	—	—
zoxamide/mancozeb	Gavel DF	—	—	—	—	—	C	C	—	—	—	—	—	—
cymoxanil + mancozeb	Curzate 60 DF + Manzate	—	—	—	—	—	—	C	—	—	—	—	—	—
fluazinam	Allegro 500F	—	—	—	—	—	—	C	—	—	—	C	—	—
mono- and dibasic sodium, potassium and ammonium phosphites	Phostrol	—	S	—	—	—	S	C	—	—	—	—	—	—
mono- and di-potassium salts of phosphorous acid	Confine Extra	—	S	—	S	—	—	S	—	—	—	—	—	—
	Rampart	—	S	—	—	—	—	S	—	—	—	—	—	—
dimethomorph	Acrobat 50 WP	—	—	—	—	—	—	C ⁶	—	—	—	—	—	—
	Forum	—	—	—	—	—	—	C ⁶	—	—	—	—	—	—
mandipropamid	Revus	—	S ⁷	—	—	—	—	C	—	—	—	—	—	—
mandipropamid/oxathiapiprolin	Orondis Ultra	—	—	—	—	—	—	C	—	—	—	—	—	—
fluopicolide	Presidio	—	C	—	—	—	—	C ¹	—	—	—	—	—	—
ametoctradin/dimethomorph	Zampro	—	—	—	—	—	—	C	—	—	—	—	—	—

¹ When tank-mixed with Bravo.² Certain strains of late blight are resistant to metalaxyl-M.³ When tank-mixed with Bravo or Polyram DF[®].⁴ Check the most recent label on the PMRA website or the notes section in Table 3–127 for date of last use due to product phase-out.⁵ When tank-mixed with Bravo or mancozeb.⁶ When tank-mixed with Bravo, mancozeb or Polyram DF[®].⁷ When used as a seed treatment.⁸ Check the most recent label on the PMRA website or the notes section in Table 3–128 for date of last use due to product phase-out.

Table 3–123. Activity of Fungicides on Potato Diseases

LEGEND: C = control S = suppression N = registered, but not considered effective or resistance is documented
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Pythium Leak	Pink Rot	Rhizoctonia	Silver Scurf	Fusarium Dry Rot	Early Blight	Late Blight	Botrytis Gray Mold	Brown Spot	Black Dot	White Mold	Verticillium Wilt	Nematodes
oxathiapiprolin/metalaxyl-M and S-isomer	Orondis Gold	S	S	—	—	—	—	—	—	—	—	—	—	—
tea tree oil	Timorex Gold	—	—	—	—	—	—	S	—	—	—	—	—	—
<i>Bacillus subtilis</i>	Serenade SOIL	S	S	S	C	S	—	—	—	—	—	—	—	—
	Serenade Opti	—	—	—	C	—	S	—	—	—	—	—	—	—
<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	—	—	—	—	—	S	—	—	—	—	—	—	—
	Stargus	—	S	—	—	—	—	—	—	—	—	—	—	—
hydrogen peroxide	StorOx	—	—	—	S	S	—	—	—	—	—	—	—	—
hydrogen peroxide/peroxyacetic acid	OxiDate 2.0	—	—	—	—	—	—	—	S	S	—	S	—	—
copper hydroxide	Kocide 2000	—	—	—	—	—	C	C	—	—	—	—	—	—
	Parasol Flowable	—	—	—	—	—	C	C	—	—	—	—	—	—
	Coppercide WP	—	—	—	—	—	C	C	—	—	—	—	—	—
copper octanoate	Cueva	—	—	—	—	—	C	C	—	—	—	—	—	—
copper oxychloride	Copper Spray	—	—	—	—	—	C	C	—	—	—	—	—	—
copper sulphate	Copper 53W	—	—	—	—	—	C	C	—	—	—	—	—	—
mancozeb	Dithane F-45	—	—	—	—	C	C	C	—	—	—	—	—	—
	Manzate Pro-Stick	—	—	—	—	—	C	C	—	—	—	—	—	—
	Dithane Rainshield	—	—	—	—	—	C	C	—	—	—	—	—	—
	Penncozeb 75 DF Raincoat	—	—	—	—	—	C	C	—	—	—	—	—	—
metiram	Polyram DF ³	—	—	—	—	—	C	C	—	—	—	—	—	—
chlorothalonil	Bravo ZN	—	—	—	—	—	C	C	C	—	—	—	—	—
	Echo 90 DF	—	—	—	—	—	C	C	C	—	—	—	—	—

¹ When tank-mixed with Bravo.

² Certain strains of late blight are resistant to metalaxyl-M.

³ When tank-mixed with Bravo or Polyram DF³.

⁴ Check the most recent label on the PMRA website or the notes section in Table 3–127 for date of last use due to product phase-out.

⁵ When tank-mixed with Bravo or mancozeb.

⁶ When tank-mixed with Bravo, mancozeb or Polyram DF³.

⁷ When used as a seed treatment.

⁸ Check the most recent label on the PMRA website or the notes section in Table 3–128 for date of last use due to product phase-out.

Table 3–124. Potato Disease Control — Pythium Leak, Pink Rot, Rhizoctonia, Silver Scurf, Fusarium Dry RotFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) N/A = not applicable — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PYTHIUM LEAK, PINK ROT, RHIZOCTONIA, SILVER SCURF, FUSARIUM DRY ROT					
Soil Applications					
PA (group 4)	metalaxyl-M and S-isomer	Ridomil Gold 480 SL	4 mL/100 m of row (1.2 mL/100 ft of row)	80	Pink rot. Suppression. See label for application details and tank-mix partners.
SDHI (group 7)	benzovindiflupyr	Aprovia	4.5–6.8 mL/100 m row ¹ (1.4–2.1 mL/100 ft of row) ¹	—	Rhizoctonia (stem canker, stolon canker, black scurf), silver scurf and verticillium wilt. Suppression. Use high rate for suppression of verticillium wilt. See label for application details. 12-hr restricted entry interval.
	fluxapyroxad	Sercadis	3 mL/100 m of row ² (0.9 mL/100 ft of row) ²	7	Rhizoctonia canker. In-furrow application. See label for application details. 12-hr restricted entry interval.
	penthiopyrad	Vertisan	15.5–31 mL/100 m of row (4.7–9.4 mL/100 ft of row)	7	Rhizoctonia stem canker. Suppression. 12-hr restricted entry interval.
Qol (group 11)	azoxystrobin	Quadris Flowable	4–6 mL/100 m of row (1.2–2 mL/100 ft of row)	—	Rhizoctonia stem canker, stolon canker and silver scurf. See label for application details. 12-hr restricted entry interval.
		Azoshy 250 SC			
Qol (group 11) + SDHI (group 7)	azoxystrobin + benzovindiflupyr	Elatus A + Elatus B	Elatus A: 4–6 mL/100 m of row (1.2–2 mL/100 ft of row) + Elatus B: 4.5–6.8 mL/100 m row ¹ (1.4–2.1 mL/100 ft of row) ¹	—	Rhizoctonia (stem and stolon canker, black scurf) and silver scurf control. Verticillium wilt suppression. Use high rate for suppression of verticillium wilt. See label for application details. 12-hr restricted entry interval.
phosphonate (group 33)	mono- and dibasic sodium, potassium and ammonium phosphites	Phostrol	5.8–11.6 L/ha (2.3–4.6 L/acre)	0	Pink rot. Suppression. Apply as a band in-furrow. 12-hr restricted entry interval.
benzamide (group 43)	fluopicolide	Presidio	292 mL/ha (118 mL/acre)	30	Pink rot. See label for application details. Do not apply a foliar application of a group 43 fungicide following an in-furrow or soil application. 12-hr restricted entry interval.
OSBPI/PA (group 49/4)	oxathiapiprolin/ metalaxyl-M and S-isomer	Orondis Gold	18.3 mL/100 m of row (5.6 mL/100 ft of row)	—	Pink rot, pythium leak. Suppression. Do not apply a foliar application of a group 49 fungicide following an in-furrow or soil application. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus amyloliquefaciens</i> strain F727	Stargus	8 L/ha (3.24 L/acre)	0	Pink rot. Suppression. In-furrow application. 4-hr restricted entry interval.
	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Rhizoctonia (black scurf and stem canker), pink rot, pythium leak and fusarium dry rot. Suppression. See label for application details.

¹ Based on 90-cm (35.4-in.) row spacing.² Based on 91-cm (36-in.) row spacing.

Table 3–124. Potato Disease Control — Pythium Leak, Pink Rot, Rhizoctonia, Silver Scurf, Fusarium Dry RotFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) N/A = not applicable — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PYTHIUM LEAK, PINK ROT, RHIZOCTONIA, SILVER SCURF, FUSARIUM DRY ROT					
Foliar Applications					
PA/ dithiocarbamate (group 4/M3)	metalaxyl-M/ mancozeb	Ridomil Gold MZ 68WG	2.5 kg/ha (1 kg/acre)	3	Pink rot and pythium leak. Suppression. The pythium leak fungus can only penetrate potato tubers through wounds. Metalaxyl-M accumulates in the tuber skin. Tuber wounds allow the pythium fungus to get past the metalaxyl-M barrier and leak develops. Experience has shown that strains of the pink rot pathogen may develop resistance to metalaxyl-M and S-isomer. 24-hr restricted entry interval.
phosphonate (group 33)	mono- and dibasic sodium, potassium and ammonium phosphites	Phostrol	5.8–11.6 L/ha (2.3–4.6 L/acre)	0	Pink rot. Suppression. See label for list of tank-mix partners. Rotate with fungicides with a different mode of action. 12-hr restricted entry interval.
Post-Harvest					
PP/DMI/Qol (group 12/3/11)	fludioxonil/ difenoconazole/ azoxystrobin	Stadium	32.5 mL/tonne dilute in 2 L water/ metric tonne	N/A	Fusarium dry rot control. Silver scurf suppression. Do not apply to seed potatoes. Ensure proper coverage of the tubers. Do not make more than one post-harvest application to the tubers.
phosphonate (group 33)	mono- and dibasic sodium, potassium and ammonium phosphites	Phostrol	0.42 L in 2 L water for 1 tonne of potatoes	N/A	Pink rot. Suppression. Also controls late blight. See label for application details.
	mono- and di-potassium salts of phosphorous acid	Confine Extra	Dilute at a 1:5.13 ratio with water. 326 mL in 1,674 mL water to treat 1,000 kg of potatoes	N/A	Late blight, pink rot and silver scurf. Suppression. Apply 2 L of this solution as a spray to 1,000 kg of potatoes prior to storage.
		Rampart	Application prior to storage: 190 mL/1 L water Apply 2 L of this solution as spray or rinse to 1,000 kg of potatoes. Application to stored potatoes: 190 mL/1 L of water Inject 2 L of this solution/1,000 kg of tubers in water used for post-harvest storage.	N/A	Late blight and pink rot. Suppression. Apply as soon as possible after harvest. Maximum one application per year, as either single spray or rinse to harvested tubers prior to storage or as a single application through the humidification system in storage.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade SOIL	85–175 mL/ tonne of potatoes	N/A	Silver scurf. For post-harvest application to aid in the control of silver scurf. See product label for application details.
		Serenade Opti	7–14 g/tonne of potatoes	N/A	
inorganic (group M1)	hydrogen peroxide	StorOx	100 mL/ 10 L water	N/A	Fusarium dry rot, silver scurf. Suppression. Apply prior to storage or inject into humidification water. See label for application details.
dithiocarbamate (group M3)	mancozeb	Dithane F-45	1.58 L/ 1,000 kg of seed	N/A	Fusarium dry rot. Apply to seed potatoes only prior to storage.

Table 3–125. Potato Disease Control — Early Blight Fungicides

Begin applications prior to disease development.

For resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DMI (group 3)	metconazole	Quash Fungicide	175–280 g/ha (70–112 g/acre)	1	Also suppresses white mold at the high rate. Apply prior to infection for preventive control. Do not make more than two sequential applications of any group 3 fungicides. See label for restricted entry intervals.
DMI/SDHI (group 3/7)	difenoconazole/benzovindiflupyr	Aprovia Top	643–967 mL/ha (260–391 mL/acre)	14	Also suppresses brown spot. Do not make more than two sequential applications of any group 3 or group 7 fungicide. 12-hr restricted entry interval.
SDHI (group 7)	boscalid	Cantus WDG	175–315 g/ha (70–126 g/acre)	30	Do not make more than two sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
	fluxapyroxad	Sercadis	167–333 mL/ha (68–135 mL/acre)	7	Also suppresses white mold at high rate. Tank-mix with a non-ionic surfactant. Do not make more than two sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
	penthiopyrad	Vertisan	1–1.75 L/ha (0.4–0.7 L/acre)	7	Suppression. Also controls botrytis gray mold at the rate of 1.25–1.75 L/ha. Do not make more than two sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/difenoconazole	Miravis Duo	1 L/ha (0.40 L/acre)	7	Also controls brown spot, botrytis gray mold and suppresses white mold. Do not make more than two sequential applications of any group 3 or group 7 fungicide. 12-hr restricted entry interval.
SDHI/AP (group 7/9)	fluopyram/pyrimethanil	Luna Tranquility	600 mL/ha (243 mL/acre)	7	Also controls brown spot. Also controls white mold and suppresses black dot at rate of 800 mL/ha. Do not make more than two sequential applications of any group 7 or group 9 fungicides. 12-hr restricted entry interval.
AP (group 9)	pyrimethanil	Scala SC	750 mL/ha (300 mL/acre)	7	Tank-mix with Bravo. 12-hr restricted entry interval.
Qol/DMI (group 11/3)	azoxystrobin/difenoconazole	Quadris Top	566–1,000 mL/ha (226–400 mL/acre)	14	Also suppresses brown spot and black dot. Also suppresses white mold at the high rate. Do not make sequential applications of any group 11 or more than two sequential applications of group 3 fungicides. 12-hr restricted entry interval.
polyoxins (group 19)	polyoxin D zinc salt	Diplomat 5SC	537–926 mL/ha (217–375 mL/ha)	0	Suppression. Re-entry permitted once spray deposit has dried.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade Opti	1.1–2.2 kg/ha (0.45–0.9 kg/acre)	0	Suppression. Also suppresses white mold. See label for application details.
	<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	0.5–2 kg/ha (0.2–0.8 kg/acre)	0	Suppression. Also suppresses white mold. Re-entry permitted once spray deposit has dried.

Table 3–126. Potato Disease Control — Late Blight Targeted Fungicides

Begin applications when weather conditions favour late blight, or if late blight is identified in the local area.

For resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Qil (group 21)	cyazofamid	Ranman 400SC	100–200 mL/ha (40–80 mL/acre)	7	Use high rate for tuber blight protection. Tank-mix with non-ionic surfactant. Do not make sequential applications of any group 21 fungicides. 12-hr restricted entry interval.
cyanoacetamide oxime (group 27) + dithiocarbamate (group M3)	cymoxanil + mancozeb	Curzate 60 DF + Manzate Pro-Stick	225 g/ha (90 g/acre) + 1.6 kg/ha (0.65 kg/acre)	8	Make two applications, 5 days apart; then rotate with a late blight targeted protectant fungicide from a different chemical group. 24-hr restricted entry interval.
2,6-dinitroaniline (group 29)	fluazinam	Allegro 500F	400 mL/ha (160 mL/acre)	14	Also controls white mold at 0.4–0.6 L/ha. Do not make more than three sequential applications of group 29 fungicides. 24-hr restricted entry interval.
phosphonate (group 33)	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–10 L/ha (2–4 L/acre)	1	Late blight and pink rot. Suppression. Do not for use on potatoes intended for seed. 12-hr restricted entry interval.
		Rampart	3–8 L/ha (1.2–3.2 L/acre)	—	Late blight and pink rot. Suppression. Do not apply to plants that are dormant or heat or moisture stressed. 4-hr restricted entry interval.
CAA (group 40)	dimethomorph	Acrobat 50 WP Forum	450 g/ha (180 g/acre)	4	Tank-mix with Dithane Rainshield, Polyram DF or Bravo. Apply after top kill to reduce tuber blight. Do not make more than two sequential applications of any group 40 fungicides. 12-hr restricted entry interval.
	mandipropamid	Revus	400–600 mL/ha (160–240 mL/acre)	14	Tank-mix with a non-ionic surfactant. Do not apply as first fungicide application if seed treatment contained a group 40 fungicide. Do not make more than two sequential applications of any group 40 fungicides. 12-hr restricted entry interval.
CAA/OSBPI (group 40/49)	mandipropamid/ oxathiapiprolin	Orondis Ultra	400–600 mL/ha (162–243 mL/acre)	14	Do not apply foliar applications in the same season as a soil application of Orondis Gold. Do not use more than one in every three applications. Do not make more than two sequential applications before switching to a non-group 40 and 49 fungicide. 12-hr restricted entry interval.
benzamide (group 43)	fluopicolide	Presidio	220–292 mL/ha (91–120 mL/acre)	7	Tank-mix with Bravo. Do not make sequential applications of any group 43 fungicides. Do not apply a foliar application of a group 43 fungicide following an in-furrow or soil application. 12-hr restricted entry interval.
QoSI/CAA (group 45/40)	ametoctradin/ dimethomorph	Zampro	0.8–1 L/ha (0.32–0.4 L/acre)	4	High rate reduces tuber blight when applied immediately prior to or after vine kill. Do not make more than two sequential applications of any group 40 or group 45 fungicides. 12-hr restricted entry interval.
plant extract (group 46)	tea tree oil	Timorex Gold	2.25 L/ha (0.91 L/acre)	2	Suppression. Do not spray during the warm hours of the day. 4-hr restricted entry interval.

Table 3–127. Potato Disease Control — Early Blight and Late Blight Fungicides

Begin applications prior to disease development.

For resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PA (group 4)	metalaxyl-M and S-isomer	Ridomil Gold 480 SL	208 mL/ha (84 mL/acre)	14	Tank-mix with Bravo. Certain strains of late blight are resistant to metalaxyl-M. 12-hr restricted entry interval.
PA/dithiocarbamate (group 4/M3)	metalaxyl-M and S-isomer/ mancozeb	Ridomil Gold MZ 68WG	2.5 kg/ha (1 kg/acre)	3	Certain strains of late blight are resistant to metalaxyl-M. 24-hr restricted entry interval.
Qol (group 11)	azoxystrobin	Quadris Flowable	500–800 mL/ha (200–320 mL/acre)	1	Early blight. Tank-mix with Bravo. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
			800 mL/ha (320 mL/acre)		Late blight. Apply preventively. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
		Azoshy 250 SC	500–800 mL/ha (200–320 mL/acre)	1	Early blight. Tank-mix with Bravo. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
			800 mL/ha (320 mL/acre)		Late blight. Apply preventively. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
	fenamidone	Reason 500SC	200 mL/ha (80 mL/acre)	14	Tank-mix with mancozeb or Bravo. Apply preventively. Do not make sequential applications of any group 11 fungicide. Re-entry permitted once residues have dried.
	picoxystrobin	Acapela	0.6–1.0 L/ha (243–405 mL/acre)	3	Early blight. Also controls white mold. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
			0.44–1.0 L/ha (178–405 mL/acre)	3	Late blight. Apply preventively. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
	pyraclostrobin	Headline EC	450–670 mL/ha (180–268 mL/acre)	3	Tank-mix with Polyram DF or Bravo. Apply preventively. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
Qol/cyanoacetamide oxime (group 11/27)	famoxadone/ cymoxanil	Tanos 50 DF	560–840 g/ha (224–336 g/acre)	14	Do not make sequential applications of group 11 fungicide. 24-hr restricted entry interval.
Qol/ dithiocarbamate (group 11/M3)	pyraclostrobin/ metiram	Cabrio Plus	2.25–3.35 kg/ha (0.91–1.35 kg/acre)	3	Cabrio Plus is currently in a phase-out period. The last date of sale for retailers is June 21, 2020. The last date of use for growers is June 21, 2021. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
benzamide/ dithiocarbamate (group 22/M3)	zoxamide/ mancozeb	Gavel DF	1.7–2.25 kg/ha (0.7–0.9 kg/acre)	3	48-hr restricted entry interval.
phosphonate (group 33)	mono- and dibasic sodium, potassium and ammonium phosphites	Phostrol	2.9–11.6 L/ha (1.2–4.6 L/acre)	0	Preventive control of late blight. See label for list of tank-mix partners. 12-hr restricted entry interval.
			2.9–5.8 L/ha (1.2–2.3 L/acre)		Suppression of early blight and brown spot. 12-hr restricted entry interval.

Table 3–127. Potato Disease Control — Early Blight and Late Blight Fungicides

Begin applications prior to disease development.

For resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
inorganic (group M1)	copper hydroxide	Kocide 2000	0.8–1.6 kg/ha (0.3–0.6 kg/acre)	2	Tank-mix with Manzate Pro-Stick at a rate of 1.75–2.25 kg/ha. At vine kill use a rate of 2.4 kg/ha to reduce tuber blight. 48-hr restricted entry interval.
		Parasol Flowable			
		Coppercide WP	1.1–2.25 kg/ha (0.4–0.9 kg/acre)	1	Tank-mix with Manzate Pro-Stick at a rate of 1.75–2.25 kg/ha. May be applied at vine kill with a desiccant or alone after vine kill, prior to harvest at the rate of 3.4 kg/ha to reduce tuber blight. 48-hr restricted entry interval.
	copper octanoate	Cueva	0.5%–2% (v/v) solution, applied in 470–940 L/ha (190–380 L/acre)	1	See label for applications details. Copper products may cause phytotoxicity. 4-hr restricted entry interval.
	copper oxychloride	Copper Spray	4 kg/ha (1.6 kg/acre)	2	48-hr restricted entry interval.
	copper sulphate	Copper 53W	3.8 kg/ha (1.5 kg/acre)	2	Copper sulphate can cause phytotoxicity, especially under hot and humid conditions. Apply close to vine-killing time to kill spores of the late blight fungus. 48-hr restricted entry interval.

Table 3–128. Potato Disease Control — Broad-Spectrum Protectant Fungicides

Start spraying prior to row closure. For resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes	
dithiocarbamate (group M3)	mancozeb	Manzate Pro-Stick	1.1–2.25 kg/ha (0.4–0.9 kg/acre)	1	Early and late blight. 24-hr restricted entry interval.	
		Dithane Rainshield				
		Penncozeb 75 DF Raincoat	1.8–3.8 L/ha (0.73–1.5 L/ha)			
		Dithane F-45				
	metiram	Polyram DF	1.1–2.25 kg/ha (0.4–0.9 kg/acre)	1	Early and late blight. Polyram DF is currently in a phase-out period. The last date of sale for retailers is June 21, 2020. The last date of use for growers is June 21, 2021. 24-hr restricted entry interval.	
chloronitrile (group M5)	chlorothalonil	Bravo ZN	1.2–2.4 L/ha (0.5–0.97 L/acre)	1	Late blight. Restricted entry intervals: <ul style="list-style-type: none">• general – 12 hr• scouting – 3 days• handset irrigation – 23 days• rouging seed – 19 days	
			1.6–2.4 L/ha (0.64–0.97 L/acre)		Early blight and botrytis vine rot. Restricted entry intervals: <ul style="list-style-type: none">• general – 12 hr• scouting – 3 days• handset irrigation – 23 days• rouging seed – 19 days	
		Echo 90 DF	0.7–1.3 kg/ha (0.3–0.5 kg/acre)	1	Late blight. Restricted entry intervals: <ul style="list-style-type: none">• general – 12 hr• scouting – 3 days• handset irrigation – 23 days• rouging seed – 19 days	
			0.9–1.3 kg/ha (0.4–0.5 kg/acre)		Early blight and botrytis vine rot. Restricted entry intervals: <ul style="list-style-type: none">• general – 12 hr• scouting – 3 days• handset irrigation – 23 days• rouging seed – 19 days	

Table 3–129. Potato Disease Control — Nematodes and Verticillium Wilt

See Table 1–5 for soil fumigants registered for control of nematodes and *Verticillium* spp.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Soil Applications					
SDHI (group 7)	benzovindiflupyr	Aprovia	6.8 mL/100 m of row ¹ (2.1 mL/100 ft of row)	—	Verticillium wilt. Suppression. See label for application details. 12-hr restricted entry interval.
	fluopyram	Velum Prime	500 mL/ha (202 mL/acre) or 4.5 mL/100 m of row ¹ (1.37 mL/100 ft of row)	—	Root lesion nematodes, root knot nematodes, potato cyst nematodes (including pale cyst and golden nematode). Suppression. Also suppresses early blight and black dot. See label for application details. When applied as a soil application, use another mode of action for the first foliar fungicide application. 12-hr restricted entry interval.
QoI/SDHI (group 11/7)	azoxystrobin + benzovindiflupyr	Elatus A + Elatus B	Elatus A: 4–6 mL/100 m of row ¹ (1.2–2 mL/100 ft of row) + Elatus B: 4.5–6.8 mL/100 m of row ¹ (1.4–2.1 mL/100 ft of row)	—	Verticillium wilt. Suppression. Use high rate for suppression of verticillium wilt. Mount the spray nozzle so the spray is directed into the furrow as a 15–20-cm band just before the seed is covered. 12-hr restricted entry interval.

¹ Based on 90 cm (35.4 in.) row spacing

Table 3–130. Activity of Insecticides on Potato Insects

LEGEND: C = control RD = reduction in damage S = suppression
 N = registered, but not considered effective or resistance is documented
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Colorado Potato Beetle	Potato Leafhopper	Flea Beetle	Tarnished Plant Bug	Aphids	Cutworms	Spider Mites	Cabbage Looper	Armyworms	European Chafer Grubs	European Corn Borer	Tomato Hornworm	Wireworm
carbaryl	Sevin XLR	N	C	C	C	—	C	—	—	C	—	C	C	—
oxamyl	Vydate L	N	C	C	C	C	—	—	—	—	—	—	—	—
acephate	Orthene 97% SG	—	C	C	C	C	—	—	—	—	—	—	—	—
chlorpyrifos	Lorsban 4E/NT	N	—	C	C	—	C	—	—	—	—	—	—	—
	Nufos 4E	—	—	C	C	—	C	—	—	—	—	—	—	—
	Pyrinex 480 EC	—	—	C	C	—	C	—	—	—	—	—	—	C
	Sharphos	—	—	C	C	—	C	—	—	—	—	—	—	C
	Warhawk 480 EC	—	—	C	C	—	C	—	—	—	—	—	—	—
dimethoate	Cygon 480	—	C	—	—	C	—	—	—	—	—	—	—	—
	Lagon 480 E	—	C	—	C	C	—	—	—	—	—	—	—	—
naled	Dibrom	N	C	C	—	—	—	—	—	—	—	—	—	—
phosmet	Imidan 70-WP	N	C	C	—	C	—	—	—	—	—	—	—	—
phorate	Thimet 20-G	—	—	—	—	—	—	—	—	—	—	—	—	C
cypermethrin	Mako	N	C	C	C	—	C	—	—	—	—	—	—	—
	Ship 250	N	C	C	C	—	—	—	—	—	—	—	—	—
	UP-Cyde 2.5 EC	N	C	C	C	—	—	—	—	—	—	—	—	—
deltamethrin	Decis 5 EC	N	C	C	C	C	—	—	—	—	—	C	—	—
	Decis 100 EC	N	C	C	C	C	—	—	—	—	—	C	—	—
	Poleci 2.5 EC	N	C	C	C	C	—	—	—	—	—	C	—	—
lambda-cyhalothrin	Labamba	N	C	C	C	—	—	—	—	—	—	C	—	—
	Matador 120EC	N	C	C	C	—	—	—	—	—	—	C	—	—
	Silencer 120 EC	N	C	C	C	—	—	—	—	—	—	C	—	—
permethrin	Pounce 384EC	N	C	C	C	—	C	—	—	—	—	C	—	—
	Perm-UP	N	C	C	C	—	C	—	—	—	—	C	—	—
deltamethrin/imidacloprid	Concept	C	C	C	C	C	—	—	—	—	—	S	—	—
lambda-cyhalothrin/chlorantraniliprole	Voliam Xpress	—	—	—	—	—	C	—	C	C	—	—	C	—
acetamiprid	Aceta 70WP	C	—	—	—	C	—	—	—	—	—	—	—	—
	Assail 70 WP	C	—	—	—	C	—	—	—	—	—	—	—	—
clothianidin	Clutch 50 WDG	C	C	—	—	C	—	—	—	—	—	—	—	—
	Titan	C	C	C	—	C	—	—	—	—	—	—	—	RD
imidacloprid	Admire 240 F	C	C	C	—	C	—	—	—	—	RD	—	—	—
	Alias 240 SC	C	C	—	—	C	—	—	—	—	—	—	—	—
thiamethoxam	Actara 240 SC	C	C	—	—	C	—	—	—	—	—	—	—	—
	Actara 25WG	C	C	—	—	C	—	—	—	—	—	—	—	—
acetamiprid/novaluron	Cormoran	C	C	—	—	C	—	—	C	C	—	C	—	—

¹ Variegated cutworm only.² Early-season control of flea beetle adults.

Table 3–130. Activity of Insecticides on Potato Insects

LEGEND: C = control RD = reduction in damage S = suppression
 N = registered, but not considered effective or resistance is documented
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Colorado Potato Beetle	Potato Leafhopper	Flea Beetle	Tarnished Plant Bug	Aphids	Cutworms	Spider Mites	Cabbage Looper	Armyworms	European Chafer Grubs	European Corn Borer	Tomato Hornworm	Wireworm
thiamethoxam/cyantraniliprole	Minecto Duo 40WG	C	C	C	—	C	—	—	—	—	—	—	—	—
sulfoxaflor	Closer	—	C	—	C	C	—	—	—	—	—	—	—	—
sulfoxaflor/spinetoram	TwinGuard	C	C	—	C	C	—	—	—	—	—	C	—	—
flupyradifurone	Sivanto Prime	C	C	—	—	C	—	—	—	—	—	—	—	—
spinetoram	Delegate WG	C	—	—	—	—	—	—	—	—	—	C	—	—
spinosad	Entrust	C	—	S	—	—	—	—	C	—	—	C	—	—
	Scorpio Ant and Insect Bait	—	—	—	—	—	C	—	—	—	—	—	—	RD
	Success	C	—	—	—	—	—	—	—	—	—	C	—	—
abamectin	Agri-mek SC	C	—	—	—	—	—	C	—	—	—	—	—	—
abamectin/cyantraniliprole	Minecto Pro	C	—	C	—	—	—	C	—	—	—	C	—	—
<i>Bacillus thuringiensis</i>	Bioprotec PLUS	—	—	—	—	—	—	—	C	—	—	—	—	—
novaluron	Rimon 10 EC	C	—	—	—	—	—	—	—	—	—	C	—	—
spirotetramat	Movento 240 SC	—	—	—	—	C	—	—	—	—	—	—	—	—
spiromesifen	Oberon Flowable	—	—	—	—	—	—	C	—	—	—	—	—	—
chlorantraniliprole	Coragen	C	—	—	—	—	C	—	C	C	—	C	C	—
cyantraniliprole	Exirel	C	—	—	—	C	C ¹	—	C	C	—	C	S	—
	Verimark	C	—	C ²	—	—	—	—	—	—	—	—	—	—
cyclaniliprole	Harvanta	C	—	—	—	—	—	—	C	C	—	—	—	—
tetraniliprole	Vayego 200 SC	C	—	C	—	S	—	—	—	—	—	C	—	—
flonicamid	Beleaf 50SG	—	—	—	—	C	—	—	—	—	—	—	—	—
kaolin	Surround WP	—	S	—	—	—	—	—	—	—	—	—	—	—
potassium salts of fatty acids	Kopa Insecticidal Soap	—	—	—	—	C	—	C	—	—	—	—	—	—
mineral oil	SuffOil-X	—	—	—	—	RD	—	S	—	—	—	—	—	—
	Superior 70 Oil	—	—	—	—	RD	—	—	—	—	—	—	—	—
canola oil	Vegol	—	—	—	—	RD	—	—	—	—	—	—	—	—

¹ Variegated cutworm only.

² Early-season control of flea beetle adults.

Caution

The Colorado potato beetle (CPB) has the ability to develop resistance to insecticides very rapidly. Several insecticides for CPB control belong to the neonicotinoid chemical family. To delay the development of resistance to neonicotinoids, the following practices are strongly suggested:

- Do not apply a group 4 foliar spray in fields where a group 4 was used either in-furrow or as a seed treatment.
- Use label rates.
- Scout fields regularly to evaluate the efficacy of insecticide treatments.
- If control of CPB is poor after an insecticide application, collect CPB samples and have them tested for resistance.

CPB has developed resistance to most of the pyrethroid insecticides. Conduct a backpack spray test in a small area of the field before applying a pyrethroid to the entire field.

Table 3–131. Potato Insect Control — Colorado Potato BeetleFor resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
COLORADO POTATO BEETLE					
Soil Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/ 100 m of row (2.1–3.7 mL/ 100 ft of row)	—	See label for application details. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. 24-hr restricted entry interval.
		Alias 240 SC			
	thiamethoxam	Actara 240 SC	3.4–4.4 mL/ 100 m of row (1–1.3 mL/ 100 ft of row)	—	Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. 12-hr restricted entry interval.
	clothianidin	Clutch 50 WDG	2.4–4 g/ 100 m of row (0.7–1.2 g/ 100 ft of row)	—	Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. 12-hr restricted entry interval.
		Titan	221–373 mL/ha (89.4–150 mL/acre)	—	Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. 12-hr restricted entry interval.
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	440–700 g/ha (178–283 g/acre)	—	See label for application details. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 or group 28 insecticides in the same season. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Verimark	6.75–9 mL/ 100 m of row (2.1–2.7 mL/ 100 ft of row)	—	Apply as a narrow band in-furrow. Do not apply any subsequent applications of group 28 insecticides for Colorado potato beetle control following a soil or seed piece application. 12-hr restricted entry interval.
Foliar Applications					
carbamate (group 1A) ¹	oxamyl ¹	Vydate L	2.3–3.0 L/ha (0.9–1.2 L/acre)	7	24-hr restricted entry interval.
	carbaryl ¹	Sevin XLR	1.25 L/ha (0.5 L/acre)	1	12-hr restricted entry interval for scouting and hand weeding. 6-day restricted entry interval for irrigation.
organophosphate (group 1B) ¹	chlorpyrifos ¹	Lorsban 4E/NT	1 L/ha (0.4 L/acre)	7	24-hr restricted entry interval.
		Nufos 4E			
		Pyrinex 480 EC			
		Sharphos			
		Warhawk 480 EC			
	naled ¹	Dibrom	1.05 L/ha (0.4 L/acre)	4	48-hr restricted entry interval.
	phosmet ¹	Imidan 70-WP	1.6 kg/ha (0.64 kg/acre)	7	5-day restricted entry interval. See label for further PPE and restricted entry information.

¹ CPB resistance to group 1 carbamate insecticides has been confirmed in Ontario.

Table 3–131. Potato Insect Control — Colorado Potato BeetleFor resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Foliar Applications (continued)					
pyrethroid (group 3A)	lambda- cyhalothrin	Labamba	83–125 mL/ha (34–51 mL/acre)	7	Use the higher rate for larger instars and infestations. See note on CPB resistance to pyrethroids below. 24-hr restricted entry interval.
		Matador 120EC			
		Silencer 120 EC			
	deltamethrin	Decis 5 EC	100–150 mL/ha (40–61 mL/acre)	1	Colorado potato beetle has developed resistance to most of the pyrethroid insecticides in Ontario. Conduct a backpack spray test in a small area of the field before applying a pyrethroid to the entire field. 12-hr restricted entry interval.
		Decis 100 EC	50–75 mL/ha (20–30 mL/acre)		
		Poleci 2.5 EC	200–300 mL/ha (81–121 mL/acre)		
	cypermethrin	Mako	62.5–125 mL/ha (25–51 mL/acre)	7	
		Ship 250	140 mL/ha (57 mL/acre)		
		UP-Cyde 2.5 EC			
	permethrin	Pounce 384EC	180–260 mL/ha (73–105 mL/acre)	1	
Perm-UP					
pyrethroid/ neonicotinoid (group 3A/4A)	deltamethrin/ imidacloprid	Concept	650 mL/ha (263 mL/acre)	7	Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. Do not apply during flowering. 12-hr restricted entry interval.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. Do not apply during flowering. 24-hr restricted entry interval.
		Alias 240 SC			
	acetamiprid	Aceta 70WP	40–80 g/ha (16–32 g/acre)	7	Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 12-hr restricted entry interval.
		Assail 70 WP			
	clothianidin	Clutch 50 WDG	70–105 g/ha (28–42 g/acre)	14	Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 12-hr restricted entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. Do not apply between 50% row closure and petal fall. 12-hr restricted entry interval.
		Actara 240SC	109 mL/ha (44 mL/acre)	7	
neonicotinoid/ benzoylurea (group 4A/15)	acetamiprid/ novaluron	Cormoran	440–700 mL/ha (178–283 mL/acre)	7	Do not apply more than twice to a single generation and do not apply to successive generations. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 12-hr restricted entry interval.
sulfoxaflor/ spinosyn (group 4C/5)	sulfoxaflor/ spinetoram	TwinGuard	200–300 g/ha (81–121 g/acre)	7	Time the application for egg hatch or small larvae. 12-hr restricted entry interval or re-entry permitted once spray deposit has dried.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	750–1,000 mL/ha (304–405 mL/acre)	1	12-hr restricted entry interval.

Table 3–131. Potato Insect Control — Colorado Potato BeetleFor resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Foliar Applications (continued)					
spinosyn (group 5)	spinetoram	Delegate WG	160–240 g/ha (65–97 g/acre)	7	Time the application for egg hatch or small larvae. 12-hr restricted entry interval.
	spinosad	Entrust	167–334 mL/ha (68–135 mL/acre)	7	12-hr restricted entry interval.
		Success	83–167 mL/ha (34–68 mL/acre)	7	12-hr restricted entry interval.
avermectin (group 6)	abamectin	Agri-mek SC	225 mL/ha (91 mL/acre)	14	Tank-mix with a non-ionic surfactant. 12-hr restricted entry interval.
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	556–670 mL/ha (225–271 mL/acre)	14	Tank-mix with a non-ionic surfactant. For control of Colorado potato beetle, make the first application after approximately 50% of the egg masses have hatched and larvae are present. If two applications are needed, limit them to a single Colorado potato beetle generation per crop. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. 12-hr restricted entry interval.
benzoylurea (group 15)	novaluron	Rimon 10 EC	410–820 mL/ha (166–332 mL/acre)	14	Apply at egg hatch to 2nd instar. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–500 mL/ha (101–202 mL/acre)	1	Early applications on larval stages provide best control. Do not apply any subsequent applications of group 28 insecticides for Colorado potato beetle control following a seed treatment or soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	750–1,000 mL/ha (300–400 mL/acre)	7	Use the higher application rate when larger larvae are present. Do not apply any subsequent applications of group 28 insecticides for Colorado potato beetle control following a seed treatment or soil application. 12-hr restricted entry interval.
	cyclaniliprole	Harvanta	0.8–1.2 L/ha (0.32–0.48 L/acre)	7	Do not apply foliar group 28 insecticides in the same season as a seed or soil application. 12-hr restricted entry interval.
	tetraniliprole	Vayego 200 SC	150 mL/ha (61 mL/acre)	14	Do not apply foliar group 28 insecticides in the same season as a seed or soil application. Do not apply during flowering. 12-hr restricted entry interval.

Table 3–132. Potato Insect Control — Potato Leafhopper, Flea Beetle, Tarnished Plant Bug

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
POTATO LEAFHOPPER, FLEA BEETLE, TARNISHED PLANT BUG					
Soil Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.1–3.7 mL/100 ft of row)	—	Potato leafhopper. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. 24-hr restricted entry interval.
		Alias 240 SC			
	thiamethoxam	Actara 240 SC	3.4–4.4 mL/100 m of row (1–1.3 mL/100 ft of row)	—	Potato leafhopper. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. 12-hr restricted entry interval.
	clothianidin	Titan	221–373 mL/ha ¹ (89.4–150 mL/acre) ¹	—	Potato leafhopper. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. 12-hr restricted entry interval.
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	440–700 g/ha (178–283 g/acre)	—	Potato leafhopper and flea beetle. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 or group 28 insecticides in the same season. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Verimark	6.75–9 mL/100 m of row (2.1–2.7 mL/100 ft of row)	—	Potato flea beetle adults. Early season control. See label for application details and worker safety protocols. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil or seed piece application. 12-hr restricted entry interval.
Foliar Applications					
carbamate (group 1A)	oxamyl	Vydate L	2.3–3.0 L/ha (0.9–1.2 L/acre)	7	24-hr restricted entry interval.
	carbaryl	Sevin XLR	2.5 L/ha (1 L/acre)	7	Potato leafhopper and flea beetle. 12-hr restricted entry interval for scouting and hand weeding. 6-day restricted entry interval for irrigation.
			5.3–6.4 L/ha (2.1–2.6 L/acre)	7	Tarnished plant bug. 12-hr restricted entry interval for scouting and hand weeding. 6-day restricted entry interval for irrigation.
organophosphate (group 1B)	dimethoate	Cygon 480	0.55–1.1 L/ha (0.22–0.4 L/acre)	7	Leafhoppers and tarnished plant bug. 12-hr restricted entry interval.
		Lagon 480 E			Leafhoppers. 12-hr restricted entry interval.
	naled	Dibrom	1.05 L/ha (0.4 L/acre)	4	Leafhoppers and flea beetle. 48-hr restricted entry interval.
	acephate	Orthene 97% SG	580–850 g/ha (235–344 g/acre)	21	24-hr restricted entry interval. Re-entry with significant foliar contact requires gloves and cotton overalls for one week after restricted entry interval.
	chlorpyrifos	Lorsban 4E/NT	1 L/ha (0.4 L/acre)	7	Flea beetle and tarnished plant bug. 24-hr restricted entry interval.
		Nufos 4E			
		Pyrinex 480 EC			
		Sharphos			
organophosphate (group 1B)	phosmet	Imidan 70-WP	1.6 kg/ha (0.64 kg/acre)	7	Potato leafhopper and flea beetle. 5-day restricted entry interval. See label for further PPE and restricted entry information.

¹ Based on 90-cm (36-in.) row spacing.

Table 3–132. Potato Insect Control — Potato Leafhopper, Flea Beetle, Tarnished Plant Bug

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days); — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Foliar Applications (continued)					
pyrethroid (group 3A)	lambda- cyhalothrin	Labamba	83 mL/ha (34 mL/acre)	7	24-hr restricted entry interval.
		Matador 120EC			
		Silencer 120 EC			
	deltamethrin	Decis 5 EC	100–150 mL/ha (40–61 mL/acre)	1	12-hr restricted entry interval.
		Decis 100 EC	50–75 mL/ha (20–30 mL/acre)		
		Poleci 2.5 EC	200–300 mL/ha (81–121 mL/acre)		
	permethrin	Pounce 384EC Perm-UP	180–260 mL/ha (73–105 mL/acre)	1	12-hr restricted entry interval.
	cypermethrin	Mako	62.5–125 mL/ha (25–51 mL/acre)	7	Use high rate to control tarnished plant bug. 12-hr restricted entry interval.
		Ship 250	140 mL/ha (57 mL/acre)	7	Potato leafhopper and flea beetle. 12-hr restricted entry interval.
		UP-Cyde 2.5 EC	200 mL/ha (81 mL/acre)		Tarnished plant bug. 12-hr restricted entry interval.
pyrethroid/ neonicotinoid (group 3A/4A)	deltamethrin/ imidacloprid	Concept	650 mL/ha (263 mL/acre)	7	Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. Do not apply during flowering. 12-hr restricted entry interval.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Potato leafhopper. Suppression. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. Do not apply during flowering. 24-hr restricted entry interval.
	thiamethoxam	Actara 240 SC	109 mL/ha (44 mL/acre)	7	Potato leafhopper. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. Do not apply between 50% row closure and petal fall. 12-hr restricted entry interval.
		Actara 25WG	105 g/ha (42 g/acre)		
neonicotinoid/ benzoylurea (group 4A/15)	acetamiprid/ novaluron	Cormoran	490–750 mL/ha (198–304 mL/acre)	7	Potato leafhopper. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 12-hr restricted entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	300 mL/ha (121 mL/ha)	7	Potato leafhopper and tarnished plant bug. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 12-hr restricted entry interval.
sulfoxaflor/ spinosyn (group 4C/5)	sulfoxaflor/ spinetoram	TwinGuard	360 g/ha (146 g/acre)	7	Leafhoppers and tarnished plant bug. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 12-hr restricted entry interval.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	1	Leafhoppers. 12-hr restricted entry interval.
spinosyn (group 5)	spinosad	Entrust	334 mL/ha (135 mL/acre)	7	Tuber flea beetle. Suppression. 12-hr restricted entry interval.
avermectin/ diamide (group 6/28)	abamectin/ cyantranilprole	Minecto Pro	370–670 mL/ha (150–271 mL/acre)	14	Flea beetle. Tank-mix with a non-ionic surfactant. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. 12-hr restricted entry interval.
diamide (group 28)	tetranilprole	Vayego 200 SC	150 mL/ha (61 mL/acre)	14	Flea beetle. Do not apply foliar group 28 insecticides in the same season as a seed or soil application. Do not apply during flowering. 12-hr restricted entry interval.
not classified (group NC)	kaolin	Surround WP	6.25–12.5 kg/ha (2.5–5.1 kg/acre)	—	Leafhoppers. Suppression. For early applications, use the higher labelled rate. Follow-up applications may only require the lower labelled rate.

Table 3–133. Potato Insect Control — Cutworms, European Corn Borer, Cabbage Looper, Armyworms, Tomato Hornworm

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS, EUROPEAN CORN BORER, CABBAGE LOOPER, ARMYWORMS, TOMATO HORNWORM					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5–5.3 L/ha (1–2.1 L/acre)	7	European corn borer, armyworms, tomato hornworm. 12-hr restricted entry interval for scouting and hand weeding. 6-day restricted entry interval for irrigation.
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT	1.2–2.4 L/ha (0.5–1 L/acre)	7	Cutworms. 24-hr restricted entry interval.
		Nufos 4E			
		Pyrinex 480 EC			
		Sharphos			
		Warhawk 480 EC			
pyrethroid (group 3A)	cypermethrin	Mako	175 mL/ha (70 mL/acre)	7	Cutworms. Do not disturb soil surface for 5 days after application. 12-hr restricted entry interval.
	deltamethrin	Decis 5 EC	150–250 mL/ha (61–101 mL/acre)	1	European corn borer. 12-hr restricted entry interval.
		Decis 100 EC	75–125 mL/ha (30–51 mL/acre)		
		Poleci 2.5 EC	300–500 mL/ha (121–202 mL/acre)		
	lambda-cyhalothrin	Labamba	83 mL/ha (34 mL/acre)	7	European corn borer. 24-hr restricted entry interval.
		Matador 120EC			
		Silencer 120 EC			
	permethrin	Perm-UP	180–390 mL/ha (73–158 mL/acre)	1	Cutworms. For cutworms, do not disturb ground for 5 days following application. For European corn borer, use low rate. 12-hr restricted entry interval. Variegated cutworm and European corn borer. 12-hr restricted entry interval.
		Pounce 384EC			
		Perm-UP	180 mL/ha (73 mL/acre)		
pyrethroid/ neonicotinoid (group 3A/4A)	deltamethrin/ imidacloprid	Concept	650 mL/ha (263 mL/acre)	7	European corn borer. Suppression. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. Do not apply during flowering. 12-hr restricted entry interval.
pyrethroid/ diamide (group 3A/28)	lambda- cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	7	Black cutworm, variegated cutworm, cabbage looper, armyworms and tomato hornworm. Do not apply foliar group 28 insecticides in the same season as a seed treatment or soil application. 24-hr restricted entry interval.
neonicotinoid/ benzoylurea (group 4A/15)	acetamiprid/ novaluron	Cormoran	650–750 mL/ha (263–304 mL/acre)	7	European corn borer. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 12-hr restricted entry interval.
			440–700 mL/ha (178–283 mL/acre)		Cabbage looper and armyworms. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 12-hr restricted entry interval.
sulfoxaflor/ spinosyn (group 4C/5)	sulfoxaflor/ spinetoram	TwinGuard	200 g/ha (81 g/acre)	7	European corn borer. Control of small larvae. 12-hr restricted entry interval or re-entry permitted once spray deposit has dried.

Table 3–133. Potato Insect Control — Cutworms, European Corn Borer, Cabbage Looper, Armyworms, Tomato Hornworm

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS, EUROPEAN CORN BORER, CABBAGE LOOPER, ARMYWORMS, TOMATO HORNWORM (continued)					
spinosyn (group 5)	spinetoram	Delegate WG	160 g/ha (65 g/acre)	7	European corn borer. 12-hr restricted entry interval.
	spinosad	Entrust	250 mL/ha (101 mL/acre)	7	European corn borer (small larvae). 12-hr restricted entry interval.
			334 mL/ha (135 mL/acre)	7	Cabbage looper. 12-hr restricted entry interval.
		Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	7	Black cutworm only. Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
		Success	125 mL/ha (51 mL/acre)	7	European corn borer. 12-hr restricted entry interval.
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	370–556 mL/ha (150–225 mL/acre)	14	European corn borer. Tank-mix with a non-ionic surfactant. For European corn borer control, time the application to coincide with peak egg hatch. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. 12-hr restricted entry interval.
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i> var. <i>kurstaki</i> strain EVB-113-19	Bioprotec PLUS	0.9–1.8 L/ha (0.36–0.73 L/acre)	0	Cabbage looper. See label for application details. 4hr restricted entry interval or when residue has dried.
benzoylurea (group 15)	novaluron	Rimon 10 EC	410–820 mL/ha (166–332 mL/acre)	14	European corn borer. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Variegated cutworm, European corn borer, armyworms and tomato hornworm. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil or seed piece application. 12-hr restricted entry interval.
			250 mL/ha (101 mL/acre)	1	Black cutworm and cabbage looper. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil or seed piece application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	7	Variegated cutworm, European corn borer, tomato hornworm. Use rate of 750 mL/ha for suppression of tomato hornworm. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil or seed piece application. 12-hr restricted entry interval.
			250–500 mL/ha (100–200 mL/acre)	7	Cabbage looper and armyworms. Use high rate for armyworms. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil or seed piece application. 12-hr restricted entry interval.
	cyclaniliprole	Harvanta	0.8–1.2 L/ha (0.32–0.48 L/acre)	7	Cabbage looper, armyworms. Do not apply foliar group 28 insecticides in the same season as a seed or soil application. 12-hr restricted entry interval.
	tetraniliprole	Vayego 200 SC	150 mL/ha (61 mL/acre)	14	European corn borer. Do not apply foliar group 28 insecticides in the same season as a seed or soil application. Do not apply during flowering. 12-hr restricted entry interval.

Table 3–134. Potato Insect Control — Aphids, Spider Mites, Wireworms, Potato Psyllid

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
Soil Application					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.1–3.7 mL/100 ft of row)	7	Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. 24-hr restricted entry interval.
		Alias 240 SC			
	thiamethoxam	Actara 240 SC	3.4–4.4 mL/100 m of row (1–1.3 mL/100 ft of row)	—	Green peach, potato, buckthorn, and foxglove aphid. Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 insecticides in the same season. 12-hr restricted entry interval.
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	440–700 g/ha (178–283 g/acre)	—	Do not use on seed already treated with a group 4 insecticide; do not apply any subsequent foliar group 4 or group 28 insecticides in the same season. 12-hr restricted entry interval.
Foliar Applications					
carbamate (group 1A)	oxamyl	Vydate L	2.3–3.0 L/ha (0.9–1.2 L/acre)	7	Green peach and potato aphids. 24-hr restricted entry interval.
organophosphate (group 1B)	dimethoate	Cygon 480	0.55–1.1 L/ha (0.22–0.4 L/acre)	7	12-hr restricted entry interval.
		Lagon 480 E			
	acephate	Orthene 97% SG	580–850 g/ha (235–344 g/acre)	21	Green peach and potato aphids. 24-hr restricted entry interval. Re-entry with significant foliar contact requires gloves and cotton overalls for one week after restricted entry interval.
	phosmet	Imidan 70-WP	1.6 kg/ha (0.64 kg/acre)	7	Potato aphid only. 5-day restricted entry interval. See label for further PPE and restricted entry information.
pyrethroid (group 3A)	deltamethrin	Decis 5 EC	250 mL/ha (101 mL/acre)	1	Potato and buckthorn aphid only. 12-hr restricted entry interval.
		Decis 100 EC	125 mL/ha (51 mL/acre)		
		Poleci 2.5 EC	500 mL/ha (202 mL/acre)		
pyrethroid/ neonicotinoid (group 3A/4A)	deltamethrin/ imidacloprid	Concept	650 mL/ha (263 mL/acre)	7	Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. Do not apply during flowering. 12-hr restricted entry interval.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. Do not apply during flowering. 24-hr restricted entry interval.
		Alias 240 SC			
	acetamiprid	Aceta 70WP	56–86 g/ha (23–35 g/acre)	7	Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 12-hr restricted entry interval.
		Assail 70 WP			
	thiamethoxam	Actara 240SC	109 mL/ha (44 mL/acre)	7	Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. Do not apply between 50% row closure and petal fall. 12-hr restricted entry interval.
		Actara 25WG	105 g/ha (42 g/acre)		
neonicotinoid/ benzoylurea (group 4A/15)	acetamiprid/ novaluron	Cormoran	650–750 mL/ha (263–304 mL/acre)	7	Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 12-hr restricted entry interval.

¹ Based on 90-cm (35-in.) row spacing

Table 3–134. Potato Insect Control — Aphids, Spider Mites, Wireworms, Potato Psyllid

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS — Foliar applications					
sulfoxaflor (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–60 mL/acre)	7	Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 12-hr restricted entry interval.
sulfoxaflor/spinosyn (group 4C/5)	sulfoxaflor/ spinetoram	TwinGuard	200 g/ha (81 g/acre)	7	12-hr restricted entry interval or re-entry permitted once spray deposit has dried.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	1	12-hr restricted entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	7	Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (200–600 mL/acre)	7	Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil or seed piece application. 12-hr restricted entry interval.
	tetraniliprole	Vayego 200 SC	150 mL/ha (61 mL/acre)	14	Suppression. Do not apply foliar group 28 insecticides in the same season as a seed or soil application. Do not apply during flowering. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (48–64 g/acre)	7	12-hr restricted entry interval.
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water applied at 700–1,900 L solution/ha (283–770 L/acre)	0	Do not spray when plants are under stress. Avoid spraying during full sun. See label for tank-mix and crop tolerance information.
	mineral oil	SuffOil-X	13 L/1,000 L water	0.5	Deters feeding of aphids. See label for application details, crop tolerance and tank-mix information. 12-hr restricted entry interval.
		Superior 70 Oil	1% solution, applied at 1,000 L water/ha (405 L/acre)	14	Mineral oil acts as an aphid deterrent. It reduces the spread of PVY vectored by aphids. See label for application details, crop tolerance and tank-mix information. 12-hr restricted entry interval.
	canola oil	Vegol	2% solution, applied at 700–1,900 L/ha (283–769 L/acre)	1	Deters feeding of aphids. Do not apply in direct sunlight. See label for crop safety precautions.
SPIDER MITES					
avermectin (group 6)	abamectin	Agri-mek SC	225 mL/ha (91 mL/acre)	14	Tank-mix with a non-ionic surfactant. 12-hr restricted entry interval.
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	370–670 mL/ha (150–271 mL/acre)	14	Tank-mix with a non-ionic surfactant. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. 12-hr restricted entry interval.
tetronic and tetramic acid derivatives (group 23)	spiromesifen	Oberon Flowable	500–600 mL/ha (202–243 mL/acre)	7	12-hr restricted entry interval.
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water applied at 700–1,900 L solution/ha (283–770 L/acre)	0	Do not spray when plants are under stress. See label for tank-mix and crop tolerance information. Avoid spraying during full sun.
	mineral oil	SuffOil-X	13 L/1,000 L water	0.5	Suppression. See label for application details, crop tolerance and tank-mix information. 12-hr restricted entry interval.

¹ Based on 90-cm (35-in.) row spacing

Table 3–134. Potato Insect Control — Aphids, Spider Mites, Wireworms, Potato Psyllid

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
WIREWORMS					
Soil Application					
organophosphate (group 1B)	chlorpyrifos	Pyrinex 480 EC	21.6 mL/100 m of row or 2.4 L/ha (1 L/acre) ¹	70	Caution: No chlorpyrifos residue is allowed on potatoes exported to the U.S. Efficacy of wireworm insecticides depends on the wireworm species infesting the soil. The species of wireworms found in Ontario might not be susceptible to chlorpyrifos. See label for application details. 24-hr restricted entry interval.
		Sharphos			
	phorate	Thimet 20-G	105 g/100 m of row in sandy or light soils 161 g/100 m of row in silt or heavy soils	90	Product must be applied with a properly calibrated SmartBox application system. Due to soil adaptation, repeated annual applications of phorate to the same soil may result in significantly reduced insecticide persistence in the second and subsequent years of application. See label for further application details. 48-hr restricted entry interval.
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	7	Reduction in damage. Incorporate into the soil at planting to a depth of 10–20cm.
POTATO PSYLLID (POTENTIAL PEST IN ONTARIO)					
pyrethroid/ diamide (group 3A/28)	lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	7	Do not use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a seed treatment or soil application. 24-hr restricted entry interval.
avermectin (group 6)	abamectin	Agri-mek SC	225 mL/ha (91 mL/acre)	14	Tank-mix with a non-ionic surfactant. 12-hr restricted entry interval.
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	370–670 mL/ha (150–271 mL/acre)	14	Tank-mix with a non-ionic surfactant. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. 12-hr restricted entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	7	Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. 12-hr restricted entry interval.
diamide (group 28)	cyclaniliprole	Harvanta	0.8–1.2 L/ha (0.32–0.48 L/acre)	7	Suppression. Do not apply foliar group 28 insecticides in the same season as a seed or soil application. 12-hr restricted entry interval.

¹ Based on 90-cm (35-in.) row spacing.

RADISHES

In this section:

- Table 3–135.** Radish Seed Treatments
- Table 3–136.** Activity of Fungicides on Radish Diseases
- Table 3–137.** Radish Disease Control
- Table 3–138.** Activity of Insecticides on Radish Insects
- Table 3–139.** Radish Insect Control — Cabbage Maggot, Flea Beetles, Cabbage Looper, Imported Cabbageworm, Diamondback Moth, Cutworms
- Table 3–140.** Radish Insect Control — Swede Midge, Aphids

This information is provided as a guideline only. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication. See product labels for complete information.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–135. Radish Seed Treatments

Trade Name	Active Ingredient	Rate	Pests Controlled	Notes
FUNGICIDES				
Apron XL LS	metalaxyl-M and S-isomer	20–40 mL/ 100 kg seed	damping-off (pythium)	Radish and Oriental radish. For use in commercial seed treatment facilities.
Apron Maxx	fludioxonil + metalaxyl-m	665 mL/ 100 kg seed	Seed rot, damping-off (<i>Fusarium</i> spp. <i>Rhizoctonia</i> spp. and <i>Pythium</i> spp.)	Radish and Oriental radish. For use in commercial seed treatment facilities.
Dynasty 100FS	azoxystrobin	25–50 mL/ 100 kg seed	damping-off (rhizoctonia)	Radish and Oriental radish. For import use only; do not treat seed in Canada.
Maxim 480FS	fludioxonil	5.2–10.4 mL/ 100 kg of seed	seed decay, damping off	Radish and Oriental radish. For use in commercial seed treatment facilities.
Thiram 75 WP	thiram	90 g/25 kg seed	seed decay and damping-off	Radish only. Seed box and commercial seed treatment.

Table 3–136. Activity of Fungicides on Radish Diseases

LEGEND: C = control S = suppression — = not registered for control of this pest, or activity on this pest has not been documented						
Common Name	Trade Name	Alternaria	Powdery Mildew	Downy Mildew	Rhizoctonia Root Rot, Crown Rot, Stem Canker	Botrytis Gray Mold
metalaxyl-M and S-isomer	Ridomil Gold 480SL	—	—	S	—	—
fluxapyroxad	Sercadis	C	C	—	—	—
penthiopyrad	Fontelis	—	C	—	—	C
pydiflumetofen/difenoconazole	Miravis Duo	C	C	—	—	—
fluopyram/trifloxystrobin	Luna Sensation	C	C	—	—	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	—	—	C
pyraclostrobin	Cabrio EG	C	C	—	—	—
trifloxystrobin	Flint	C	—	—	—	—
azoxystrobin	Quadris Flowable	—	—	—	C	—
	Azoshy 250 SC	—	—	—	C	—
	Serenade SOIL	—	—	—	S	—
<i>Bacillus subtilis</i>	Serenade Opti	—	—	S	—	—

Table 3–137. Radish Disease Control

For resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1. Products are registered on both radish and Oriental (daikon) radish unless specified in the notes.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ALTERNARIA, POWDERY MILDEW					
SDHI (group 7)	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	7	Powdery mildew. Alternaria suppression. Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
	penthiopyrad	Fontelis	1–1.75 L/ha (0.4–0.7 L/acre)	0	Powdery mildew. Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/difenoconazole	Miravis Duo	1 L/ha (0.40 L/acre)	7	Alternaria and powdery mildew. Do not make more than two sequential applications of any group 3 or group 7 fungicide. 12-hr restricted entry interval.
SDHI/QoI (group 7/11)	fluopyram/trifloxystrobin	Luna Sensation	300–500 mL/ha (121–202 mL/acre)	7	Alternaria. Do not make sequential applications of any group 11 or more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
			300–400 mL/ha (122–162 mL/acre)	7	Powdery mildew. Do not make sequential applications of any group 11 or more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
QoI (group 11)	pyraclostrobin	Cabrio EG	0.56–1.1 kg/ha (226–445 g/acre)	3	Alternaria. Do not make sequential applications of any group 11 fungicides. 3-day restricted entry interval for hand harvesting. 12-hr restricted entry interval for all other activities.
			0.56–0.84 kg/ha (226–340 g/acre)	3	Powdery mildew. Do not make sequential applications of any group 11 fungicides. 3-day restricted entry interval for hand harvesting. 12-hr restricted entry interval for all other activities.
	trifloxystrobin	Flint	280 g/ha (113 g/acre)	7	Radish only. Alternaria. Do not make sequential applications of any group 11 fungicides. 12-hr restricted entry interval.
DOWNY MILDEW					
phenylamide (group 4)	metalaxyl-M and S-isomer	Ridomil Gold 480SL	1.2–2.4 L/ha (0.5–1 L/acre)	21	Radish only. Suppression. Applied as a banded application at planting or broadcast application pre-plant. 12-hr restricted entry interval.
microbial (group BMO2)	<i>Bacillus subtilis</i>	Serenade Opti	1.4 kg/ha (0.57 kg/acre)	0	Radish only. Suppression. See label for application details.
RHIZOCTONIA — ROOT ROT, CROWN ROT, STEM CANCKER					
QoI (group 11)	azoxystrobin	Quadris Flowable	4–6 mL/100 m of row (1.2–1.8 mL/100 ft of row)	15	Radish. 12-hr restricted entry interval.
				40	Oriental radish (daikon). 12-hr restricted entry interval.
		Azoshy 250 SC	4–6 mL/100 m of row (1.2–1.8 mL/100 ft of row)	15	Radish. 12-hr restricted entry interval.
				40	Oriental radish (daikon). 12-hr restricted entry interval.
microbial (group BMO2)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Root rots caused by <i>Rhizoctonia solani</i>, <i>Pythium</i> spp. and <i>Fusarium</i> spp. Suppression. May be applied at planting and/or post-planting. See label for application details.
BOTRYTIS GRAY MOLD					
SDHI (group 7)	penthiopyrad	Fontelis	1–1.75 L/ha (0.4–0.7 L/acre)	0	Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
AP/PP (group 9/12)	cyprodinil/fludioxonil	Switch 62.5 WG	775–975 g/ha (313–395 g/acre)	7	12-hr restricted entry interval.

Table 3–138. Activity of Insecticides on Radish Insects

LEGEND: C = control S = suppression RD = reduction in damage
 N = registered, but not considered effective or resistance is documented
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Cabbage Maggot	Flea Beetles	Aphids	Cabbage Looper	Imported Cabbageworm	Diamondback Moth	Cutworms	Swede Midge	European Chafer Grubs
carbaryl	Sevin XLR	—	C	—	—	C	C	—	—	—
chlorpyrifos	Lorsban 4E/NT	C	—	—	—	—	—	—	—	—
	Pyrinex 480 EC	C	—	—	—	—	—	—	—	—
	Nufos 4E	C	—	—	—	—	—	—	—	—
	Sharphos	C	—	—	—	—	—	—	—	—
	Warhawk 480 EC	C	—	—	—	—	—	—	—	—
malathion	Malathion 85E	—	C	N	—	—	—	—	—	—
permethrin	Perm-UP	—	C	—	—	—	—	—	—	—
	Pounce 384EC	—	C	—	—	—	—	—	—	—
imidacloprid	Admire 240 F	—	C	C	—	—	—	—	—	RD
thiamethoxam	Actara 25WG	—	—	C	—	—	—	—	—	—
sulfoxaflor	Closer	—	—	C	—	—	—	—	—	—
flupyradifurone	Sivanto Prime	—	—	C	—	—	—	—	—	—
spinetoram	Delegate WG	—	S	—	C	C	C	—	—	—
spinosad	Entrust	—	S	—	C	C	C	—	—	—
	Scorpio Ant and Insect Bait	—	—	—	—	—	—	C	—	—
	Success	—	S	—	C	C	C	—	—	—
<i>Bacillus thuringiensis</i>	Bioprotec PLUS	—	—	—	C	C	C	—	—	—
	Dipel 2X DF	—	—	—	C	C	C	—	—	—
	XenTari WG	—	—	—	C	C	C	—	—	—
chlorantraniliprole	Coragen	—	—	—	C	C	C	C	C	—
cyantraniliprole	Exirel	—	C	C	C	—	—	C	—	—
	Verimark	C	RD	—	—	—	—	—	—	—
flonicamid	Beleaf 50SG	—	—	C	—	—	—	—	—	—
soap	Kopa Insecticidal Soap	—	—	C	—	—	—	—	—	—

Table 3–139. Radish Insect Control — Cabbage Maggot, Flea Beetles, Cabbage Looper, Imported Cabbageworm, Diamondback Moth, Cutworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.

Products are registered on both radish and Oriental (daikon) radish unless specified in the notes.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE MAGGOT					
Soil Applications					
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT	85 mL in 380 L water/1,000 m of row (26 mL in 30 gal water/1,000 ft of row)	21	Radish. See label for application details. 24-hr restricted entry interval.
		Pyrinex 480 EC			
		Nufos 4E			
		Sharphos			
		Warhawk 480 EC			
		Lorsban 4E/NT	210 mL in 1,000 L water/1,000 m of row (64 mL in 79 gal water/1,000 ft of row)	32	Asian radish (lo bok, daikon). See label for application details. 24-hr restricted entry interval.
		Pyrinex 480 EC			
		Nufos 4E			
		Sharphos			
		Warhawk 480 EC			
diamide (group 28)	cyantraniliprole	Verimark	10–15 mL/100 m of row (3–4.6 mL/100 ft of row)	21	Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
FLEA BEETLES					
Soil Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.6 mL/100 ft of row)	21	See label for application details. Do not use subsequent foliar group 4 insecticides in the same season. 24-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Verimark	6.75–9 mL/100 m of row (2.1–2.7 mL/100 ft of row)	21	Early season damage reduction. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
Foliar Applications					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	7	Radish only. See label for restricted entry intervals.
pyrethroid (group 3A)	permethrin	Perm-UP	180 mL/ha (73 mL/acre)	2	Radish only. 12-hr restricted entry interval.
		Pounce 384EC			
spinosyn (group 5)	spinetoram	Delegate	200 g/ha (80 g/acre)	3	Suppression. 12-hr restricted entry interval.
	spinosad	Entrust	364 mL/ha (146 mL/acre)	3	Suppression. Apply at emergence of adults. Re-entry permitted once spray deposit has dried.
		Success	182 mL/ha (73 mL/acre)		
diamide (group 28)	cyantraniliprole	Exirel	500–1,000 mL/ha (202–405 mL/acre)	7	Do not apply any group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.

Table 3–139. Radish Insect Control — Cabbage Maggot, Flea Beetles, Cabbage Looper, Imported Cabbageworm, Diamondback Moth, Cutworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.

Products are registered on both radish and Oriental (daikon) radish unless specified in the notes.

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE LOOPER, IMPORTED CABBAGEWORM, DIAMONDBACK MOTH					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5–5.25 L/ha (1–2.1 L/acre)	7	Radish only. Imported cabbageworm and diamondback moth. See label for restricted entry intervals.
spinosyn (group 5)	spinosad	Entrust	364 mL/ha (147 mL/acre)	3	Re-entry permitted once spray deposit has dried.
		Success	182 mL/ha (74 mL/acre)		
	spinetoram	Delegate WG	140–200 g/ha (57–81 g/acre)	3	12-hr restricted entry interval.
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i> var. <i>kurstaki</i> strain EVB-113-19	Bioprotec PLUS	0.9–1.8 L/ha (0.36–0.73 L/acre)	0	Asian radish only. 4-hr restricted entry interval or when residues have dried.
	<i>Bacillus thuringiensis</i>	Dipel 2X DF	55–550 g/ha (22–223 g/acre)	0	Asian radish only. Imported cabbageworm.
			275–550 g/ha (111–223 g/acre)	0	Asian radish only. Cabbage looper.
			275 g/ha (111 g/acre)	0	Asian radish only. Diamondback moth.
	<i>Bacillus thuringiensis</i> , subsp. <i>aizawai</i>	XenTari WG	500–1,000 g/ha (202–405 g/acre)	0	For best results apply in evening or on cloudy days. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	250–500 mL/ha (101–202 mL/acre)	7	Cabbage looper. Do not apply any group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
CUTWORMS					
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	3	Black cutworm only. Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Black and variegated cutworm. Use low rate for black cutworm. Do not apply any group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	7	Variegated cutworm. Do not apply any group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.

Table 3–140. Radish Insect Control — Swede Midge, Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1. Products are registered on both radish and Oriental (daikon) radish unless specified in the notes.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
SWEDE MIDGE					
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Do not apply any group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
APHIDS					
Soil Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.6 mL/100 ft of row)	21	See label for application details. Do not use subsequent foliar group 4 insecticides in the same season. 24-hr restricted entry interval.
Foliar Applications					
organophosphate (group 1B)	malathion	Malathion 85E	535–1,345 mL/ha (216–544 mL/acre)	7	Radish only. Control of aphids with this product has been inconsistent in many areas. 12-hr restricted entry interval.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Do not apply foliar group 4 insecticides in the same season as a soil application. 24-hr restricted entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Do not apply foliar group 4 insecticides in the same season as a soil application. 12-hr restricted entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–61 mL/acre)	7	Do not apply a foliar group 4 insecticide in the same season as a soil application. 12-hr restricted entry interval.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	7	12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	7	Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	3	12-hr restricted entry interval.
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water applied at 700–1,900 L solution/ha (283–770 L/acre)	0	Radish only. Do not spray when plants are under stress. See label for tank-mix and crop tolerance information. Avoid spraying during full sun.

RHUBARB

In this section:

Table 3–141. Activity of Fungicide and Insecticides on Rhubarb Diseases and Insects

Table 3–142. Rhubarb Disease and Insect Control

This information is provided as a guideline only. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication. See product labels for complete information.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–141. Activity of Fungicide and Insecticides on Rhubarb Diseases and Insects

LEGEND: C = control S = suppression
— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Aphids	Potato Stem Borer	Cabbage Looper	Cutworms	Slugs	Root Rots
FUNGICIDES							
<i>Bacillus subtilis</i>	Serenade SOIL	—	—	—	—	—	S
INSECTICIDES							
acetamiprid	Assail 70WP	C	—	—	—	—	—
thiamethoxam/cyantraniliprole	Minecto Duo 40WG	C	—	C	—	—	—
sulfoxaflor	Closer	C	—	—	—	—	—
flupyradifurone	Sivanto Prime	C	—	—	—	—	—
spinetoram	Delegate	—	—	C	—	—	—
spinosad	Entrust	—	—	C	—	—	—
	Scorpio Ant and Insect Bait ¹	—	—	—	C	—	—
	Success	—	C	C	—	—	—
abamectin/cyantraniliprole	Minecto Pro	—	—	C	—	—	—
methoxyfenozide	Intrepid	—	—	C	—	—	—
spirotetramat	Movento 240 SC	C	—	—	—	—	—
flonicamid	Beleaf 50SG	C	—	—	—	—	—
chlorantraniliprole	Coragen ¹	—	—	C	C	—	—
cyantraniliprole	Exirel	C	—	C	C	—	—
ferric phosphate	Sluggo Professional	—	—	—	—	C	—

¹ For black cutworm control.

Table 3–142. Rhubarb Disease and Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on the label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ROOT ROTTS					
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Root rots caused by <i>Rhizoctonia solani</i>, <i>Pythium</i> spp. and phytophthora. Suppression only. See label for in-furrow application instructions. For broadcast or banded application, incorporate into the root zone with rainfall or overhead irrigation within 24 hours.
APHIDS					
Soil Applications					
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (304 g/acre)	—	See label for application details. Do not use subsequent foliar group 28 insecticides in the same season. 12-hr restricted entry interval.
Foliar Applications					
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	56–86 g/ha (23–35 g/acre)	7	Use high rate under heavy pest pressure. 12-hr restricted entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	100–150 mL/ha (40–61 mL/acre)	3	Also controls tarnished plant bug. 12-hr restricted entry interval.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	1	Do not use on areas treated with product the previous season. 12-hr restricted entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	3	Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. See label for guidance on adjuvant use. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	Use high rate under heavy pest pressure. Do not apply foliar group 28 insecticides in the same season as a soil application. See label for guidance on adjuvant use and crop tolerance information. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (48–65 g/acre)	0	Use high rate for heavy infestations. 12-hr restricted entry interval.

Table 3–142. Rhubarb Disease and Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on the label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
POTATO STEM BORER, CABBAGE LOOPER					
Soil Applications					
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (304 g/acre)	—	Cabbage looper. In-furrow application at planting. See label for application details. Do not apply foliar group 4 or group 28 insecticides in the same season as an in-furrow or soil application. 12-hr restricted entry interval.
Foliar Applications					
spinosyn (group 5)	spinetoram	Delegate	140–200 g/ha (57–81 g/acre)	1	Cabbage looper. Use the high rate for heavy infestations or large larvae. 12-hr restricted entry interval.
	spinosad	Entrust	364 mL/ha (147 mL/acre)	1	Cabbage looper. Rotate with insecticides with a different mode of action. Maintain a spray pH of 6 or higher. Re-entry permitted when residues are dry.
		Success	182 mL/ha (74 mL/acre)	1	Rotate with insecticides with a different mode of action. Maintain a spray pH of 6 or higher. Re-entry permitted when residues are dry.
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	370 mL/ha (150 mL/acre)	7	Cabbage Looper. Tank-mix with a non-ionic surfactant. Apply to foliage when rain is not expected in the next 24 hr. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide.
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	1	Cabbage looper. Do not use on areas treated with product the previous season. Apply at first sign of feeding damage. Use high rate for heavy infestations, advanced pest growth stages or larger crops. See label for recropping interval. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Cabbage looper. Also controls cutworms, corn earworm and armyworm. Do not use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	250–500 mL/ha (101–202 mL/acre)	1	Cabbage looper. Also controls cutworms, corn earworm and armyworm. Use high rate under heavy pest pressure. Do not apply foliar group 28 insecticides in the same season as a soil application. See label for tank-mix directions and crop tolerance information. 12-hr restricted entry interval.

Table 3–142. Rhubarb Disease and Insect Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on the label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BLACK CUTWORM					
Soil Applications					
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	1	Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
SLUGS					
not classified (group NC)	ferric phosphate	Sluggo Professional	12–50 kg/ha (5–20 kg/acre)	0	Use higher rates on severe infestations.

RUTABAGAS

In this section:

Table 3-143.	Rutabaga Seed Treatments
Table 3-144.	Activity of Fungicides on Rutabaga Diseases
Table 3-145.	Rutabaga Disease Control
Table 3-146.	Activity of Insecticides on Rutabaga Insects
Table 3-147.	Rutabaga Insect Control — Cabbage Root Maggot, Flea Beetles, Leaf-Eating Caterpillars
Table 3-148.	Rutabaga Insect Control — Cutworms, Aphids

This information is provided as a guideline only. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication. See product labels for complete information.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3-143. Rutabaga Seed Treatments

Trade Name	Active Ingredient	Rate	Pests Controlled	Notes
Apron XL LS	metalaxyl-M and S-isomer	20–40 mL/100 kg seed	damping-off (pythium)	For use in commercial seed treatment facilities.
Apron Maxx	fludioxonil + metalaxyl-m	665 mL/100 kg seed	seed rot, damping-off (<i>Fusarium</i> spp. <i>Rhizoctonia</i> spp. and <i>Pythium</i> spp.)	For use in commercial seed treatment facilities.
Dynasty 100FS	azoxystrobin	25–50 mL/100 kg seed	damping-off (rhizoctonia)	For import use only; do not treat seed in Canada.
Maxim 480FS	fludioxonil	5.2–10.4 mL/100 kg of seed	seed decay, damping off	For use in commercial seed treatment facilities.

Table 3-144. Activity of Fungicides on Rutabaga Diseases

LEGEND: C = control S = suppression — = not registered for control of this pest, or activity on this pest has not been documented							
Common Name	Trade Name	Downy Mildew	Powdery Mildew	Rhizoctonia	Alternaria	Botrytis Gray Mold	Root Rots
propiconazole	Tilt 250E	—	C	—	—	—	—
	Bumper 418 EC	—	C	—	—	—	—
	Fitness	—	C	—	—	—	—
	Princeton	—	C	—	—	—	—
fluxapyroxad	Sercadis	—	C	—	S	—	—
penthiopyrad	Fontelis	—	C	—	—	C	—
pydiflumetofen/difenoconazole	Miravis Duo	—	C	—	C	—	—
fluopyram/trifloxystrobin	Luna Sensation	—	C	—	C	—	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	—	—	C	—
pyraclostrobin	Cabrio EG	—	C	—	C	—	—
azoxystrobin	Quadris Flowable	—	—	C	—	—	—
	Azoshy 250 SC	—	—	C	—	—	—
trifloxystrobin	Flint	—	—	—	C	—	—
fosetyl-AL	Aliette WDG	C	—	—	—	—	—
fluopicolide	Presidio	C	—	—	—	—	—
sulphur	Microscopic Sulphur	—	C	—	—	—	—
captan	Sharda Captan 80 WDG	—	—	—	—	—	C
<i>Bacillus subtilis</i>	Serenade Opti	S	—	—	—	—	—
	Serenade SOIL	—	—	—	—	—	S

Table 3–145. Rutabaga Disease ControlFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
RHIZOCTONIA					
Soil Application					
QoI (group 11)	azoxystrobin	Quadris Flowable Azoshy 250 SC	4–6 mL/ 100 m of row (1.2–1.8 mL/ 100 ft of row)	40	Applied in-furrow at planting or banded soon after emergence. Do not make sequential applications of any group 11 fungicides. 12-hr restricted entry interval.
POWDERY MILDEW					
DMI (group 3)	propiconazole	Tilt 250E	400 mL/ha (162 mL/acre)	21	Also suppresses black leg. See label for application details. 12-hr restricted entry interval.
		Bumper 418 EC	240 mL/ha (97 mL/acre)	21	See label for application details. 12-hr restricted entry interval.
		Fitness			
		Princeton			
SDHI (group 7)	penthiopyrad	Fontelis	1–1.75 L/ha (0.4–0.7 L/acre)	0	Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	7	Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.40 L/acre)	7	Do not make two sequential applications of any group 3 or group 7 fungicide. 12-hr restricted entry interval.
SDHI/QoI (group 7/11)	fluopyram/ trifloxystrobin	Luna Sensation	300–400 mL/ha (121–162 mL/acre)	7	Use high rate when disease pressure is high. Do not make sequential applications of any group 11 or more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
QoI (group 11)	pyraclostrobin	Cabrio EG	0.56–0.84 kg/ha (0.23–0.34 kg/acre)	3	Do not make sequential applications of any group 11 fungicides. 3-day restricted entry interval for hand harvesting. 12-hr restricted entry interval for all other activities.
inorganic (group M1)	sulphur	Microscopic Sulphur	6.8 kg/ha (2.75 kg/acre)	—	See label for water volumes. This product is not compatible with Superior 70 Oil. 24-hr restricted entry interval.
DOWNY MILDEW					
phosphonate (group 33)	fosetyl-AL	Aliette WDG	2.25–3.12 kg/ha (0.9–1.26 kg/acre)	7	12-hr restricted entry interval.
benzamide (group 43)	fluopicolide	Presidio	220–292 mL/ha (89–118 mL/acre)	7	Tank-mix with Aliette WDG fungicide. Do not make sequential applications. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade Opti	1.4 kg/ha (0.56 kg/acre)	0	Suppression. Also suppresses white mold. See label for application details.

Table 3–145. Rutabaga Disease ControlFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
MOSAIC VIRUS					
not classified (group NC)	mineral oil	Superior 70 Oil	11 L in 550–1,100 L of water/ha (4.4 L in 50–100 gal of water/acre)	21	Deters feeding of aphids. Do not apply in direct sunlight. See label for crop safety precautions. 12-hr restricted entry interval.
		PureSpray Green Spray Oil 13E	10 L in 550–1,100 L of water/ha (4 L in 223–445 L of water/acre)	21	Deters feeding of aphids. Do not apply in direct sunlight. See label for crop safety precautions. 12-hr restricted entry interval.
	canola oil	Vegol	2% solution, applied at 700–1900 L/ha (283–769 L/acre)	1	Deters feeding of aphids. Do not apply in direct sunlight. See label for crop safety precautions.
ALTERNARIA					
SDHI (group 7)	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	7	Suppression. Do not make more than two sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.40 L/acre)	7	Alternaria. Do not make more than two sequential applications of any group 3 or group 7 fungicide. 12-hr restricted entry interval.
SDHI/QoI (group 7/11)	fluopyram/ trifloxystrobin	Luna Sensation	300–500 mL/ha (121–202 mL/acre)	7	Use high rate when disease pressure is high. Do not make sequential applications of any group 11 or more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
QoI (group 11)	pyraclostrobin	Cabrio EG	0.56–1.1 kg/ha (226–445 g/acre)	3	Do not make sequential applications of any group 11 fungicides. 3-day restricted entry interval for hand harvesting. 12-hr restricted entry interval for all other activities.
	trifloxystrobin	Flint	140–210 g/ha (56–85 g/acre)	7	Do not make sequential applications of any group 11 fungicides. 12-hr restricted entry interval.
BOTRYTIS GRAY MOLD					
SDHI (group 7)	penthiopyrad	Fontelis	1–1.75 L/ha (0.4–0.7 L/acre)	0	Do not make more than two sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
AP/PP (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	7	12-hr restricted entry interval.
SCLEROTINIA WHITE MOLD					
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.40 L/acre)	7	Suppression. Do not make more than two sequential applications of any group 3 or group 7 fungicide. 12-hr restricted entry interval.
SDHI/QoI (group 7/11)	fluopyram/ trifloxystrobin	Luna Sensation	500 mL/ha (202 mL/acre)	7	Do not make sequential applications of any group 11 or more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
AP/PP (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	7	12-hr restricted entry interval.

Table 3–146. Activity of Insecticides on Rutabaga Insects

LEGEND: C = control S = suppression RD = reduction in damage
 N = registered, but not considered effective or resistance is documented
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Cabbage Maggot	Flea Beetles	Leaf-Eating Caterpillars	Cutworms	Aphids	European Chafer Grubs	Swede Midge
carbaryl	Sevin XLR	—	C	C ¹	—	—	—	—
chlorpyrifos	Lorsban 15G	C	—	—	—	—	—	—
	Pyrifos 15G	C	—	—	—	—	—	—
	Lorsban 4E/NT	C	—	—	C	—	—	—
	Pyrinex 480 EC	C	—	—	C	—	—	—
	Nufos 4E	C	—	—	C	—	—	—
	Sharphos	C	—	—	C	—	—	—
	Warhawk 480 EC	C	—	—	C	—	—	—
diazinon	Diazinon 500 E	C	—	—	—	—	—	—
malathion	Malathion 85E	—	—	C ²	—	N	—	—
cypermethrin	Mako	—	C	—	—	—	—	—
	Ship 250	—	C	—	—	—	—	—
	Up-Cyde 2.5 EC	—	C	—	—	—	—	—
acetamiprid	Assail 70 WP	—	—	—	—	—	—	C
	Aceta 70WP	—	—	—	—	—	—	C
imidacloprid	Admire 240 F	—	C	—	—	C	RD	—
thiamethoxam	Actara 25WG	—	—	—	—	C	—	—
sulfoxaflor	Closer	—	—	—	—	C	—	—
flupyradifurone	Sivanto Prime	—	—	—	—	C	—	—
spinosad	Entrust	—	S	C	—	—	—	—
	Scorpio Ant and Insect Bait	—	—	—	C	—	—	—
	Success	—	S	C	—	—	—	—
spinetoram	Delegate WG	—	S	C	—	—	—	—
<i>Bacillus thuringiensis</i>	XenTari WG	—	—	C	—	—	—	—
chlorantraniliprole	Coragen	—	—	C	C	—	—	C
cyantraniliprole	Exirel	—	C	C ³	C	C	—	—
	Verimark	C	RD	—	—	—	—	—
flonicamid	Beleaf 50SG	—	—	—	—	C	—	—

¹ For control of cabbage looper only.

² For control of imported cabbageworm and diamondback moth only.

³ For control of imported cabbageworm and cabbage loopers only.

Table 3–147. Rutabaga Insect Control — Cabbage Root Maggot, Flea Beetles, Leaf-Eating Caterpillars

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE ROOT MAGGOT					
Soil Applications					
organophosphate (group 1B)	chlorpyrifos	Lorsban 15G	0.6–1 kg/1,000 m of row (0.18–0.3 kg/1,000 ft of row)	30	24-hr restricted entry interval.
		Pyrifos 15G			
	diazinon	Diazinon 500 E	2.2 L/ha (0.9 L/acre)	14	Apply as a banded soil drench application only. See label for restricted entry intervals.
diamide (group 28)	cyantraniliprole	Verimark	10–15 mL/100 m of row (3–4.6 mL/100 ft of row)	21	Apply as a narrow band in-furrow. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
Treatment after planting					
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT	210 mL/1,000 m of row (64 mL/1,000 ft of row)	30	See label for application details. 24-hr restricted entry interval.
		Nufos 4E			
		Sharphos			
		Warhawk 480 EC			
FLEA BEETLES					
Soil Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.6 mL/100 ft of row)	21	Also controls leafhoppers. Do not use subsequent foliar group 4 insecticides in the same season. 24-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Verimark	6.75–9 mL/100 m of row (2.1–2.7 mL/100 ft of row)	21	Early-season damage reduction. Apply as a narrow band in-furrow. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
Foliar Applications					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	7	5-hr restricted entry interval for hand harvesting and irrigation. 12-hr restricted entry interval for scouting, hand weeding and thinning.
pyrethroid (group 3A)	cypermethrin	Mako	123 mL/ha (50 mL/acre)	21	Crucifer flea beetle. 12-hr restricted entry interval.
		Ship 250	200 mL/ha (81 mL/acre)	21	12-hr restricted entry interval.
		UP-Cyde 2.5 EC			
spinosyn (group 5)	spinetoram	Delegate WG	200 g/ha (80 g/acre)	3	Suppression. Apply when pests appear. 12-hr restricted entry interval.
	spinosad	Entrust	364 mL/ha (146 mL/acre)	3	Suppression. Apply at emergence of adults. Re-entry permitted once spray deposit has dried.
		Success	182 mL/ha (73 mL/acre)	3	
diamide (group 28)	cyantraniliprole	Exirel	500–1,000 mL/ha (202–405 mL/acre)	7	Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.

Table 3–147. Rutabaga Insect Control — Cabbage Root Maggot, Flea Beetles, Leaf-Eating Caterpillars

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAF-EATING CATERPILLARS					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5–5.25 L/ha (1–2.1 L/acre)	7	Imported cabbageworm and diamondback moth. 5-hr restricted entry interval for hand harvesting and irrigation. 12-hr restricted entry interval for scouting, hand weeding and thinning.
organophosphate (group 1B)	malathion	Malathion 85E	535–1,345 mL/ha (216–544 mL/acre)	3	Imported cabbageworm and cabbage loopers. Apply when temperature is at or above 20°C. 12-hr restricted entry interval.
spinosyn (group 5)	spinetoram	Delegate WG	140–200 g/ha (57–81 g/acre)	3	Cabbage looper, imported cabbageworm and diamondback moth. 12-hr restricted entry interval.
	spinosad	Entrust	364 mL/ha (147 mL/acre)	3	Cabbage looper, imported cabbageworm and diamondback moth. Re-entry once spray deposit has dried.
		Success	182 mL/ha (74 mL/acre)	3	
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i> , subsp. <i>aizawai</i>	XenTari WG	500–1,000 g/ha (202–405 g/acre)	0	Cabbage looper, imported cabbageworm and diamondback moth. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Cabbage looper, imported cabbageworm and diamondback moth. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	250–500 mL/ha (101–202 mL/acre)	7	Cabbage looper. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.

Table 3–148. Rutabaga Insect Control — Cutworms, Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT	1.2–2.4 L in 200–400 L water/ha (0.5–1 L in 20–40 gal water/acre)	30	See label for application details. 24-hr restricted entry interval.
		Pyrinex 480 EC			
		Nufos 4E			
		Sharphos			
		Warhawk 480 EC			
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	3	Black cutworm only. Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Black and variegated cutworm. Use low rate for black cutworm. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	7	Variegated cutworm. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
APHIDS					
Soil Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/100 m of row (2.3–3.6 mL/100 ft of row)	21	Do not use subsequent foliar group 4 insecticides in the same season. 24-hr restricted entry interval.
Foliar Applications					
organophosphate (group 1B)	malathion	Malathion 85E	535–1,345 mL/ha (216–544 mL/acre)	3	Control of aphids with malathion has been inconsistent in many areas. 12-hr restricted entry interval.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Do not apply foliar group 4 insecticides in the same season as a soil application. 24-hr restricted entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Do not apply foliar group 4 insecticides in the same season as a soil application. 24-hr restricted entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–61 mL/acre)	7	Do not apply foliar group 4 insecticides in the same season as a soil application. 12-hr restricted entry interval.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	7	Do not use on areas treated with product the previous season. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	7	Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	3	12-hr restricted entry interval.

SPINACH

In this section:

Table 3–149.	Spinach Seed Treatments
Table 3–150.	Activity of Fungicides on Spinach Diseases
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Table 3–152.	Spinach Disease Control — Anthracnose, Botrytis Gray Mold
Table 3–153.	Activity of Insecticides on Spinach Insects
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Table 3–155.	Spinach Insect Control — Leafminers, Cutworms
Table 3–156.	Spinach Insect Control — Cabbage Looper, Thrips

This information is provided as a guideline only. See product labels for complete information. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–149. Spinach Seed Treatments

Group Name (Group #)	Common Name	Trade Name	Rate	Pests Controlled	Notes
phenylamide (group 4)	metalaxyl-M and S-isomer	Apron XL LS	20–40 mL/ 100 kg seed	damping-off (<i>Pythium</i>)	For use in commercial seed treatment facilities. Not for greenhouse-grown spinach.
QoI (group 11)	azoxystrobin	Dynasty 100FS	25–50 mL/ 100 kg seed	seed rot and damping-off (<i>Rhizoctonia solani</i>)	For import use only; do not treat seed in Canada.
dithiocarbamate (group M3)	thiram	Thiram 75 WP	90 g/ 25 kg seed	seed decay and damping-off	Seed box or commercial seed treatment.

Table 3–150. Activity of Fungicides on Spinach Diseases

LEGEND: C = control S = suppression — = not registered for control of this pest, or activity on this pest has not been documented						
Common Name	Trade Name	Damping-Off	Downy Mildew	White Rust	Anthracnose	Botrytis Gray Mold
metalaxyl-M and S-isomer	Apron XL LS	C	—	—	—	—
	Ridomil Gold 480SL	—	C	—	—	—
penthiopyrad	Fontelis	—	—	—	—	C
boscalid/pyraclostrobin	Pristine WG	—	S	—	—	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	—	C	C
azoxystrobin	Dynasty 100FS	C	—	—	—	—
	Quadris Flowable	—	C	—	—	—
	Azoshy 250 SC	—	C	—	—	—
fenamidone	Reason 500SC	—	S	—	—	—
polyoxin D zinc salt	Diplomat 5SC	—	—	S	—	—
cyazofamid	Torrent 400SC	—	—	S	—	—
fosetyl-AL	Aliette WDG	—	S	S	—	—
mandipropamid	Revus	—	C	—	—	—
mandipropamid/oxathiapiprolin	Orondis Ultra	—	C	—	—	—
fluopicolide	Presidio	—	C	—	—	—
<i>Bacillus subtilis</i>	Serenade Opti	—	—	S	—	—
	Serenade SOIL	S	—	—	—	—
copper sulphate	Copper 53W	—	C	C	—	—
thiram	Thiram 75 WP	C	—	—	—	—

Table 3–151. Spinach Disease Control — Damping-Off, Root Rots, Downy Mildew, White Rust

For resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.
Avoid using these products in areas treated during the previous season. See product labels for product-specific information.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DAMPING-OFF/ ROOT ROTS					
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Damping-off caused by <i>Rhizoctonia solani</i>. Root rots caused by <i>Rhizoctonia solani</i>, <i>Pythium</i> spp. and <i>Phytophthora</i> spp. Suppression. May be applied at planting and/or post-planting. See label for application instructions. For broadcast or banded applications, incorporate into the seed zone with rainfall or overhead irrigation within 24-hr of application.
DOWNY MILDEW					
phenylamide (group 4)	metalaxyl-M and S-isomer	Ridomil Gold 480SL	1 L/ha (0.4 L/acre)	—	Apply at planting as a banded application over row. 12-hr restricted entry interval.
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	1,000 g/ha (405 g/acre)	0	Suppression. Do not make sequential applications of any group 11 fungicide. See label for recropping restrictions and restricted entry intervals.
QoI (group 11)	azoxystrobin	Quadris Flowable Azoshy 250 SC	1.125 L/ha (455 mL/acre)	7	Begin applications prior to disease development. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
	fenamidone	Reason 500SC	400 mL/ha (162 mL/acre)	2	Suppression. Begin application at the onset of disease. Do not make sequential applications of any group 11 fungicide. Re-entry permitted once spray deposit has dried.
CAA/OSBPI (group 40/49)	mandipropamid/ oxathiapiprolin	Orondis Ultra	600 mL/ha (243 mL/acre)	1	No more than two consecutive applications before switching to non-group 49 and 40 fungicides. 12-hr restricted entry interval.
phosphonate (group 33)	fosetyl-AL	Aliette WDG	3.38–4.5 kg/ha (1.4–1.8 kg/acre)	3	Suppression. Begin applications when conditions favour disease development. 12-hr restricted entry interval.
benzamide (group 43)	fluopicolide	Presidio	220–292 mL/ha (89–118 mL/acre)	2	Tank-mix with Aliette WDG fungicide. Begin applications prior to disease development. Use the lower rate and longer interval as preventive applications. Use the higher rate and shorter interval if disease is present. Do not make sequential applications. 12-hr restricted entry interval.
CAA (group 40)	mandipropamid	Revus	400–600 mL/ha (162–243 mL/acre)	1	Tank-mix with a non-ionic surfactant. See label for recropping restrictions. 12-hr restricted entry interval.
inorganic (group M1)	copper sulphate	Copper 53W	2.5 kg/ha (1 kg/acre)	2	Ensure thorough plant coverage. 48-hr restricted entry interval.
WHITE RUST					
polyoxin (group 19)	polyoxin D zinc salt	Diplomat 5SC	463 mL/ha (187 mL/ha)	0	Suppression. Re-entry permitted when spray deposit has dried.
Qil (group 21)	cyazofamid	Torrent 400SC	150–200 mL/ha (61–81 mL/acre)	1	Suppression. Do not make sequential applications. Tank-mix with non-ionic or organosilicone surfactant. 12-hr restricted entry interval.
phosphonate (group 33)	fosetyl-AL	Aliette WDG	3.38–4.5 kg/ha (1.4–1.8 kg/acre)	3	Suppression. Begin applications when conditions favour disease development. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade Opti	0.6–1.1 kg/ha (0.2–0.4 kg/acre)	0	Suppression. Begin applications when conditions become conducive for disease development. Repeat at 7–10 day intervals.
inorganic (group M1)	copper sulphate	Copper 53W	2.5 kg/ha (1 kg/acre)	2	Ensure thorough plant coverage. 48-hr restricted entry interval.

Table 3–152. Spinach Disease Control — Anthracnose, Botrytis Gray MoldFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ANTHRACNOSE					
AP/PP (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (314–394 g/acre)	3	Make preventive applications when conditions are favourable for disease. Use high rate when disease pressure is high. See label for recropping restrictions and restricted entry intervals.
BOTRYTIS GRAY MOLD					
SDHI (group 7)	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	Use higher rate and shorter spray interval when disease pressure is high. See label for rotational crop restrictions. Do not make more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	1,000 g/ha (405 g/acre)	0	Do not use on areas treated with product the previous season. Do not make sequential applications of any group 11 fungicide. See label for recropping restrictions and restricted entry intervals.
AP/PP (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (314–394 g/acre)	3	Make preventive applications when conditions are favourable for disease. Use high rate when disease pressure is high. See label for recropping restrictions and restricted entry intervals.

Table 3–153. Activity of Insecticides on Spinach Insects

LEGEND: C = control S = suppression RD = reduction in damage
 N = registered, but not considered effective or resistance is documented
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Leafminers	Aphids	Cabbage Looper	Cutworms	Thrips
acetamiprid	Assail 70 WP	RD ¹	C	—	—	—
imidacloprid	Admire 240 F	—	C	—	—	—
thiamethoxam	Actara 240SC	C ²	C	—	—	—
	Actara 25WG	—	C	—	—	—
thiamethoxam/cyantraniliprole	Minecto Duo 40WG	C	C	C	—	—
sulfoxaflor	Closer	—	C	—	—	—
flupyradifurone	Sivanto Prime	—	C	—	—	—
spinosad	Entrust	—	—	C	—	—
	Scorpio Ant and Insect Bait	—	—	—	C	—
	Success	—	—	C	—	—
spinetoram	Delegate WG	—	—	C	—	S
<i>Bacillus thuringiensis</i>	Bioprotec PLUS	—	—	C	—	—
	Dipel 2X DF	—	—	C	—	—
	Thuricide HPC	—	—	C	—	—
cyromazine	Citation 75WP	C ¹	—	—	—	—
methoxyfenozide	Intrepid	—	—	C	—	—
spirotetramat	Movento 240 SC	—	C	—	—	C
chlorantraniliprole	Coragen	C ²	—	C	C	—
cyantraniliprole	Exirel	C ³	C	C	C	—
flonicamid	Beleaf 50SG	—	C	—	—	—
soap	Kopa Insecticidal Soap	—	C	—	—	—

¹ Pea leafminers only.

² Vegetable and serpentine leafminers only.

³ Dipteran leafminers.

Table 3–154. Spinach Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
Soil and Transplant Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	10.2 mL/ 1,000 plants	21	Transplant drench. See label for application details. Do not use on areas treated with product in the previous season. Do not use subsequent foliar group 4 insecticides in the same season. Gloves must be worn at transplanting. See label for rotational crop restrictions. 24-hr restricted entry interval.
	imidacloprid	Admire 240 F	6 mL/100 m of row (1.8 mL/100 ft of row)	21	Soil application. See label for application details. Do not use on areas treated with product in the previous season. Do not use subsequent foliar group 4 insecticides in the same season. See label for rotational crop restrictions. 24-hr restricted entry interval.
neonicotinoid (group 4A)	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Soil application. See label for application details. Also controls leafhoppers and suppresses early-season flea beetles. Do not use subsequent foliar group 4 insecticides in the same season. See label for rotational crop restrictions. 12-hr restricted entry interval.
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	Soil application. Also suppresses early-season flea beetles. See label for application details. Do not use subsequent foliar group 4 or group 28 insecticides in the same season. See label for rotational crop restrictions. 12-hr restricted entry interval.
Foliar Applications					
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	56–86 g/ha (23–35 g/acre)	7	Do not apply foliar group 4 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Also suppresses leafhoppers. Do not use on areas treated with product in the previous season. Do not apply foliar group 4 insecticides in the same season as a soil or transplant application. See label for rotational crop restrictions. 24-hr restricted entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	100–150 mL/ha (40–60 mL/acre)	3	See label for recropping restrictions. Re-entry permitted when dry.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	1	Do not use on areas treated with product the previous season. See label for rotational crop restrictions. 12-hr restricted entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	3	Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. See label for guidance on adjuvant use and recropping restrictions. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	Use high rate under heavy pest pressure. See label for guidance on adjuvant use, tank-mix and crop tolerance information, and rotational crop restrictions. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	0	Use higher rates for high pest populations or dense foliage. See label for recropping restrictions. 12-hr restricted entry interval.
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water Apply dilute solution at a rate of 700–1,900 L/ha (283–770 L/acre)	0	Do not spray when plants are under stress. See label for crop tolerance information. Avoid spraying during full sun.

Table 3–155. Spinach Insect Control — Leafminers, Cutworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFMINERS					
Soil and Transplant Applications					
neonicotinoid (group 4A)	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Dipteran leafminers. Also controls leafhoppers and suppresses early-season flea beetles. See label for application details and rotational crop restrictions. Do not use subsequent foliar group 4 insecticides in the same season. 12-hr restricted entry interval.
neonicotinoid/diamide (group 4A/28)	thiamethoxam/cytraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	Dipteran leafminers. Also suppresses early season flea beetles. See label for application details and rotational crop restrictions. Do not use subsequent foliar group 4 or group 28 insecticides in the same season. 12-hr restricted entry interval.
Foliar Applications					
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	86 g/ha (35 g/acre)	7	Pea leafminers. Reduction in damage. Do not apply foliar group 4 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
cyromazine (group 17)	cyromazine	Citation 75WP	188 g/ha (76 g/acre)	7	Pea leafminers. Use sufficient water to achieve adequate coverage. See label for rotational crop restrictions. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Vegetable and serpentine leafminers. Do not use on areas treated with product in the previous season. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	1–1.5 L/ha (0.4–0.6 L/acre)	1	Dipteran leafminers. Use high rate under heavy pest pressure. See label for guidance on adjuvant use, tank-mix and crop tolerance information, and rotational crop restrictions. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
CUTWORMS					
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha	1	Black cutworm only. Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Black cutworm. Apply when no rain is forecast in the next 24 hr. Do not use on areas treated with product in the previous season. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–303 mL/acre)	1	Apply to small plants, when no rain is forecast in next 24 hr. Use high rate under heavy pest pressure. See label for tank-mix and crop tolerance information, and rotational crop restrictions. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.

Table 3–156. Spinach Insect Control — Cabbage Looper, Thrips

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE LOOPER					
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	Early-season control. In-furrow application. Also suppresses early-season flea beetles. See label for application details. Do not use subsequent foliar group 4 or group 28 insecticides in the same season. See label for rotational crop restrictions. 12-hr restricted entry interval.
spinosyn (group 5)	spinosad	Entrust	364 mL/ha (147 mL/acre)	1	Maintain a spray water pH of 6 or higher. See label for restricted entry intervals.
		Success	182 mL/ha (74 mL/acre)	1	
	spinetoram	Delegate	140–200 g/ha (57–81 g/acre)	1	12-hr restricted entry interval.
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i>	Bioprotec PLUS	0.9–1.8 L/ha (0.36–0.73 L/acre)	0	Cabbage Looper. Treat when larvae are young (early instars) before the crop is damaged.
		Dipel 2X DF	275–550 g/ha (111–223 g/acre)		
		Thuricide HPC	2–4.25 L/ha (0.8–1.72 L/acre)		
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	1	Do not use on areas treated with product the previous season. Apply at first sign of feeding damage. Use high rate for heavy infestations, advanced pest growth stages or larger crops. See label for rotational crop restrictions. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Do not use on areas treated with product in the previous season. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	250–500 mL/ha (101–202 mL/acre)	1	Use high rate under heavy pest pressure. See label for tank-mix and crop tolerance information, and rotational crop restrictions. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
THRIPS					
spinosyn (group 5)	spinetoram	Delegate WG	200–336 g/ha (81–136 g/acre)	1	Onion thrips. Suppression. Use high rate when pest pressure is high and/or insects are in advance growth stages. 12-hr restricted entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	365 mL/ha (148 mL/acre)	3	Onion thrips larvae. Apply when thrips are first seen, during the first half of the season when adult populations are relatively low or building. Reduction in number of thrips larvae may take 3–4 days after application. See label for guidance on adjuvant use and recropping restrictions. 12-hr restricted entry interval.

SUGARBEETS

In this section:

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This information is provided as a guideline only. Some products are under re-evaluation with the PMRA and may change within the lifetime of this publication. See product labels for complete information.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–157. Sugarbeet Seed Treatments

Group Name (Group #)	Active Ingredients	Trade Name	Rate	Pests Controlled	Notes
FUNGICIDES					
DMI (group 3)	metconazole	Metlock	23.7–47.4 mL/ 100 kg seed	seed rots, pre- and post-emergence damping-off (<i>Fusarium</i> spp., <i>Rhizoctonia solani</i>)	Suppression. For application with commercial seed treatment equipment only.
phenylamide (group 4)	metalaxyl	Allegiance FL	93 mL/ 100 kg seed	pythium seed rots, seedling blights	For application with commercial seed treatment equipment only.
	metalaxyl-M and S-isomer	Apron XL LS	20–40 mL/ 100 kg seed	pythium damping-off	For application with commercial seed treatment equipment only.
SDHI (group 7)	sedaxane	Vibrance 500FS	1–5 mL/100,000 seeds	damping-off and suppression of rhizoctonia crown and root rot	For import use only; do not treat seed in Canada. Do not feed treated foliage prior to harvest of mature roots.
QoI (group 11)	azoxystrobin	Dynasty 100FS	25–50 mL/ 100 kg seed	seed rot and pre-emergence damping-off caused by <i>Rhizoctonia solani</i>	For application with commercial seed treatment equipment only.
PP (group 12)	fludioxonil	Maxim 480FS	5.2–10.4 mL/ 100 kg seed	seed- and soil-borne diseases (<i>fusarium</i> , <i>rhizoctonia</i> , <i>aspergillus</i> , <i>penicillium</i>)	For import use only; do not treat seed in Canada.
dithiocarbamate (group M03)	thiram	Thiram 75 WP	90 g/ 25 kg seed	seed decay, seedling blight, damping-off	Seed box or commercial seed treatment. Do not graze or feed treated clippings to livestock.
INSECTICIDES					
neonicotinoid (group 4A)	thiamethoxam ¹	Cruiser 5FS ¹	50–100 mL/ 100,000 seeds	wireworm	For import use only; do not treat seed in Canada.

¹ Dust generated during the planting of treated seed may be harmful to bees and other pollinators. Bees can be exposed to product residues on flowers, leaves, pollen and/or nectar resulting from seed treatments.

Table 3–158. Activity of Fungicides on Sugarbeet Diseases

LEGEND: C = control S = suppression PS = partial suppression
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Cercospora Leaf Spot	Rhizoctonia Root and Crown Rot	Powdery Mildew
thiophanate-methyl	Senator 50SC	C	—	—
metconazole	Caramba	C	—	—
propiconazole	Tilt	C	—	C
prothioconazole	Proline 480 SC	C	C	—
tetraconazole	Mettle 210 ME	C	—	C
inpyrfluxam	Excalia	—	C	—
penthiopyrad	Vertisan	—	C	S
pydiflumetofen/difenoconazole	Miravis Duo	C	—	C
fluxapyroxad/pyraclostrobin	Priaxor	C	—	C
azoxystrobin	Quadris	—	C	—
	Azoshy 250 SC	—	C	—
pyraclostrobin	Headline EC	C	—	C
picoxystrobin	Acapela	C	S	C
trifloxystrobin	Flint	—	—	C
azoxystrobin/difenoconazole	Quadris Top	C	—	C
<i>Bacillus subtilis</i>	Serenade SOIL	—	S	—
copper hydroxide	Coppercide WP	C	—	—
	Kocide 2000	C	—	—
	Parasol WG	C	—	—
copper octanoate	Cueva	C	—	—
sulphur	Microthiol Disperss	—	—	C
mancozeb	Manzate Pro-Stick	C	—	—
hydrogen peroxide (27%)/ peroxyacetic acid (2.5%)	OxiDate 2.0	PS	—	—

Table 3–159. Sugarbeet Disease Control — Cercospora Leaf SpotFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CERCOSPORA LEAF SPOT					
To manage fungicide resistance, all <i>Cercospora</i> fungicides should be tank-mixed with another fungicide from a different chemical group. The most common tank-mix partners are the dithiocarbamate and copper fungicides. There have been no resistance issues documented with the products listed from the M1 and M3 chemical groups.					
MBC (group 1)	thiophanate-methyl	Senator 50 SC	588–784 mL/ha (240–320 mL/acre)	21	For sugarbeets grown for export use only. Always tank-mix or rotate with a different fungicide group. Do not make sequential applications. Do not feed any part of treated plants to livestock.
DMI (group 3)	metconazole	Caramba	1.0–1.25 L/ha (0.4–0.51 L/acre)	14	Always tank-mix or rotate with a different fungicide group. Do not make sequential applications of any group 3 fungicides. 12-hr restricted entry interval.
	propiconazole	Tilt 250E	500 mL/ha (202 mL/acre)	21	Always tank-mix or rotate with a different fungicide group. Do not make sequential applications of any group 3 fungicides. 12-hr restricted entry interval.
	prothioconazole	Proline 480 SC	315–415 mL/ha (127–168 mL/acre)	7	Always tank-mix or rotate with a different fungicide group. Do not make sequential applications of any group 3 fungicides. Tank-mix with a non-ionic surfactant. 24-hr restricted entry interval.
	tetraconazole	Mettle 210 ME	565 mL/ha (229 mL/acre)	14	3-day restricted entry interval for irrigation activities, 12-hr for all other activities.
DMI/SDHI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.40 L/acre)	7	Two consecutive applications can be made before switching to non-group 7 and group 3 fungicides. 12-hr restricted entry interval.
SDHI/QoI (group 7/11)	fluxapyroxad/ pyraclostrobin	Priaxor	0.45 L/ha (0.18 L/acre)	7	Begin applications prior to disease development. Tank-mix with a non-ionic surfactant. Do not make sequential applications of any group 7 or group 11 fungicides. 12-hr restricted entry interval.
QoI (group 11)	pyraclostrobin	Headline EC	670–900 mL/ha (271–364 mL/acre)	7	Isolates of <i>Cercospora beticola</i> from Ontario have shown resistance to group 11 fungicides. Always tank-mix or rotate with a different fungicide group. Do not make sequential applications of any group 11 fungicides. 12-hr restricted entry interval.
	picoxystrobin	Acapela	0.6–1.0 L/ha (0.24–0.41 L/acre)	3	Begin applications prior to row closure and prior to disease development. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	566–1,000 mL/ha (229–405 mL/acre)	7	Isolates of <i>Cercospora beticola</i> from Ontario have shown resistance to group 11 fungicides. Always tank-mix or rotate with a different fungicide group. Do not make sequential applications of any group 3 or group 11 fungicides. 12-hr restricted entry interval.
inorganic (group M01)	copper hydroxide	Coppercide WP	2.25–4.5 kg/ha (0.91–1.82 kg/acre)	1	Follow label instructions regarding addition of a suitable non-herbicidal agricultural oil at 4.5 L/ha (1.8 L/acre).
		Kocide 2000	1.6–3.2 kg/ha (0.65–1.3 kg/acre)	2	Follow label instructions regarding addition of a suitable non-herbicidal agricultural oil at 5.5 L/ha (2.2 L/acre). 48-hr restricted entry interval.
		Parasol WG	2.25–4.25 kg/ha (0.91–1.72 kg/acre)		
	copper octanoate	Cueva	0.5%–2% (v/v) solution, applied in 470–940 L solution/ha (190–380 L/acre)	1	4-hr restricted entry interval.
dithiocarbamate (group M03)	mancozeb	Manzate Pro-Stick	2.25 kg/ha (0.91 kg/acre)	21	Do not use treated beet tops for feed. 24-hr restricted entry interval.
not classified (group NC)	hydrogen peroxide (27%)/ peroxyacetic acid (2.5%)	OxiDate 2.0	1.0% (v/v) (100 mL product per 10 L of water)	0	Partial suppression only. Do not spray during conditions of intense heat, drought or poor plant vigor. 4-hr restricted entry interval.

Table 3–160. Sugarbeet Disease Control — Powdery Mildew, Rhizoctonia Root and Crown RotFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
POWDERY MILDEW					
DMI (group 3)	propiconazole	Tilt 250E	500 mL/ha (202 mL/acre)	21	Always tank-mix or rotate with a different fungicide group. Do not make sequential applications of any group 3 fungicides. 12-hr restricted entry interval.
	tetraconazole	Mettle 210 ME	565 mL/ha (229 mL/acre)	14	3-day restricted entry interval for irrigation activities, 12-hr for all other activities.
SDHI (group 7)	penthiopyrad	Vertisan	1.0–1.5 L/ha (0.4–0.6 L/acre)	7	Suppression. Always tank-mix or rotate with a different fungicide group. Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
DMI/SDHI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.40 L/acre)	7	Two consecutive applications can be made before switching to non-group 7 and group 3 fungicides. 12-hr restricted entry interval.
SDHI/QoI (group 7/11)	fluxapyroxad/ pyraclostrobin	Priaxor	0.45 L/ha (0.18 L/acre)	7	Begin applications prior to disease development. Tank-mix with a non-ionic surfactant. Do not make sequential applications of any group 7 or group 11 fungicides. 12-hr restricted entry interval.
QoI (group 11)	pyraclostrobin	Headline EC	670–900 mL/ha (271–364 mL/acre)	7	Always tank-mix or rotate with a different fungicide group. Do not make sequential applications of any group 11 fungicides. 12-hr restricted entry interval.
	trifloxystrobin	Flint	182–244 g/ha (74–99 g/acre)	21	Always tank-mix or rotate with a different fungicide group. Do not make sequential applications of any group 11 fungicides. 12-hr restricted entry interval.
	picoxystrobin	Acapela	0.6–1.0 L/ha (0.24–0.41 L/acre)	3	Begin applications prior to row closure and prior to disease development. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	566–1,000 mL/ha (229–405 mL/acre)	7	Always tank-mix or rotate with a different fungicide group. Do not make sequential applications of any group 3 or group 11 fungicides. 12-hr restricted entry interval.
inorganic (group M02)	sulphur	Microthiol Disperss	6 kg/ha (2.4 kg/acre)	1	24-hr restricted entry interval.

Table 3–160. Sugarbeet Disease Control — Powdery Mildew, Rhizoctonia Root and Crown RotFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
RHIZOCTONIA ROOT AND CROWN ROT					
Soil and In-Furrow Applications					
SDHI (group 7)	penthiopyrad	Vertisan	15.5–31 mL/100 m of row (4.7–9.4 mL/100 ft of row)	7	Apply in-furrow at planting in 1.4–1.75 L of water/100 m of row. Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
	inpyrfluxam	Excalia	146 mL/ha (59 mL/acre)	50	Apply with a non-ionic surfactant at 125 mL/100 L of water. Do not apply as a dribble over seed row. 12-hr restricted entry interval.
QoI (group 11)	azoxystrobin	Quadris	4–6 mL/100 m of row (1.2–1.8 mL/100 ft of row)	100	12-hr restricted entry interval.
		Azoshy 250 SC			
	picoxystrobin	Acapela	12.2 mL/100 m of row (3.7 mL/100 ft of row)	3	Suppression. Apply as a banded foliar application at the 4 to 6-leaf stage. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
microbial (group BMO2)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Suppression. See label for application details.
Over-the-Row Application					
DMI (group 3)	prothioconazole	Proline 480 SC	415 mL/ha (168 mL/acre)	7	Do not make sequential applications of any group 3 fungicides. Tank-mix with a non-ionic surfactant. 24-hr restricted entry interval.
QoI (group 11)	azoxystrobin	Quadris	0.5–1.1 L/ha (0.2–0.45 L/acre)	100	Banded over the row before the 6-leaf stage. Do not apply over-the-row in the same season as a soil application. 12-hr restricted entry interval.

Table 3–161. Activity of Insecticides on Sugarbeet Insects**LEGEND:** C = control — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Flea Beetles	Cutworms	Aphids	Leafhoppers	Spider Mites
chlorpyrifos	Lorsban 4E/NT	—	C	—	—	—
	Pyrinex 480 EC	—	C	—	—	—
	Warhawk 480 EC	—	C	—	—	—
	Sharphos	—	C	—	—	—
malathion	Malathion 85E	C	—	—	—	—
naled	Dibrom	—	—	—	C	C
deltamethrin	Decis 100 EC	—	C	—	—	—
permethrin	Ambush 500EC	—	C	—	—	—
	Perm-UP	—	C	—	—	—
	Pounce 384EC	—	C	—	—	—
sulfoxaflor	Closer	—	—	C	C	—
spinosad	Scorpio Ant and Insect Bait	—	C	—	—	—
spirotetramat	Movento 240 SC	—	—	C	—	—
chlorantraniliprole	Coragen	—	C	—	—	—

Table 3–162. Sugarbeet Insect Control — Cutworms, Flea Beetles, Leafhoppers and Spider Mites

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
organophosphate (group 1B)	chlorpyrifos	Lorsban NT	1.2–2.4 L/ha (0.5–1.0 L/acre)	90	24-hr restricted entry interval.
		Pyrinex 480 EC			
		Warhawk 480 EC			
		Sharphos			
pyrethroid (group 3A)	deltamethrin	Decis 100 EC	100 mL/ha (40 mL/acre)	100	12-hr restricted entry interval.
	permethrin	Ambush 500EC	140–300 mL/ha (57–121 mL/acre)	—	See label for application details. Re-entry permitted once spray deposit has dried.
		Perm-UP	180–390 mL/ha (73–158 mL/acre)		See label for application details. 12-hr restricted entry interval.
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha	3	Black cutworm only. Also reduction in damage to wireworm (see label for application details). Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Early application on larval stages provides best control. 12-hr restricted entry interval.
FLEA BEETLES, LEAFHOPPERS, SPIDER MITES					
organophosphate (group 1B)	malathion	Malathion 85E	535 mL/ha (217 mL/acre)	—	Flea beetles. Less effective at temperatures below 20°C. 12-hr restricted entry interval.
	naled	Dibrom	2.1 L/ha (0.85 L/acre)	5	Spider mites and leafhoppers. 48-hr restricted entry interval.
sulfoximine (group 4C)	sulfoxaflor	Closer	300 mL/ha (121 mL/acre)	7	Leafhoppers. 12-hr restricted entry interval.

SWEET CORN

In this section:

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This information is provided as a guideline only. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication. See product labels for complete information.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–163. Sweet Corn Seed Treatments

LEGEND: C = control — = not registered for control of this pest, or activity on this pest has not been documented

Active Ingredient(s)	Trade Name	Insects				Seedling Blights ¹				Notes
		Seedcorn Maggots	Wireworm	European Chafer	Flea Beetles	Penicillium	Pythium	Fusarium	Rhizoctonia	
FUNGICIDE ONLY										
difenoconazole/ metalaxyl-M and S-isomer	Dividend XL RTA	—	—	—	—	C	C	C	—	For application with commercial seed treatment equipment only. Use 325 mL/100 kg of seed. See label for livestock and recropping restrictions.
metalaxyl	Allegiance FL	—	—	—	—	—	C	—	—	For application with commercial seed treatment equipment only. Use 46–110 mL/100 kg of seed.
metalaxyl-M and S-isomer + fludioxonil	Apron XL LS + Maxim 480FS	—	—	—	—	C	C	C	C	For use in commercial seed treatment facilities. See the product labels for rates.
azoxystrobin + fludioxonil	Dynasty 100FS + Maxim XL	—	—	—	—	C	C	C	C	For use in commercial seed treatment facilities. See the product labels for rates.
thiram	Thiram 75WP	—	—	—	—	—	C	C	C	Seed box or commercial seed treatment. Use 55 g/25 kg of seed.

¹ Also known as 3–5-leaf dieback.

² Dust generated during the planting of treated seed may be harmful to bees and other pollinators. Bees can be exposed to product residues on flowers, leaves, pollen and/or nectar resulting from seed treatments.

Table 3–163. Sweet Corn Seed Treatments

LEGEND: C = control										
— = not registered for control of this pest, or activity on this pest has not been documented										
Active Ingredient(s)	Trade Name	Insects				Seedling Blights ¹				Notes
		Seedcorn Maggots	Wireworm	European Chafer	Flea Beetles	Penicillium	Pythium	Fusarium	Rhizoctonia	
INSECTICIDE ONLY										
clothianidin ²	Poncho 600FS ²	C	C	C	C	—	—	—	—	For use in commercial seed treatment facilities. See product label for rates. Will also control corn rootworm and black cutworm. Do not use any subsequent foliar applications of a group 4 insecticide in the same season.
imidacloprid ²	Gaucho 480 FL ²	—	C	—	C	—	—	—	—	For use in commercial seed treatment facilities. See product label for rates. Request the high rate for flea beetles. Do not use on areas treated with product the previous season. Do not use any subsequent foliar applications of any group 4 insecticide in the same season. Gaucho-treated seed should not be carried over
thiamethoxam ²	Cruiser 5FS ²	C	C	C	C	—	—	—	—	For use in commercial seed treatment facilities. See product label for rates. Do not use any subsequent foliar applications of any group 4 insecticide in the same season. See label for livestock feeding restrictions.
cyantraniliprole	Fortenza ²	—	C	C	—	—	—	—	—	Also controls cutworm. Apply using commercial seed treatment equipment. See the product label for rates. Do not use any subsequent foliar applications of a group 28 insecticide in the same season.
INSECTICIDE + FUNGICIDE										
thiamethoxam ² + fludioxonil + metalaxyl-M and S-isomer	Cruiser 5FS2 + Maxim 480FS + Apron XL LS	C	C	C	C	C	C	C	C	For use in commercial seed treatment facilities. See the product labels for rates. Do not use any subsequent foliar applications of any group 4 insecticide in the same season.
thiamethoxam ² + fludioxonil + azoxystrobin	Cruiser 5FS2 + Maxim XL + Dynasty 100FS	C	C	C	C	C	C	C	C	

¹ Also known as 3–5-leaf dieback.² Dust generated during the planting of treated seed may be harmful to bees and other pollinators. Bees can be exposed to product residues on flowers, leaves, pollen and/or nectar resulting from seed treatments.

Table 3–164. Activity of Fungicides on Sweet Corn DiseasesFor information on seed decay, root rots and 3–5 leaf dieback, see Table 3–163. *Sweet Corn Seed Treatments.***LEGEND:** C = control

— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Rust	Northern Corn Leaf Blight	Common Smut	Stewart's Wilt ¹
propiconazole	Bumper 418 EC	C	C	—	—
	Fitness	C	C	—	—
	Princeton	C	C	—	—
	Tilt 250E	C	C	—	—
prothioconazole	Proline 480 SC	C	C	—	—
pydiflumetofen/azoxystrobin/ propiconazole	Miravis Neo	C	C	—	—
penthiopyrad	Vertisan	C	—	—	—
fluxapyroxad + pyraclostrobin	Priaxor	C	C	—	—
azoxystrobin	Azoshy 250 SC	C	—	—	—
	Quadris Flowable	C	—	—	—
picoxystrobin	Acapela	—	C	—	—
pyraclostrobin	Headline EC	C	—	—	—
azoxystrobin/propiconazole	Quilt	C	C	—	—
trifloxystrobin/prothioconazole	Stratego PRO	C	C	—	—
azoxystrobin/propiconazole + benzovindiflupyr	Trivapro A + Trivapro B	C	C	—	—
chlorothalonil	Bravo ZN	C	—	—	—
	Echo 90DF	C	—	—	—

¹ See Flea Beetles in Table 3–163. *Sweet Corn Seed Treatments.*

Table 3–165. Sweet Corn Disease ControlFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
RUST, NORTHERN CORN LEAF BLIGHT					
DMI (group 3)	propiconazole	Bumper 432 EC	150–300 mL/ha (61–121 mL/acre)	14	Use high rate for rust. 12-hr restricted entry interval.
		Fitness			
		Princeton			
		Tilt 250E	250–500 mL/ha (101–202 mL/acre)		
	prothioconazole	Proline 480 SC	315 mL/ha (127 mL/acre)	14	Apply when the earliest disease symptoms appear on the leaves and stems. Under high disease pressure, tank-mix with a non-ionic surfactant (do not apply a non-ionic surfactant prior to tassel emergence as crop injury may occur). Do not make sequential applications of any group 3 fungicides. See label for recropping and restricted entry intervals.
DMI/SDHI/Qol (group 3/7/11)	pydiflumetofen/azoxystrobin/propiconazole	Miravis Neo	0.75–1.0 L/ha (0.3–0.4 L/acre)	14	Use low rate for northern corn leaf blight. Make the first application at the first sign of disease. See label for rate selection and timing information. 12-hr restricted entry interval.
SDHI (group 7)	penthiopyrad	Vertisan	1–1.75 L/ha (0.4–0.7 L/acre)	7	Rust. Also suppresses grey leaf spot. Do not make more than two sequential applications of any group 7 fungicide. See label for restricted entry intervals.
SDHI/Qol (group 7/11)	fluxapyroxad/pyraclostrobin	Priaxor	0.3 L/ha (0.12 L/acre)	7	Do not make sequential applications of any group 7 or group 11 fungicides. 12-hr restricted entry interval.
Qol (group 11)	azoxystrobin	Azoshy 250 SC	453 mL/ha (183 mL/acre)	7	Rust. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
		Quadris Flowable			
	picoxystrobin	Acapela	530–800 mL/ha (214–323 mL/acre)	7	Northern corn leaf blight. Use high rate and shorter interval when disease pressure is high. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
	pyraclostrobin	Headline EC	400–600 mL/ha (162–243 mL/acre)	7	Rust. Use high rate and shorter interval when disease pressure is high. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
Qol/DMI (group 11/3)	azoxystrobin/propiconazole	Quilt	0.75–1 L/ha (0.3–0.4 L/acre)	14	Do not use on areas treated with product the previous season. Make the first application at the first sign of disease; use high rate only under conditions of high disease pressure. Do not make sequential applications of any group 11 or group 3 fungicides. 12-hr restricted entry interval.
	trifloxystrobin/prothioconazole	Stratego PRO	572 mL/ha (232 mL/acre)	14	Do not make sequential applications of any group 11 or group 3 fungicides. Do not apply with an adjuvant in corn. See label for recropping restrictions. 24-hr restricted entry interval.
Qol/DMI (group 11/3) + SDHI (group 7)	azoxystrobin/propiconazole + benzovindiflupyr	Trivapro A + Trivapro B	750–1,000 mL/ha (304–405 mL/acre) + 300–750 mL/ha (121–304 mL/acre)	14	For optimal disease control, begin applications prior to disease development. Do not make more than two sequential applications of any group 3, 7 or 11 fungicides. 1-day restricted entry interval.
chloronitrile (group M5)	chlorothalonil	Bravo ZN	3.2 L/ha (1.3 L/acre)	14	Rust. Restricted entry intervals: • general – 12 hr • scouting – 1 day • hand harvest – 18 days • machine harvest – 14 days
		Echo 90DF	1.8 kg/ha (0.7 kg/acre)		

Table 3–166. Activity of Insecticides on Sweet Corn InsectsFor information on seed corn maggot, wireworm, white grubs and flea beetles, see Table 3–163. *Sweet Corn Seed Treatments.***LEGEND:** C = control

S = suppression

SC = some control of this pest may be expected when the product is used to control labelled pests

N = registered, but not considered effective or resistance is documented

— = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Corn Rootworm (larvae)	Slugs	Cutworm	Aphids	Brown Marmorated Stink Bug	Fall Armyworm	European Corn Borer	Corn Earworm	Western Bean Cutworm
methomyl	Lannate TNG	—	—	—	—	S	—	C	C	—
acephate	Orthene 97% SG	—	—	—	—	—	—	C	—	—
chlorpyrifos	Lorsban 4E/NT	—	—	C	—	—	—	—	—	—
	Nufos 4E	—	—	C	—	—	—	—	—	—
	Pyrifos 15G	C	—	S	—	—	—	—	—	—
	Pyrinex 480 EC	—	—	C	—	—	—	—	—	—
	Sharphos	—	—	C	—	—	—	—	—	—
	Warhawk 480 EC	—	—	C	—	—	—	—	—	—
cypermethrin	Mako	—	—	C	—	—	SC	C	N	—
	Ship 250	—	—	C	—	—	SC	C	N	—
	UP-Cyde 2.5 EC	—	—	C	—	—	SC	C	—	—
deltamethrin	Decis 100 EC	—	—	—	—	—	SC	C	N	C
	Poleci 2.5 EC	—	—	—	—	—	SC	C	N	C
lambda-cyhalothrin	Labamba	—	—	C	—	—	C ¹	C	N	C
	Matador 120EC	—	—	C	—	—	C ¹	C	N	C
	Silencer 120 EC	—	—	C	—	—	C	C	N	SC
permethrin	Perm-UP	—	—	C	—	—	C	C	N	—
	Pounce 384EC	—	—	C	—	—	C	C	N	—
tefluthrin	Force 3.0G	C	—	C	—	—	—	—	—	—
lambda-cyhalothrin/chlorantraniliprole	Voliam Xpress	—	—	—	—	—	C ¹	C	C	C
acetamiprid	Aceta 70 WP	—	—	—	C	—	—	—	—	—
	Assail 70 WP	—	—	—	C	—	—	—	—	—
sulfoxaflor	Closer	—	—	—	C	—	—	—	—	—
flupyradifurone	Sivanto Prime	—	—	—	C	—	—	—	—	—
acetamiprid/novaluron	Cormoran	—	—	—	C	—	—	—	—	—
spinetoram	Delegate	—	—	—	—	—	—	C	—	C
spinosad	Entrust	—	—	—	—	—	—	C	—	—
	Success	—	—	—	—	—	—	C	—	—
	Scorpio Ant and Insect Bait	—	—	C	—	—	—	—	—	—
methoxyfenozide	Intrepid	—	—	—	—	—	—	C	—	—
spirotetramat	Movento 240 SC	—	—	—	C	—	—	—	—	—
chlorantraniliprole	Coragen	—	—	—	—	—	C ¹	C	C	C
tetraniliprole	Vayego 200 SC	—	—	C	S	—	C ¹	C	C	—
<i>Bacillus thuringiensis</i> var. <i>kurstaki</i>	Dipel 2X DF	—	—	—	—	—	—	C	—	—
	Bioprotec PLUS	—	—	—	—	—	—	C	—	—
ferric phosphate	Sluggo Professional	—	C	—	—	—	—	—	—	—
potassium salts of fatty acids	Kopa Insecticidal Soap	—	—	—	C	—	—	—	—	—

¹ Also controls common armyworm.

Table 3–167. Sweet Corn Insect Control — Corn Rootworm, Cutworms, Slugs

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CORN ROOTWORM — soil applications					
organophosphate (group 1B)	chlorpyrifos	Pyrifos 15G	9.8 kg/ha ¹ (3.9 kg/acre)	70	Apply in-furrow at planting at a rate of 75 g/100 m of row. Will also provide suppression of cutworms. See label for recropping restrictions. 24-hr restricted entry interval.
pyrethroid (group 3A)	tefluthrin	Force 3.0G	5 kg/ha ¹ (2 kg/acre)	49	Apply in-furrow at planting at a rate of 37.5 g/100 m of row. Will also control seed corn maggot, wireworm and black cutworm. See label for recropping restrictions. 12-hr restricted entry interval.
WIREWORM — soil applications					
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	7	Reduction in damage. Incorporate into the soil at planting to a depth of 10–20 cm.
CUTWORMS					
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT	1.2–2.4 L/ha (0.5–1 L/acre)	70	Apply during 2–5-leaf stage. See label for recropping restrictions. 24-hr restricted entry interval.
		Nufos 4E			
		Pyrinex 480 EC			
		Sharphos			
		Warhawk 480 EC			
pyrethroid (group 3A)	cypermethrin	Mako	175 mL/ha (71 mL/acre)	21	Apply to moist soils up to 5-leaf stage. Do not disturb soil for 5 days after application. 12-hr restricted entry interval.
		Ship 250	280 mL/ha (113 mL/acre)		
		UP-Cyde 2.5 EC	285 mL/ha (115 mL/acre)		
	lambda- cyhalothrin	Labamba	83 mL/ha (34 mL/acre)	1	Apply to moist soils up to 5-leaf stage. Do not disturb soil for 5 days after application. 14-day PHI for silage. 24-hr restricted entry interval.
		Matador 120EC			
		Silencer 120 EC			
	permethrin	Perm-UP	180–390 mL/ha (73–158 mL/acre)	—	Apply to moist soils up to 5-leaf stage. Do not disturb soil for 5 days after application. Use high rate on large larvae, dry soils or muck soils. 12-hr restricted entry interval. Apply to moist soils up to 5-leaf stage. Do not disturb soil for 5 days after application. Use high rate on large larvae, dry soils or muck soils. Re-entry permitted when dry.
		Pounce 384EC			
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	7	Black cutworm only. Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Variegated cutworm, black cutworm. Do not use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a seed treatment. 12-hr restricted entry interval.
SLUGS					
not classified (group NC)	ferric phosphate	Sluggo Professional	12–50 kg/ha (4.8–20 kg/acre)	0	Use high rates on severe infestations.

¹ Row spacing: 76 cm (30 in.)

Table 3–168. Sweet Corn Insect Control — European Corn Borer

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
EUROPEAN CORN BORER					
carbamate (group 1A)	methomyl	Lannate TNG	625 g/ha (253 g/acre)	3	Apply when egg masses begin to hatch. Do not apply after August 15. 12-hr restricted entry interval.
organophosphate (group 1B)	acephate	Orthene 97% SG	580–850 g/ha (232–340 g/acre)	21	See label for restricted entry intervals.
pyrethroid ¹ (group 3A)	cypermethrin	Mako	175 mL/ha (71 mL/acre)	5	Apply when egg masses begin to hatch, but no later than when the first pinhole feeding is seen on the leaves. 12-hr restricted entry interval.
		Ship 250	280 mL/ha (113 mL/acre)		
		UP-Cyde 2.5 EC			
	deltamethrin	Decis 100 EC	125–150 mL/ha (51–61 mL/acre)	5	Apply when egg masses begin to hatch, but no later than when the first pinhole feeding is seen on the leaves. 12-hr restricted entry interval.
		Poleci 2.5 EC	500–600 mL/ha (202–243 mL/acre)	5	
	lambda- cyhalothrin	Labamba	83–187 mL/ha (34–76 mL/acre)	1	Apply when egg masses begin to hatch, but no later than when the first pinhole feeding is seen on the leaves. 14-day PHI for silage. 24-hr restricted entry interval.
		Matador 120EC			
		Silencer 120 EC	83 mL/ha (34 mL/acre)		
	permethrin	Perm-UP	275–375 mL/ha (111–152 mL/acre)	1	Apply when egg masses begin to hatch, but no later than when the first pinhole feeding is seen on the leaves. 12-hr restricted entry interval.
		Pounce 384EC			Apply when egg masses begin to hatch, but no later than when the first pinhole feeding is seen on the leaves. Re-entry permitted when dry.
pyrethroid ¹ / diamide (group 3A/28)	lambda- cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	1	Apply no later than when first feeding is seen on foliage. Do not use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a seed treatment. 24-hr restricted entry interval.
spinosyn (group 5)	spinetoram	Delegate	120–210 g/ha (48–85 g/acre)	1	Applications should be timed at egg hatch or to small larvae. Use high rate when pest pressure is high. See label for livestock feeding restrictions. 12-hr restricted entry interval.
	spinosad	Entrust	167 mL/ha (67 mL/acre)	7	Use only on very small larvae and low populations. Maintain a spray water pH of 6 or greater. See label for livestock feeding restrictions and restricted entry intervals.
		Success	83 mL/ha (34 mL/acre)	7	
microbial (group BMO2)	<i>Bacillus thuringiensis var. kurstaki</i>	Bioprotec PLUS	1.8–2.5 L/ha (0.72–1.0 L/acre)	0	Allow 5–10 days between applications. Apply at hatching, before larvae bore into plant tissues. 4-hr restricted entry interval or when residues have dried.
		Dipel 2X DF	0.56–1.12 kg/ha (0.22–0.45 kg/acre)	0	Apply when pinhole feeding is observed on 5% of plants. Use high rate on large plants. Apply on a 7-day spray interval.
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	3	Apply at the first signs of feeding damage. Use high rate for heavy infestations or larger plants. Do not use on areas treated with product the previous season. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Time applications to coincide with peak egg hatch. Do not use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a seed treatment. 12-hr restricted entry interval.

¹ Pyrethroid sprays rapidly degrade at temperatures over 26.5°C, and more frequent spray applications are often required. Spraying during cooler evening temperatures may increase the performance of these products.

Table 3–169. Sweet Corn Insect Control — Corn Earworm, Western Bean Cutworm, Fall Armyworm, Armyworm

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CORN EARWORM					
carbamate (group 1A)	methomyl	Lannate TNG	430–625 g/ha (174–253 g/acre)	3	Apply at 25% green silk. Do not apply after August 15. 12-hr restricted entry interval.
pyrethroid ¹ / diamide (group 3A/28)	lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	1	Target spray to ensure coverage of ears and green silk. Do not use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a seed treatment. 24-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Target spray to ensure coverage of ears and green silk. Do not use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a seed treatment. 12-hr restricted entry interval.
WESTERN BEAN CUTWORM					
pyrethroid ¹ (group 3A)	deltamethrin	Decis 100 EC	125–150 mL/ha (51–61 mL/acre)	5	12-hr restricted entry interval.
		Poleci 2.5 EC	500–600 mL/ha (202–243 mL/acre)	5	
	lambda-cyhalothrin	Labamba Matador 120EC	83–187 mL/ha (34–76 mL/acre)	1	14-day PHI for silage. 24-hr restricted entry interval.
pyrethroid ¹ / diamide (group 3A/28)	lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	1	Do not use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a seed treatment. 24-hr restricted entry interval.
spinosyn (group 5)	spinetoram	Delegate	120–210 g/ha (48–85 g/acre)	1	Applications should be timed at egg hatch or to small larvae. Use high rate when pest pressure is high. See label for livestock feeding restrictions. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Time applications to coincide with peak egg hatch, based on local pest pressure. Do not use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a seed treatment. 12-hr restricted entry interval.
FALL ARMYWORM, ARMYWORM					
pyrethroid ¹ (group 3A)	lambda-cyhalothrin	Labamba Matador 120EC	83–208 mL/ha (34–84 mL/acre)	1	Use low rate for fall armyworm. 14-day PHI for silage. 24-hr restricted entry interval.
		Silencer 120 EC	83 mL/ha (34 mL/acre)		14-day PHI for silage. 24-hr restricted entry interval.
	permethrin	Perm-UP Pounce 384EC	180 mL/ha (73 mL/acre)	1	Fall armyworm. 12-hr restricted entry interval. Fall armyworm. Re-entry permitted when dry.
pyrethroid ¹ / diamide (group 3A/28)	lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	1	Armyworm. Do not use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a seed treatment. 24-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Do not use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a seed treatment. 12-hr restricted entry interval.

¹ Pyrethroid sprays rapidly degrade at temperatures over 26.5°C, and more frequent spray applications are often required. Spraying during cooler evening temperatures may increase the performance of these products.

Table 3–170. Sweet Corn Insect Control — Brown Marmorated Stink Bug, Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BROWN MARMORATED STINK BUG					
See ontario.ca/stinkbug for the most up-to-date information on registrations and brown marmorated stink bug control measures.					
carbamate (group 1A)	methomyl	Lannate TNG	625 g/ha (253 g/acre)	3	Suppression. Apply when insect first appears. Do not apply after August 15. 12-hr restricted entry interval.
APHIDS					
neonicotinoid (group 4A)	acetamiprid	Aceta 70 WP	56–86 g/ha (23–35 g/acre)	10	Do not apply foliar group 4 insecticides in the same season as a soil application. 12-hr restricted entry interval.
		Assail 70 WP			Use high rate for heavy infestations. Do not apply foliar group 4 insecticides in the same season as a seed treatment. See label for restricted entry intervals.
sulfoximide (group 4C)	sulfoxaflor	Closer	75–150 mL/ha (30–61 mL/acre)	7	12-hr restricted entry interval.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	7	Do not use on areas treated with product the previous season. 12-hr restricted entry interval.
neonicotinoid/ benzoxylurea (group 4A/15)	acetamiprid/ novaluron	Cormoran	500–700 mL/ha (202–283 mL/acre)	10	Use the higher rate for heavy infestations or dense foliage. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 12-hr restricted entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	7	Apply after pollen shed. Apply when aphids are first noticed, before damaging populations become established. 50-day PHI for silage. 12-hr restricted entry interval.
diamide (group 28)	tetraniliprole	Vayego 200 SC	150 mL/ha (61 mL/acre)	1	Suppression. Do not apply any group 28 insecticide for a minimum of 60 days after planting seed treated with any group 28 insecticide. Apply up to V15 or after pollen shed. Do not feed forage or stover to livestock within 14 days of application. 12-hr restricted entry interval.
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water Apply dilute solution at a rate of 700–1,900 L/ha (283–770 L/acre).	0	Do not spray when plants are under stress. See label for crop tolerance information. Avoid spraying during full sun.

SWEET POTATOES

In this section:

Table 3–171.	Sweet Potato Transplant (Slip) Production Insect Control (Greenhouse)
Table 3–172.	Activity of Fungicides on Sweet Potato Diseases
Table 3–173.	Sweet Potato Disease and Nematode Control
Table 3–174.	Sweet Potato Postharvest Disease Control
Table 3–175.	Activity of Insecticides on Sweet Potato Insects
Table 3–176.	Sweet Potato Insect Control — European Chafer Grubs, Wireworms, Flea Beetles, Two-Spotted Spider Mites
Table 3–177.	Sweet Potato Insect Control — Aphids, Cutworm, Armyworm, Cabbage Looper, Hornworm, Slugs

This information is provided as a guideline only. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication. See product labels for complete information.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–171. Sweet Potato Transplant (Slip) Production Insect Control (Greenhouse)

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.

Group Name (Group #)	Common Name	Trade Name	Rate	Notes
TWO SPOTTED SPIDER MITES				
not classified (group NC)	potassium salts of fatty acids	Safer's Insecticide Soap Concentrate	2 L in 100 L water Apply 250 L of solution per 4,000 m ²	Begin treatment at first appearance of pest.
APHIDS AND WHITEFLIES				
not classified (group NC)	potassium salts of fatty acids	Safer's Insecticide Soap Concentrate	1–2 L in 100 L water Apply 250 L of solution per 4,000 m ²	Use 1 L/100 L water for whiteflies and 2 L/100 L water for aphids. Begin treatment at first appearance of pest.
fungal agents of uncertain mode of action (group UNF)	<i>Beauveria bassiana</i> strain ANT-03	Bioceres EC	2–4 mL/L water	Reduction in numbers. Also reduces numbers of thrips. Greenhouse use only. Begin treatment at first appearance of pest. Apply dilute spray mix at 500–1,000 L/ha. Do not mix with fungicide. Reduction in numbers may not be apparent for 5–7 days after first application. 4-hr restricted entry interval, or when spray deposits have dried.

Table 3–172. Activity of Fungicides on Sweet Potato Diseases

LEGEND: C = control S = suppression — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Field						Postharvest		
		Alternaria leaf diseases	Alternaria leaf petiole and stem blights	Rhizoctonia stem rot	In season root rots <i>Fusarium</i> , <i>Pythium</i> , <i>Rhizoctonia</i> spp.)	Sclerotinia	Nematodes	Rhizopus soft rot	Fusarium rot	Bacterial soft rot
difenoconazole/benzovindiflupyr	Aprovia Top	C	—	—	—	—	—	—	—	—
fluopyram	Velum Prime	—	—	—	—	—	S	—	—	—
fluxapyroxad	Sercadis	C	—	—	—	—	—	—	—	—
penthiopyrad	Vertisan	S	—	S	—	—	—	—	—	—
pydiflumetofen/difenoconazole	Miravis Duo	C	C	—	—	S	—	—	—	—
azoxystrobin/difenoconazole	Quadris Top	C	—	—	—	—	—	—	—	—
azoxystrobin/difenoconazole/fludioxonil	Stadium	—	—	—	—	—	—	C	C	—
fludioxonil	Scholar 230SC	—	—	—	—	—	—	C	—	—
<i>Bacillus subtilis</i>	Serenade Opti	—	—	—	—	S	—	—	—	—
<i>Bacillus subtilis</i>	Serenade SOIL	—	—	S	S	—	—	—	—	—
<i>Pseudomonas syringae</i>	Bio-Save 10LP	—	—	—	—	—	—	C	—	—
hydrogen peroxide	StorOx	—	—	—	—	—	—	—	—	C

Table 3–173. Sweet Potato Disease and Nematode Control

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
NEMATODES — soil application					
SDHI (group 7)	fluopyram	Velum Prime	500 mL/ha (202 mL/acre) ¹ or 4.5 mL/100 m row (1.37 mL/100 ft of row)	—	Root lesion nematode, root knot nematode, potato cyst nematode. Suppression. See label for application details. When applied as a soil application, use another mode of action for the first foliar fungicide application. Do not make more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
IN-SEASON STEM AND ROOT ROTS					
SDHI (group 7)	penthiopyrad	Vertisan	15.5 mL/100 m of row applied in 1.4–1.75 L water/100 m of row	7	Stem rots caused by <i>Rhizoctonia solani</i>. Suppression. Apply in-furrow at planting. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.4 L/acre)	14	Alternaria leaf petiole and stem blight caused by <i>Alternaria tenuissima</i> and <i>A. bataticola</i>. Also suppresses botrytis gray mold. Do not make more than two sequential applications of any group 3 or group 7 fungicide. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Root rots caused by <i>Pythium</i> spp. and <i>Fusarium</i> spp. Stem and root rots caused by <i>Rhizoctonia solani</i>. Suppression. May be applied at planting and/or post-planting. See label for application details.
LEAF BLIGHTS AND LEAF SPOTS					
DMI/SDHI (group 3/group 7)	difenoconazole/ benzovindiflupyr	Aprovia Top	643–967 mL/ha (260–391 mL/acre)	14	Leaf blights caused by <i>Alternaria solani</i>. Also suppresses brown spot (<i>Alternaria alternata</i>). Do not make sequential applications of any group 3 or group 7 fungicides. 12-hr restricted entry interval.
SDHI (group 7)	penthiopyrad	Vertisan	1–1.75 L/ha (0.4–0.7 L/acre)	7	Leaf blights caused by <i>Alternaria solani</i>. Suppression. Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
	fluxapyroxad	Sercadis	167–333 mL/ha (68–135 mL/acre)	7	Leaf blights caused by <i>Alternaria solani</i>. Do not make sequential applications of any group 7 fungicides. Tank-mix with a non-ionic surfactant. See label for further details on surfactants. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.4 L/acre)	14	Alternaria leaf spot caused by <i>Alternaria</i> spp. Also suppresses botrytis gray mold. Do not make more than two sequential applications of any group 3 or group 7 fungicide. 12-hr restricted entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	566–1,000 mL/ha (229–405 mL/acre)	14	Leaf blights caused by <i>Alternaria solani</i>. Do not make sequential applications of any group 11 or group 3 fungicide. 12-hr restricted entry interval.
SCLEROTINIA ROT					
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.4 L/acre)	14	Suppression. Do not make more than two sequential applications of any group 3 or group 7 fungicide. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade Opti	1.1–2.2 kg/ha (0.4–0.9 kg/acre)	0	Suppression.

¹ Based on 90-cm (36-in.) row spacing.

Table 3–174. Sweet Potato Postharvest Disease Control

Group Name (Group #)	Common Name	Trade Name	Rate	Notes
BACTERIAL SOFT ROT				
not classified (group NC)	hydrogen peroxide	StorOx	100 mL/10 L water	Apply prior to storage or inject into humidification water. See label for application details. Do not enter treated areas until residues have dried. See label for precautions on entering treated storage bins.
FUNGAL ROTS				
PP (group 12)	fludioxonil	Scholar 230SC	473 mL/378 L water	Rhizopus soft rot. Post-harvest drench/dip or in-line aqueous application. For best results, uniform coverage is required. See product label for detailed application instructions.
QoI/DMI/PP (group 11/3/12)	azoxystrobin/ difenoconazole/ fludioxonil	Stadium	32.5 mL/metric tonne dilute in 2 L water/metric tonne	Rhizopus and fusarium rots. Do not apply to roots that will be used for slip production. Apply post-harvest as an in-line aqueous spray application to roots immediately before storage. See label for detailed application instructions. Ensure proper coverage of the tubers. Do not make more than one postharvest application.
microbial (group BM02)	<i>Pseudomonas syringae</i>	Bio-Save 10LP	500 g/114 L water	Rhizopus soft rot. Post-harvest drench/dip or overhead application. For best results, uniform coverage is required. See product label for detailed application instructions or consult Bio-Save agent.

Table 3–175. Activity of Insecticides on Sweet Potato Insects

LEGEND: C = control S = suppression RD = reduction in pest numbers or reduction in damage
 SC = some control of this pest may be expected when the product is used to control labelled pests
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Greenhouse transplants			Field							
		Two-spotted spider mites	Aphids	Whiteflies	Grubs	Wireworms	Flea beetles	Cutworm	Armyworm	Aphids	Potato leafhopper	Spider mites
lambda-cyhalothrin	Matador 120EC	—	—	—	—	—	C	—	—	—	C	—
	Silencer 120 EC	—	—	—	—	—	C	—	—	—	C	—
lambda-cyhalothrin/chlorantraniliprole	Voliam Xpress	—	—	—	—	—	—	C	C	—	—	—
clothianidin	Clutch WDG	—	—	—	C	SC	SC	—	—	—	—	—
imidacloprid	Admire 240 F	—	—	—	RD	SC	SC	—	—	—	—	—
	Alias 240 SC	—	—	—	RD	SC	SC	—	—	—	—	—
thiamethoxan	Actara 25 WG	—	—	—	—	—	—	—	—	C	—	—
sulfoxaflor	Closer	—	—	—	—	—	—	—	—	C	C	—
flupyradifurone	Sivanto Prime	—	—	—	—	—	—	—	—	C	C	—
spinosad	Scorpio Ant and Insect Bait	—	—	—	—	RD	—	C	—	—	—	—
abamectin + cyantraniliprole	Minecto Pro	—	—	—	—	—	C	C	C	—	—	C
<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i>	XenTari WG	—	—	—	—	—	—	—	C	—	—	—
spiromesifen	Oberon Flowable	—	—	—	—	—	—	—	—	—	—	C
spirotetramat	Movento 240 SC	—	—	—	—	—	—	—	—	C	—	—
chlorantraniliprole	Coragen	—	—	—	—	—	—	C	C	—	—	—
cyantraniliprole	Exirel	—	—	—	—	—	C	C	C	C	—	—
cyclaniliprole	Harvanta 50 SL	—	—	—	—	—	—	—	C	—	—	—
tetraniliprole	Vayego 200 SC	—	—	—	—	—	C	—	—	S	—	—
flonicamid	Beleaf 50SG	—	—	—	—	—	—	—	—	C	—	—
potassium salts of fatty acids	Safer's Insecticide Soap Concentrate	C	C	C	—	—	—	—	—	—	—	—
<i>Beauveria bassiana</i> strain ANT-03	Bio Ceres EC	—	RD	RD	—	—	—	—	—	—	—	—

Table 3–176. Sweet Potato Insect Control — European Chafer Grubs, Wireworms, Flea Beetles, Two-Spotted Spider Mites

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
EUROPEAN CHAFER GRUBS — soil applications					
neonicotinoid (group 4A)	clothianidin	Clutch 50WDG	448 g/ha (181 g/acre)	—	Apply pre-plant incorporated, prior to transplanting slips. Ensure application is followed by sufficient water for optimal uptake. Do not use subsequent foliar group 4 insecticides in the same season. 12-hr restricted entry interval.
	imidacloprid	Admire 240 F	1.2 L/ha (0.5 L/acre)	125	Reduction in numbers of larvae only. Apply as a soil drench after transplant and before foliage covers more than 25% of the planting bed. Ensure that application is followed by sufficient water for optimal uptake. Do not apply during flowering. Do not use subsequent foliar group 4 insecticides in the same season. 24-hr restricted entry interval.
		Alias 240 SC	1.2 L/ha (0.5 L/acre)		
WIREWORMS					
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	7	Reduction in damage only. Incorporate into the soil to a depth of 10–20 cm.
FLEA BEETLES					
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	7	Will also control potato leafhoppers. 24-hr restricted entry interval.
		Silencer 120 EC	83 mL/ha (34 mL/acre)		
avermectin/ diamide (group 6/ group 28)	abamectin/ cyantraniliprole	Minecto Pro	370–670 mL/ha (150–271 mL/acre)	14	Tank-mix with a non-ionic surfactant. See label for further details. Avoid application when heavy rain is forecast. Thorough coverage is important to obtain optimum control. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	7	See label for guidance on adjuvant use, tank-mix and crop tolerance information. Do not apply foliar group 28 insecticides in the same season as a seed or soil application. 12-hr restricted entry interval.
diamide (group 28)	tetraniliprole	Vayego 200 SC	150 mL/ha (61 mL/acre)	14	Do not apply foliar group 28 insecticides in the same season as a seed or soil application. Do not apply during flowering. 12-hr restricted entry interval.
TWO-SPOTTED SPIDER MITES					
tetronic and tetramic acid derivatives (group 23)	spiromesifen	Oberon Flowable	500–600 mL/ha (202–243 mL/acre)	7	Will also control whiteflies. Effective against egg and nymphal stages. See label for guidance on adjuvant use to improve coverage and control. 12-hr restricted entry interval.
avermectin/ diamide (group 6/ group 28)	abamectin/ cyantraniliprole	Minecto Pro	370–670 mL/ha (150–271 mL/acre)	14	Tank-mix with a non-ionic surfactant. See label for further details. Avoid application when heavy rain is forecast. Thorough coverage is important to obtain optimum control. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. 12-hr restricted entry interval.

Table 3–177. Sweet Potato Insect Control — Aphids, Cutworm, Armyworm, Cabbage Looper, Hornworm, Slugs

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Do not apply foliar group 4 insecticides in the same season as a soil application. Do not apply between 50% row closure and petal fall. 12-hr restricted entry interval.
sulfoximines (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–61 mL/acre)	7	Also controls leafhoppers (see label for rate). 12-hr restricted entry interval.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	7	Also controls leafhoppers. Tops or greens from treated crops may not be fed to livestock or humans. 12-hr restricted entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	7	Most effective on young stages. Has slow activity; control may not be apparent for up to 2–3 weeks. See label for guidance on adjuvant use. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	7	See label for guidance on adjuvant use, tank-mix and crop tolerance information. Do not apply foliar group 28 insecticides in the same season as a seed or soil application. 12-hr restricted entry interval.
	tetraniliprole	Vayego 200 SC	150 mL/ha (61 mL/acre)	14	Suppression. Do not apply foliar group 28 insecticides in the same season as a seed or soil application. Do not apply during flowering. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	0.12–0.16 kg/ha (0.05–0.06 kg/acre)	7	Rotate applications with other insecticide groups. Do not use with adjuvants. 12-hr restricted entry interval.

Table 3–177. Sweet Potato Insect Control — Aphids, Cutworm, Armyworm, Cabbage Looper, Hornworm, Slugs

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORM, ARMYWORM, CABBAGE LOOPER, HORNWORM					
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	7	Black cutworm. Scatter the bait on the soil around or near the plants to be protected.
<i>Bacillus thuringiensis</i> (group 11)	<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i>	XenTari WG	500–1,000 g/ha (202–405 g/acre)	0	Beet armyworm. For best results apply in evening or on cloudy days and target younger larvae. 4-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Variegated cutworm, fall armyworm, beet armyworm, tomato and tobacco hornworm. Avoid application when heavy rain is forecast. Make no more than two applications of group 28 insecticides per generation to the same insect species on a crop. 12-hr restricted entry interval.
			250 mL/ha (101 mL/acre)	1	Black cutworm, cabbage looper. Avoid application when heavy rain is forecast. Make no more than two applications of group 28 insecticides per generation to the same insect species on a crop. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	7	Variegated cutworm. Suppression of tobacco and tomato hornworm (use 750 mL/ha). See label for tank-mix directions and crop tolerance. Make no more than two applications of group 28 insecticides per generation to the same insect species on a crop. Do not apply foliar group 28 insecticides in the same season as a seed or soil application. 12-hr restricted entry interval.
			250–500 mL/ha (101–202 mL/acre)	7	Cabbage looper, armyworm, beet armyworm and fall armyworm. Use 500 mL/ha for armyworm species. See label for tank-mix directions and crop tolerance. Make no more than two applications of group 28 insecticides per generation to the same insect species on a crop. Do not apply foliar group 28 insecticides in the same season as a seed or soil application. 12-hr restricted entry interval.
	cyclaniliprole	Harvanta	0.8–1.2 L/ha (0.32–0.48 L/acre)	7	Fall armyworm, beet armyworm, cabbage looper. Make no more than two applications of group 28 insecticides per generation to the same insect species on a crop. Do not apply foliar group 28 insecticides in the same season as a seed or soil application. Avoid applying consecutively more than 2 times within a 30-day period. 12-hr restricted entry interval.
pyrethroid/diamide (group 3A/28)	lambda-cyhalothrin/chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	7	Black cutworm, variegated cutworm, fall armyworm, beet armyworm, cabbage looper, tomato hornworm, tobacco hornworm. Apply when rain is not expected for 24 hr. Make no more than two applications of group 28 insecticides per generation to the same insect species on a crop. 24-hr restricted entry interval.
avermectin/diamide (group 6/ group 28)	abamectin/cyantraniliprole	Minecto Pro	370–556 mL/ha (150–225 mL/acre)	14	Variegated cutworm. Suppression of tobacco and tomato hornworm. Tank-mix with a non-ionic surfactant. See label for further details. Avoid application when heavy rain is forecast. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. 12-hr restricted entry interval.
			370 mL/ha (150 mL/acre)	14	Armyworm, beet armyworm, fall armyworm, cabbage looper. See comments for cutworm.
			556 mL/ha (225 mL/acre)	14	Suppression of tobacco and tomato hornworm. See comments for cutworm.
SLUGS					
not classified (group NC)	ferric phosphate	Sluggo Professional	25–50 kg/ha (10–20 kg/acre)	—	Slugs are not usually a problem in established sweet potato fields but under certain conditions may damage newly planted slips. If damage warrants, scatter bait around base of plants and between rows.

SWISS CHARD

In this section:

- Table 3–178.** Swiss Chard Seed Treatments
- Table 3–179.** Activity of Fungicides and Insecticides on Swiss Chard Diseases and Insects
- Table 3–180.** Swiss Chard Disease Control — Root Rots, Damping-off, Botrytis Gray Mold
- Table 3–181.** Swiss Chard Insect Control — Aphids
- Table 3–182.** Swiss Chard Insect Control — Leafminers, Cutworms, Cabbage Looper

This information is provided as a guideline only. See product labels for complete information. Many products are under re-valuation with the PMRA and may change within the lifetime of this publication.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–178. Swiss Chard Seed Treatments

Group Name (Group #)	Common Name	Trade Name	Rate	Pests Controlled	Notes
Qol (group 11)	azoxystrobin	Dynasty 100FS	25–50 mL/100 kg seed	seed rot and damping-off (<i>Rhizoctonia solani</i>)	For import use only; do not treat seed in Canada.

Table 3–179. Activity of Fungicides and Insecticides on Swiss Chard Diseases and Insects

LEGEND: C = control S = suppression RD = reduction in damage
 N = registered, but not considered effective or resistance is documented
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Damping-Off	Botrytis Gray Mold	Leafminers	Aphids	Cabbage Looper	Cutworms
FUNGICIDES							
azoxystrobin	Dynasty 100FS	C	—	—	—	—	—
penthiopyrad	Fontelis	—	C	—	—	—	—
<i>Bacillus subtilis</i>	Serenade Opti	—	S	—	—	—	—
	Serenade SOIL	S	—	—	—	—	—
<i>Trichoderma harzianum</i>	RootShield HC	S	—	—	—	—	—
INSECTICIDES							
dimethoate	Cygon 480	—	—	—	C	—	—
	Lagon 480 E	—	—	—	C	—	—
malathion	Malathion 85E	—	—	C	N	—	—
acetamiprid	Aceta 70WP	—	—	RD ¹	C	—	—
	Assail 70 WP	—	—	RD ¹	C	—	—
imidacloprid	Admire 240 F	—	—	—	C	—	—
thiamethoxam	Actara 25WG	—	—	—	C	—	—
thiamethoxam/cyantraniliprole	Minecto Duo 40WG	—	—	C	C	C	—
sulfoxaflor	Closer	—	—	—	C	—	—
flupyradifurone	Sivanto Prime	—	—	—	C	—	—
spinosad	Entrust	—	—	—	—	C	—
	Scorpio Ant and Insect Bait	—	—	—	—	—	C
	Success	—	—	—	—	C	—
spinetoram	Delegate WG	—	—	—	—	C	—

¹ Pea leafminers only.

² Vegetable and serpentine leafminers only.

³ Dipteran leafminers.

Table 3–179. Activity of Fungicides and Insecticides on Swiss Chard Diseases and Insects

LEGEND: C = control S = suppression RD = reduction in damage
 N = registered, but not considered effective or resistance is documented
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Damping-Off	Botrytis Gray Mold	Leafminers	Aphids	Cabbage Looper	Cutworms
INSECTICIDES (continued)							
cyromazine	Citation 75WP	—	—	C ¹	—	—	—
methoxyfenozide	Intrepid	—	—	—	—	C	—
spirotetramat	Movento 240 SC	—	—	—	C	—	—
chlorantraniliprole	Coragen	—	—	C ²	—	C	C
cyantraniliprole	Exirel	—	—	C ³	C	C	C
flonicamid	Beleaf 50SG	—	—	—	C	—	—

¹ Pea leafminers only.

² Vegetable and serpentine leafminers only.

³ Dipteran leafminers.

Table 3–180. Swiss Chard Disease Control — Root Rots, Damping-off, Botrytis Gray Mold

For resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ROOT ROTS, DAMPING-OFF					
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Damping-off caused by <i>Rhizoctonia solani</i>. Root rots caused by <i>Rhizoctonia solani</i>, <i>Pythium</i> spp. and <i>Phytophthora</i> spp. Suppression. May be applied at planting and/or post planting. See label for application instructions. For broadcast or banded application, incorporate into the seed zone with rainfall or overhead irrigation within 24 hr.
not classified (group NC)	<i>Trichoderma harzianum</i>	RootShield HC	55–110 g/m ³ of loose planting mix, soil or planting beds	—	Root rots caused by <i>Rhizoctonia</i> spp., <i>Pythium</i> spp. and <i>Fusarium</i> spp. Suppression. Drench application to potting mix, soil or planting beds for greenhouse transplants. 4-hr restricted entry interval.
BOTRYTIS GRAY MOLD					
SDHI (group 7)	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	Use higher rate and shorter spray interval when disease pressure is high. See label for rotational crop restrictions. Do not make more than two sequential applications. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade Opti	0.6–1.7 kg/ha (0.2–0.7 kg/acre)	0	Suppression. When environmental conditions and plant stage are conducive to rapid disease development, use in a rotational program with other registered fungicides.

Table 3–181. Swiss Chard Insect Control — Aphids

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
Soil and Transplant Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	6 mL/100 m of row (1.8 mL/100 ft of row)	45	See label for application details. Do not use on areas treated with product the previous season. Do not use subsequent foliar group 4 insecticides in the same season. See label for rotational crop restrictions. 24-hr restricted entry interval.
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	Also suppresses early-season flea beetles. See label for application details. Do not use subsequent foliar group 4 or group 28 insecticides in the same season. See label for rotational crop restrictions. 12-hr restricted entry interval.
Foliar Applications					
organophosphate (group 1B)	dimethoate	Cygon 480	700 mL/ha (283 mL/acre)	7	3-day restricted entry interval.
		Lagon 480 E			
	malathion	Malathion 85E	1,100 mL/ha (445 mL/acre)	7	Ensure thorough coverage. Control of aphids with malathion has been inconsistent in many areas. Apply when temperature is at or above 20°C. 1-day restricted entry interval.
neonicotinoid (group 4A)	acetamiprid	Aceta70 WP	56–86 g/ha (23–35 g/acre)	7	Do not apply foliar group 4 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
		Assail 70 WP			
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Also effective at reducing damage by tarnished plant bug at rate of 210 g/ha. Apply in sufficient water volume to ensure adequate coverage. Do not apply foliar group 4 insecticides in the same season as a soil or transplant application. See label for rotational crop restrictions. 12-hr restricted entry interval.
butenolide (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	1	Do not use on areas treated with product the previous season. See label for rotational crop restrictions. 12-hr restricted entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	100–150 mL/ha (40–60 mL/acre)	3	See label for recropping restrictions. Re-entry permitted when dry.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	3	Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. See label for guidance on adjuvant use and recropping restrictions. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	Use high rate under heavy pest pressure. See label for guidance on adjuvant use, tank-mix and crop tolerance information, and rotational crop restrictions. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	0	Use higher rates for high pest populations or dense foliage. See label for recropping restrictions. 12-hr restricted entry interval.

Table 3–182. Swiss Chard Insect Control — Leafminers, Cutworms, Cabbage Looper

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFMINERS					
Soil Applications					
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	Dipteran leafminers. Also suppresses early season flea beetles. See label for application details. Do not use subsequent foliar group 4 or group 28 insecticides in the same season. See label for rotational crop restrictions. 12-hr restricted entry interval.
Foliar Applications					
organophosphate (group 1B)	malathion	Malathion 85E	1,100 mL/ha (445 mL/acre)	7	Ensure thorough coverage. Apply when temperature is at or above 20°C. 1-day restricted entry interval.
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP Aceta 70 WP	86 g/ha (35 g/acre)	7	Pea leafminers. Reduction in damage. Do not apply foliar group 4 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
cyromazine (group 17)	cyromazine	Citation 75WP	188 g/ha (76 g/acre)	7	Pea leafminers. Use sufficient water to achieve adequate coverage. See label for rotational crop restrictions. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Vegetable and serpentine leafminers. Do not use on areas treated with product in the previous season. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	1–1.5 L/ha (0.4–0.6 L/acre)	1	Dipteran leafminers. Use high rate under heavy pest pressure. See label for guidance on adjuvant use, tank-mix and crop tolerance information, and rotational crop restrictions. Do not apply foliar group 28 insecticides in the same season as soil application. 12-hr restricted entry interval.
CUTWORMS					
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	1	Black cutworm. Also, reduction in damage to wireworm (see label for alternative application details). Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Black cutworm. Apply when no rain is forecast in the next 24 hr. Do not use on areas treated with product in the previous season. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–303 mL/acre)	1	Apply to small plants, when no rain is forecast in next 24 hr. Use high rate under heavy pest pressure. See label for tank-mix and crop tolerance information, and rotational crop restrictions. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.

Table 3–182. Swiss Chard Insect Control — Leafminers, Cutworms, Cabbage Looper

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE LOOPER					
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	In-furrow application. Early-season control. Also suppresses early-season flea beetles. See label for application details. Do not use subsequent foliar group 4 or group 28 insecticides in the same season. See label for rotational crop restrictions. 12-hr restricted entry interval.
spinosyn (group 5)	spinetoram	Delegate	140–200 g/ha (57–81 g/acre)	1	12-hr restricted entry interval.
	spinosad	Entrust	364 mL/ha (147 mL/acre)	1	Maintain a spray water pH of 6 or higher. See label for restricted entry intervals.
		Success	182 mL/ha (74 mL/acre)	1	
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	1	Apply at first sign of feeding damage. Use high rate for heavy infestations, advanced pest growth stages or larger crops. Do not use on areas treated with product the previous season. See label for rotational crop restrictions. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Do not use on areas treated with product in the previous season. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	250–500 mL/ha (101–202 mL/acre)	1	Use high rate under heavy pest pressure. See label for tank-mix, crop tolerance information and rotational crop restrictions. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.

TOMATOES

In this section:

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Table 3–187.	Tomato Fungal Disease Control — Botrytis Gray Mold, Sclerotinia White Mold
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Table 3–194.	Tomato Insect Control — Tarnished Plant Bug, Two-Spotted Spider Mite, Wireworm

This information is provided as a guideline only. Some products are under re-evaluation with the PMRA and may change within the lifetime of this publication. See product labels for complete information.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–183. Tomato Transplant Production Disease and Insect Control (Greenhouse)

Group Name (Group #)	Common Name	Trade Name	Rate	Notes
SEED AND SEEDLING DISEASE				
Seed Treatments				
phenylamide (group 4)	metalaxyl-M and S-isomer	Apron XL LS	20–40 mL/ 100 kg of seed	Pythium damping-off. For import use only; do not treat seeds in Canada.
QoI (group 11)	azoxystrobin	Dynasty 100FS	25–50 mL/ 100 kg of seed	Seed rot and pre-emergence damping-off caused by <i>Rhizoctonia solani</i>. For import use only; do not treat seeds in Canada.
PP (group 12)	fludioxonil	Maxim 480FS	5.2–10.4 mL/ 100 kg of seed	Seed decay, damping-off and seedling blight caused by fusarium and rhizoctonia. For application with commercial seed treatment equipment only.
dithiocarbamate (group M03)	thiram	Thiram 75 WP	65–80 g/ 25 kg of seed	Seed decay, seedling blight, damping-off. Seedbox and commercial treatment.
not classified (group NC)	<i>Streptomyces</i> strain K611	Mycostop	5–8 g/1 kg of seed	Fusarium damping off. Suppression. See label for application details.
Soil and Media Treatments				
Qil (group 21)	cyazofamid	Torrent 400SC	30 mL in 100 L of water/ha Apply as a soil drench to thoroughly wet the growing medium.	Pythium damping-off and root rot. Apply immediately after seeding. Do not use any surfactant with drench application. Do not make sequential applications of any group 21 fungicides. 60-day pre-harvest interval. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus</i> <i>amyloliquefaciens</i>	Double Nickel 55	25–250 g in 100 L of water See label for application instructions.	Phytophthora capsici (soil). Partial suppression. Make preventive applications to transplants in the greenhouse before transplanting. Follow-up applications of 100–500 g/ha (40–202 g/acre) can be made by drip irrigation or directed spray at 2–4-week intervals after transplanting. Re-entry permitted once spray deposit has dried.

Table 3–183. Tomato Transplant Production Disease and Insect Control (Greenhouse)

Group Name (Group #)	Common Name	Trade Name	Rate	Notes
SEED AND SEEDLING DISEASE – Soil and Media Treatments (continued)				
phthalimide (group M04)	captan	Maestro 80DF Supra Captan 80 WDG	1.25 kg in 1,000 L of water Apply 50–85 L of solution per 100 m².	Damping-off, fungus root rot. 48-hr restricted entry interval.
not classified (group NC)	Gliocladium catenulatum	Prestop WG	Refer to label for rates and application instructions.	Damping-off caused by Pythium sp. and Rhizoctonia solani. Suppression. Do not tank-mix with any fungicides, insecticides, herbicides or adjuvants.
	Streptomyces strain K611	Mycostop	Refer to label for rates and application instructions.	Fusarium and phytophthora. Suppression. Apply first spray after emergence using lower rate.
	Trichoderma harzianum	RootShield Granules	600–750 g/m³ of loose planting mix or soil	Root diseases caused by pythium, rhizoctonia and fusarium. Suppression. 4-hr restricted entry interval for greenhouse applications.
	Trichoderma harzianum Rifai strain KRL-AG2/ Trichoderma virens strain G-41	RootShield PLUS+ G	600–1,200 g of product per m³ of soil/potting mixture	Root diseases cause by pythium, rhizoctonia, fusarium and phytophthora. Suppression. Potting mix application.
	Trichoderma harzianum Rifai strain T22	Triatum P	See label for rate and application instructions.	Fusarium root rot and damping off caused by Pythium ultimum and Rhizoctonia solani. Suppression. 4-hr restricted entry interval.
Foliar Application				
not classified (group NC)	Gliocladium catenulatum	Prestop WG	Refer to label for rates and application instructions.	Botrytis stem canker. Suppression. Do not tank-mix with any fungicides, insecticides, herbicides or adjuvants. 4-hr restricted entry interval after foliar applications.
BOTRYTIS GRAY MOLD, POWDERY MILDEW				
hydroxylanilide (group 17)	fenhexamid	Decree 50 WDG	1.5 kg/ha (0.61 kg/acre)	Botrytis gray mold. Do not make more than two sequential applications of any group 17 fungicides. 60-day pre-harvest interval. 4-hr restricted entry interval.
microbial (group BM02)	Bacillus subtilis	Cease	1–2 L/100 L water	Botrytis gray mold. Suppression.
not classified (group NC)	Trichoderma harzianum	RootShield HC	10 g in 1 L of water Spray to wet but avoid runoff. Use sufficient volume to thoroughly cover foliage.	Botrytis gray mold. Suppression. Foliar application. 4-hr restricted entry interval.
BACTERIAL DISEASES				
microbial (group BM02)	Bacillus subtilis	Cease	1–2 L/100 L water	Bacterial speck. Suppression.
inorganic (group M1)	copper hydroxide	Coppercide WP	2.25 kg/ha (0.91 kg/acre)	Bacterial spot. 24-hr restricted entry interval.
		Kocide 2000	3.2 kg/ha (1.3 kg/acre)	Bacterial spot. 24-hr restricted entry interval.
INSECTS				
Seed Treatments				
neonicotinoid (group 4A)	clothianidin/ imidacloprid	Sepresto 75 WS	0.067 g/1,000 seeds	Aphids and thrips. For import use only; do not treat seeds in Canada. Do not use any subsequent soil, transplant or foliar applications of a group 4 insecticide in the same season. See label for rotational crop restrictions.
Foliar Application				
Bacillus thuringiensis (group 11A)	Bacillus thuringiensis var. kurstaki strain EVB-113-19	Bioprotec PLUS	1 L in 1,000 L of water See label for application instructions.	Duponchelia fovealis. 4-hr restricted entry interval or once spray deposit has dried.
	Bacillus thuringiensis	Dipel 2X DF	625 g/ha (255 g/acre)	

Table 3–184. Activity of Fungicides on Tomato Diseases

LEGEND: C = control S = suppression — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Greenhouse (Transplants)					Field								
		Damping-Off	Root Disease	Botrytis Gray Mold	Powdery Mildew	Bacterial Spot	Anthracnose	Bacterial Disease ¹	Early Blight	Botrytis Gray Mold	Late Blight	Phytophthora Blight	Powdery Mildew	Septoria Leaf Spot	Sclerotinia White Mold
tetraconazole	Mettle	—	—	—	—	—	—	—	C	—	—	—	C	C	—
difenoconazole/benzovindiflupyr	Aprovia Top	—	—	—	—	—	C	—	C	—	—	—	C	—	—
benzovindiflupyr	Aprovia	—	—	—	—	—	C	—	C	—	—	—	C	C	—
boscalid	Cantus WDG	—	—	—	—	—	—	—	C	C	—	—	—	—	—
fluxapyroxad	Sercadis	—	—	—	—	—	—	—	C	—	—	—	—	—	—
penthiopyrad	Fontelis	—	—	—	—	—	—	—	S	C	—	—	—	—	—
fluopyram	Velum Prime	—	—	—	—	—	—	—	S	—	—	—	—	—	—
pydiflumetofen/difenoconazole	Miravis Duo	—	—	—	—	—	C	—	C	S	—	—	C	—	S
fluopyram/pyrimethanil	Luna Tranquility	—	—	—	—	—	—	—	C	—	—	—	—	C	—
pyrimethanil	Scala SC	—	—	—	—	—	—	—	C	C	—	—	—	—	—
cyprodinil/fludioxinol	Switch 62.5 WG	—	—	—	—	—	—	—	—	C	—	—	—	—	—
azoxystrobin	Quadris	—	—	—	—	—	C	—	C	—	—	—	—	—	—
	Azoshy 250SC	—	—	—	—	—	C	—	C	—	—	—	—	—	—
fenamidone	Reason 500SC	—	—	—	—	—	—	—	C	—	C	—	—	—	—
pyraclostrobin	Cabrio EG	—	—	—	—	—	C	—	C	—	C	—	—	C	—
azoxystrobin/difenoconazole	Quadris Top	—	—	—	—	—	C	—	C	—	—	—	C	C	—
famoxadone/cymoxanil	Tanos 50 DF	—	—	—	—	—	—	—	C	—	C	—	—	—	—
fenhexamid	Decree 50 WDG	—	—	C	—	—	—	—	—	—	—	—	—	—	—
polyoxin D zinc salt	Diplomat 5SC	—	—	—	—	—	—	—	S	S	—	—	C	—	—
cyazofamid	Torrent 400SC	C	C	—	—	—	—	—	—	—	C	—	—	—	—
kasugamycin	Kasumin 2L	—	—	—	—	—	—	S	—	—	—	—	—	—	—
dimethomorph	Forum	—	—	—	—	—	—	—	—	—	C	—	—	—	—
mandipropamid	Revus	—	—	—	—	—	—	—	—	—	C	S	—	—	—
amectotradin/dimethomorph	Zampro	—	—	—	—	—	—	—	—	—	C	S	—	—	—
mandipropamid/oxathiapiprolin	Orondis Ultra	—	—	—	—	—	—	—	—	—	C	S ¹	—	—	—
fluopicolide	Presidio	—	—	—	—	—	—	—	—	—	C	S	—	—	—
tea tree oil	Timorex Gold	—	—	—	—	—	—	—	S	C	S	—	C	—	—
metrafenone	Vivando SC	—	—	—	—	—	—	—	—	—	—	—	C	—	—
BLAD polypeptide	Fracture	—	—	—	—	—	—	—	—	C	—	—	—	—	—
<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	—	—	—	—	—	—	—	S	S	—	S ¹	—	—	—
<i>Bacillus subtilis</i>	Cease	—	—	—	—	—	—	S	—	S	—	—	—	—	—
	Serenade Opti	—	—	—	—	—	—	S	S	S	—	—	S	—	—
	Serenade Soil	S	S	—	—	—	—	—	—	—	—	S	—	—	—
<i>Bacillus subtilis</i> var. <i>amyloliquefaciens</i> strain FZB27	Taegro 2 Biofungicide	—	—	—	—	—	—	—	—	—	S	—	—	—	—
copper hydroxide	Coppercide WP	—	—	—	—	C	—	C	—	—	—	—	—	—	—
	Kocide 2000	—	—	—	—	C	—	C	C	—	C	—	—	C	—
	Parasol WG	—	—	—	—	—	—	C	C	—	C	—	—	—	—
copper octanoate	Cueva	—	—	—	—	—	—	C	C	—	C	—	—	C	—
copper oxychloride	Copper Spray	—	—	—	—	—	—	—	C	—	C	—	—	C	—
copper sulphate	Copper 53W	—	—	—	—	—	C	—	C	—	C	—	—	C	—

¹ See label for details.

Table 3–184. Activity of Fungicides on Tomato Diseases

LEGEND: C = control S = suppression — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Greenhouse (Transplants)					Field								
		Damping-Off	Root Disease	Botrytis Gray Mold	Powdery Mildew	Bacterial Spot	Anthracnose	Bacterial Disease ¹	Early Blight	Botrytis Gray Mold	Late Blight	Phytophthora Blight	Powdery Mildew	Septoria Leaf Spot	Sclerotinia White Mold
mancozeb	Dithane Rainshield	—	—	—	—	—	C	—	C	—	C	—	—	—	—
	Manzate Pro-Stick	—	—	—	—	—	C	—	C	—	C	—	—	—	—
	Penncozeb 75DF Raincoat	—	—	—	—	—	C	—	C	—	C	—	—	—	—
captan	Maestro 80DF	C	C	—	—	—	C	—	—	—	—	—	—	C	—
	Supra Captan 80 WDG	C	C	—	—	—	C	—	—	—	—	—	—	C	—
	Sharda Captan 80 WSP	—	—	—	—	—	C	—	C	—	C	—	—	C	—
folpet	Folpan 80 WDG	—	—	—	—	—	C	—	—	—	—	—	—	—	—
chlorothalonil	Bravo ZN/ZNC	—	—	—	—	—	C	—	C	C	C	—	—	C	—
	Echo 90DF	—	—	—	—	—	C	—	C	C	C	—	—	C	—
citric and lactic acid	Cyclone	—	—	—	—	—	—	S	—	—	—	—	—	—	—
	Tivano	—	—	—	—	—	—	S	—	—	—	—	—	—	—
<i>Coniothyrium minitans</i>	Contans WG	—	—	—	—	—	—	—	—	—	—	—	—	—	S
<i>Gliocladium catenulatum</i>	Prestop WG	S	S	—	—	—	—	—	—	—	—	—	—	—	—
mineral oil	PureSpray Green Oil 13E	—	—	—	—	—	—	—	—	—	—	—	S	—	—
	Suffoil-X	—	—	—	—	—	—	—	—	—	—	—	S	—	—
<i>Streptomyces</i> strain K611	Mycostop	—	S	—	—	—	—	—	—	—	—	—	—	—	—
<i>Streptomyces lydicus</i>	Actinovate SP	—	—	—	—	—	—	—	—	—	—	—	S	—	—
<i>Aureobasidium pullulans</i>	Botector	—	—	—	—	—	—	—	—	S	—	—	—	—	—
hydrogen peroxide (27%)/ peroxyacetic acid (2.5%)	OxiDate FC	—	—	—	—	—	—	—	—	S	—	—	—	—	—
<i>Trichoderma harzianum</i>	RootShield Granules	—	S	—	—	—	—	—	—	—	—	—	—	—	—
	RootShield HC	—	S	S	—	—	—	—	—	S	—	—	—	—	—
<i>Trichoderma harzianum</i> Rifai strain KRL-AG/ <i>Trichoderma virens</i> strain G-41	Rootshield PLUS G	S	S	—	—	—	—	—	—	—	—	—	—	—	—
<i>Trichoderma harzianum</i> Rifai strain T22	Trianum P	S	S	—	—	—	—	—	—	—	—	—	—	—	—
extract of <i>Reynoutria sachalinensis</i>	Regalia Maxx	—	—	—	—	—	—	S	—	S	S	—	S	—	—
mono- and di-basic sodium, potassium and ammonium phosphites	Phostrol	—	—	—	—	—	—	—	—	—	S	—	—	—	—
mono- and di-potassium salts of phosphorous acid	Confine Extra	—	—	—	—	—	—	—	—	—	S	S ¹	—	—	—

¹ See label for details.

Table 3–185. Tomato Bacterial Disease Control

LEGEND: PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
hexopyranosyl antibiotic (group 24)	kasugamycin	Kasumin 2L	0.5 L in 100 L of water applied in sufficient volume to ensure thorough coverage Maximum 1.2 L/ha (0.5 L/acre) of product or 240 L/ha (97 L/acre) solution.	1	Bacterial canker and bacterial spot. Suppression. May be tank-mixed with Kocide. Do not make more than two sequential applications. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade Opti	0.6–1.7 kg/ha (0.2–0.7 kg/acre)	0	Bacterial spot. Suppression.
inorganic (group M01)	copper hydroxide	Coppercide WP	2.25 kg/ha (0.9 kg/acre)	1	Bacterial spot. Tank-mix with mancozeb; see label for directions.
		Kocide 2000	2.25 kg/ha (0.9 kg/acre)	2	Bacterial canker. Tank-mix with mancozeb; see label for directions. 48-hr restricted entry interval.
			2.52–3.2 kg/ha (1.02–1.3 kg/acre)	2	Bacterial spot. Tank-mix with mancozeb; see label for directions. 48-hr restricted entry interval.
		Parasol WG	2.25 kg/ha (0.9 kg/acre)	2	Bacterial spot. Tank-mix with mancozeb; see label for directions. 48-hr restricted entry interval.
	copper octanoate	Cueva	0.5%–2% (v/v) solution, applied in 470–940 L solution/ha (190–380 L/acre)	1	Bacterial speck, bacterial spot and bacterial canker. 4-hr restricted entry interval.
not classified (group NC)	citric and lactic acid	Tivano	12 L/ha (4.9 L/acre)	0	Bacterial canker. Suppression. See label for guidance on adjuvant use. 4-hr restricted entry interval or once spray deposit has dried.
		Cyclone			
plant extract (group P05)	extract of <i>Reynoutria sachalinensis</i>	Regalia Maxx	0.125%–0.25% (v/v) solution applied in 400–1,000 L water/ha (162–405 L water/acre)	0	Bacterial spot. Suppression. When environmental conditions and plant stage are conducive to rapid disease development, use in a rotational program with other registered fungicides. Re-entry permitted once spray deposit has dried.

Table 3–186. Tomato Fungal Disease Control — Anthracnose, Early Blight, Late Blight, Septoria Leaf SpotFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ANTHRACNOSE, EARLY BLIGHT, LATE BLIGHT, SEPTORIA LEAF SPOT					
DMI (group 3)	tetraconazole	Mettle	440–584 mL/ha (178–236 mL/acre)	2	Early blight and septoria leaf spot. Restricted entry intervals: <ul style="list-style-type: none">• general – 12 hr• hand set irrigation – 7 days• hand harvesting, tying and training – 2 days
DMI/SDHI (group 3/7)	difenoconazole/ benzovindiflupyr	Aprovia Top	643–967 mL/ha (260–391 mL/acre)	1	Anthracnose and early blight. Do not make sequential applications of any group 3 or group 7 fungicides. 12-hr restricted entry interval.
SDHI (group 7)	benzovindiflupyr	Aprovia	500–750 mL/ha (202–304 mL/acre)	1	Anthracnose, early blight and septoria leaf spot. Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
	boscalid	Cantus WDG	175–315 g/ha (71–127 g/acre)	0	Early blight. Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
	fluxapyroxad	Sercadis	167–333 mL/ha (68–135 mL/acre)	7	Early blight. Use high rate to target black mold (<i>Alternaria alternata</i>) of ripe fruit. Do not make sequential applications of group 7 fungicides. Tank-mix with a non-ionic surfactant. 12-hr restricted entry interval.
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.51–0.71 L/acre)	0	Early blight. Suppression. Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
	fluopyram	Velum Prime	500 mL/ha (202 mL/acre)	0	Early blight. Suppression. Soil application. Ensure product moves to the root zone. Do not make more than 2 sequential applications of a group 7 fungicide. When Velum is applied as a soil application, use a different mode of action for the first foliar fungicide application. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.4 L/acre)	0	Anthracnose and early blight. Two consecutive applications can be made before switching to non-group 7 and group 3 fungicides. 12-hr restricted entry interval.
SDHI/AP (group 7/9)	fluopyram/ pyrimethanil	Luna Tranquility	800 mL/ha (324 mL/acre)	1	Early blight and septoria leaf spot. Do not make sequential applications of any group 7 or group 9 fungicide. 12-hr restricted entry interval.
AP (group 9)	pyrimethanil	Scala SC	750 mL/ha (304 mL/acre)	1	Early blight. Tank-mix with chlorothalonil. Do not make sequential applications of any group 9 fungicides. 12-hr restricted entry interval.
QoI (group 11)	azoxystrobin	Quadris	300–500 mL/ha (121–202 mL/acre)	1	Early blight and anthracnose. Do not apply for 21 days after transplanting. Do not apply for 6 days before or after using metribuzin. Do not make sequential applications of any group 11 fungicides. 12-hr restricted entry interval.
		Azoshy 250SC			
	pyraclostrobin	Cabrio EG	560–840 g/ha (227–340 g/acre)	0	Anthracnose, early blight and septoria leaf spot. Do not make sequential applications of any group 11 fungicides. 12-hr restricted entry interval.
			560–1,000 g/ha (227–405 g/acre)	0	Late blight. Do not make sequential applications of any group 11 fungicides. 12-hr restricted entry interval.
	fenamidone	Reason 500SC	200 mL/ha (81 mL/acre)	14	Early blight and late blight. Tank-mix with mancozeb or chlorothalonil. Apply a non-group 11 fungicide within 7–10 days after every Reason application. 12-hr restricted entry interval.

Table 3–186. Tomato Fungal Disease Control — Anthracnose, Early Blight, Late Blight, Septoria Leaf SpotFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ANTHRACNOSE, EARLY BLIGHT, LATE BLIGHT, SEPTORIA LEAF SPOT (continued)					
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	375–625 mL/ha (152–253 mL/acre)	1	Anthracnose, early blight and septoria leaf spot. Use high rate for septoria leaf spot. Do not apply until 21 days after transplanting. Do not apply for 6 days before or after metribuzin. Do not make sequential applications of any group 11 or group 3 fungicides. 12-hr restricted entry interval.
QoI/ cyanoacetamide- oxime (group 11/27)	famoxadone/ cymoxanil	Tanos 50 DF	560 g/ha (227 g/acre)	3	Early blight and late blight. Do not make sequential applications of any group 11 or group 27 fungicides. 12-hr restricted entry interval.
polyoxins (group 19)	polyoxin D zinc salts	Diplomat 5SC	537–926 mL/ha (217–375 mL/acre)	0	Early blight. Suppression Re-entry permitted once spray deposit has dried.
Qil (group 21)	cyazofamid	Torrent 400SC	100–200 mL/ha (40–80 mL/acre)	1	Late blight. Tank-mix with a non-ionic or organosilicone surfactant. See label for directions. Do not make sequential applications of any group 21 fungicides. 12-hr restricted entry interval.
CAA (group 40)	dimethomorph	Forum	450 mL/ha (182 mL/acre)	0	Late blight. Tank-mix with another fungicide with activity against late blight. Do not make sequential applications of any group 40 fungicides. 12-hr restricted entry interval.
	mandipropamid	Revus	400–600 mL/ha (162–243 mL/acre)	1	Late blight. Tank-mix with a non-ionic surfactant. A tank-mix with chlorothalonil is suggested for resistance management. Do not make sequential applications of any group 40 fungicides. 12-hr restricted entry interval.
CAA/OSBPI (group 40/49)	mandipropamid/ oxathiapiprolin	Orondis Ultra	600 mL/ha (243 mL/acre)	1	Late blight. Do not make more than 2 consecutive applications before switching to a fungicide that is not group 49 or group 40 fungicides. 12-hr restricted entry interval.
benzamide (group 43)	fluopicolide	Presidio	220–292 mL/ha (89–118 mL/acre)	2	Late blight. Must be used in tank-mix with chlorothalonil when targeting late blight. Do not make more than two sequential applications. 48-hr restricted entry interval.
QoS/ CAA (group 45/40)	ametoctradin/ dimethomorph	Zampro	1 L/ha (0.4 L/acre)	4	Late blight. See label for guidance on adjuvant use. Do not make sequential applications of any group 40 or group 45 fungicides. 12-hr restricted entry interval.
microbial (group BMO2)	<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	0.5–2 kg/ha (0.2–0.8 kg/acre)	0	Early blight. Suppression. See label for details on choosing a rate. Re-entry permitted once spray deposit has dried.
	<i>Bacillus subtilis</i>	Serenade Opti	2.5 kg/ha (1 kg/acre)	0	Early blight. Suppression.
	<i>Bacillus subtilis</i> var. <i>amyloliquefaciens</i> strain FZB27	Taegro 2 Biofungicide	375 g/ha (152 g/acre)	0	Late blight. Suppression. Apply after emergence as a foliar spray.

Table 3–186. Tomato Fungal Disease Control — Anthracnose, Early Blight, Late Blight, Septoria Leaf SpotFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ANTHRACNOSE, EARLY BLIGHT, LATE BLIGHT, SEPTORIA LEAF SPOT (continued)					
inorganic (group M01)	copper hydroxide	Kocide 2000	2.52 kg/ha (1.0 kg/acre)	2	Early blight and late blight. Tank-mix with mancozeb; see label for directions. 48-hr restricted entry interval.
			2.24 kg/ha (0.9 kg/acre)		Septoria leaf spot. Tank-mix with mancozeb; see label for directions. 48-hr restricted entry interval.
		Parasol WG	2.25 kg/ha (0.91 kg/acre)		Early blight and late blight. Tank-mix with mancozeb; see label for directions. 48-hr restricted entry interval.
	copper octanoate	Cueva	0.5%–2% (v/v) solution, applied at 470–940 L solution/ha (190–380 L/acre)	1	Early blight, late blight and septoria leaf spot. 4-hr restricted entry interval.
	copper oxychloride	Copper Spray	4 kg/ha (1.62 kg/acre)	2	Early blight, late blight and septoria leaf spot. 48-hr restricted entry interval.
	copper sulphate	Copper 53W	4.5 kg/ha (1.8 kg/acre)	2	Anthracnose, early blight, late blight and septoria leaf spot. 48-hr restricted entry interval.
dithiocarbamate (group M03)	mancozeb	Dithane Rainshield	1.1–3.25 kg/ha (0.45–1.32 kg/acre)	30	Anthracnose, early blight and late blight. See label for most up-to-date PHI information.
		Manzate Pro-Stick	1.75–3.25 kg/ha (0.71–1.32 kg/acre)		Anthracnose, early blight and late blight. See label for most up-to-date PHI information.
		Penncozeb 75DF Raincoat			24-hr restricted entry interval.
phthalimide (group M04)	captan	Maestro 80DF	2.75–4.25 kg/ha (1.11–1.72 kg/acre)	2	Anthracnose and septoria leaf spot. See label for chemical compatibility precautions. 48-hr restricted entry interval.
		Supra Captan 80 WDG			
		Sharda Captan 80 WSP	2–5 packets/1,000 L		Anthracnose, early blight, late blight and septoria leaf spot. See label for chemical compatibility precautions. 48-hr restricted entry interval.
	folpet	Folpan 80 WDG	5 kg/ha (2 kg/acre)	1	Anthracnose. 24-hr restricted entry interval.
chloronitrile (group M05)	chlorothalonil	Bravo ZN/ZNC	2.4–4.0 L/ha (1.0–1.6 L/acre)	2	Anthracnose, early blight, late blight and septoria leaf spot. 12-hr restricted entry interval (7 days for scouting processing tomatoes).
		Echo 90DF	1.3–2.2 kg/ha (0.5–0.9 kg/acre)	1	Tomatoes not for processing. Anthracnose, early blight, late blight and septoria leaf spot. 12-hr restricted entry interval (7 days for scouting processing tomatoes).
				30	Tomatoes for processing. Anthracnose, early blight, late blight and septoria leaf spot. 12-hr restricted entry interval (7 days for scouting processing tomatoes).
not classified (group NC)	tea tree oil	Timorex Gold	1.5–1.88 L/ha (0.61–0.76 L/acre)	2	Early blight. Suppression. Do not spray during the warm hours of the day and in hot seasons with temperatures above 35°C (95°F). 4-hr restricted entry interval.
			2–12 L/ha (0.81–4.86 L/acre)	2	Late blight. Suppression. Do not spray during the warm hours of the day and in hot seasons with temperatures above 35°C (95°F). 4-hr restricted entry interval.

Table 3–186. Tomato Fungal Disease Control — Anthracnose, Early Blight, Late Blight, Septoria Leaf SpotFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ANTHRACNOSE, EARLY BLIGHT, LATE BLIGHT, SEPTORIA LEAF SPOT (continued)					
plant extract (group P05)	extract of <i>Reynoutria sachalinensis</i>	Regalia Maxx	0.125%–0.25% (v/v) solution applied in 400–1,000 L water/ha (162–405 L water/acre)	0	Late blight. Suppression. When conditions are conducive to rapid disease development, use in a rotational program with other registered fungicides. Re-entry permitted once spray deposit has dried.
phosphonate (group P07)	mono- and di- potassium salts of phosphorous acid	Confine Extra	5–10 L/ha (2.0–4.1 L/acre)	1	Late blight. Suppression. May be applied as foliar sprays or through sprinkler chemigation. Re-entry permitted once spray deposit had dried.
	mono- and di- basic sodium, potassium and ammonium phosphites	Phostrol	2.9–5.8 L/ha (1.17–2.35 L/acre)	0	Late blight. Suppression. 12-hr restricted entry interval.

Table 3–187. Tomato Fungal Disease Control — Botrytis Gray Mold, Sclerotinia White MoldFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BOTRYTIS GRAY MOLD					
SDHI (group 7)	boscalid	Cantus WDG	420 g/ha (170 g/acre)	0	Do not make more than two sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.51–0.71 L/acre)	0	Do not make more than two sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/difenoconazole	Miravis Duo	1 L/ha (0.4 L/acre)	0	Suppression. Two consecutive applications can be made before switching to non-group 7 and group 3 fungicides. 12-hr restricted entry interval.
AP (group 9)	pyrimethanil	Scala SC	750 mL/ha (304 mL/acre)	1	Must be tank-mixed with chlorothalonil. Do not make sequential applications of any group 9 fungicides. 12-hr restricted entry interval.
AP/PP (group 9/12)	cyprodinil/fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	0	Do not make sequential applications of any group 9 or group 12 fungicides. 12-hr restricted entry interval.
polyoxins (group 19)	polyoxin D zinc salt	Diplomat 5SC	463–926 mL/ha (217–375 mL/acre)	0	Suppression. Re-entry permitted once spray deposit has dried.
plant extract (group BM01)	BLAD polypeptide	Fracture	1.5–3.3 L/ha (0.6–1.3 L/acre)	0	
microbial (group BM02)	<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	0.9–1 kg/ha (0.36–0.4 kg/acre) or 1.25–3.6 kg/ha (0.51–1.46 kg/acre)	0	Suppression. See label for details on choosing a rate. Re-entry permitted once spray deposit has dried.
	<i>Bacillus subtilis</i>	Serenade Opti	1.7–3.3 kg/ha (0.69–1.34 kg/acre)	0	Suppression.
chloronitrile (group M05)	chlorothalonil	Bravo ZN/ZNC	4.8 L/ha (1.9 L/acre)	2	12-hr restricted entry interval (7 days for scouting processing tomatoes).
		Echo 90DF	2.7 kg/ha (1.1 kg/acre)	1	Tomatoes not for processing. 12-hr restricted entry interval (7 days for scouting processing tomatoes).
				30	Tomatoes for processing. 12-hr restricted entry interval (7 days for scouting processing tomatoes).
not classified (group NC)	hydrogen peroxide (27%)/peroxyacetic acid (2.5%)	OxiDate FC	1.0% (v/v) (100 mL product per 10 L of water)	0	Suppression. Do not spray during conditions of intense heat, drought or poor plant vigour. 4-hr restricted entry interval.
	<i>Aureobasidium pullulans</i>	Botector	1 kg/ha (405 g/acre)	0	Suppression.
	<i>Trichoderma harzianum</i>	RootShield HC	3.75–7.5 g/L of water Spray to wet but avoid runoff.	—	Suppression. Foliar application.
	tea tree oil	Timorex Gold	1.5–2 L/ha (0.61–0.81 L/acre)	2	Do not spray during the warm hours of the day and in hot seasons with temperatures above 35°C. 4-hr restricted entry interval.
plant extract (group P05)	extract of <i>Reynoutria sachalinensis</i>	Regalia Maxx	0.25% (v/v) solution applied in sufficient volume to ensure thorough coverage	0	Suppression. When conditions are conducive to rapid disease development, use in a rotational program with other registered fungicides. Re-entry permitted once spray deposit has dried.

Table 3–187. Tomato Fungal Disease Control — Botrytis Gray Mold, Sclerotinia White MoldFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
SCLEROTINIA WHITE MOLD					
SDHI/DMI (group 7/3)	pydiflumetofen/difenoconazole	Miravis Duo	1 L/ha (0.4 L/acre)	0	Suppression. Two consecutive applications can be made before switching to non-group 7 and group 3 fungicides. 12-hr restricted entry interval.
not classified (group NC)	<i>Coniothyrium minitans</i>	Contans WG	2–4 kg/ha (0.8–1.6 kg/acre)	0	Suppression. Apply to soil prior planting, at least 3 months before the onset of disease. Regular use of Contans WG in successive years within a long-term management strategy will improve disease control. Broadcast and lightly incorporate. If incorporation will displace soil greater than 5 cm (2 in.), increase application rate to 3–6 kg/ha (1.2–2.4 kg/acre). See label for application details and chemical compatibility precautions.

Table 3–188. Tomato Fungal Disease Control — Phytophthora Blight, Powdery MildewFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PHYTOPHTHORA BLIGHT					
CAA (group 40)	mandipropamid	Revus	600 mL/ha (243 mL/acre)	1	<p>Foliar blight. Suppression. Do not make more than 2 consecutive applications before switching to a fungicide that is not group 40 fungicides. 12-hr restricted entry interval.</p> <p>Root and crown rot (soil phase). Suppression. In-furrow or drip irrigation application. See label for application details. Do not make more than 2 consecutive applications before switching to a fungicide that is not Group 40 fungicides. 12-hr restricted entry interval.</p>
CAA/OSBPI (group 40/49)	mandipropamid/oxathiapiprolin	Orondis Ultra	600 mL/ha (243 mL/acre)	1	<p>Foliar blight. Suppression. Do not make more than 2 consecutive applications before switching to a fungicide that is not group 49 or group 40 fungicides. 12-hr restricted entry interval.</p> <p>Root and crown rot. Suppression. Soil application. See label for application rates and methods. 12-hr restricted entry interval.</p>
benzamide (group 43)	fluopicolide	Presidio	220–292 mL/ha (89–118 mL/acre)	2	Suppression. Tank-mix with another fungicide registered for phytophthora blight, but from a different group. Do not make more than two sequential applications. 12-hr restricted entry interval.
QoSI/CAA (group 45/40)	ametoctradin/dimethomorph	Zampro	1 L/ha (0.4 L/acre)	4	Suppression. See label for guidance on adjuvant use. Do not make more than two sequential applications of any group 40 or group 45 fungicides. 12-hr restricted entry interval.
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Suppression. Soil application. See label for application details.
phosphonate (group P07)	mono- and di-potassium salts of phosphorous	Confine Extra	5–10 L/ha (2–4 L/acre)	1	Foliar blight. Suppression. May be applied as foliar sprays or through sprinkler chemigation. Re-entry permitted once spray deposit had dried.

Table 3–188. Tomato Fungal Disease Control — Phytophthora Blight, Powdery MildewFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
POWDERY MILDEW					
DMI (group 3)	tetraconazole	Mettle	296–584 mL/ha (120–236 mL/acre)	2	Restricted entry intervals: • general – 12 hr • hand set irrigation – 7 days • hand harvesting, tying and training – 2 days
DMI/SDHI (group 3/7)	difenoconazole/ benzovindiflupyr	Aprovia Top	643–967 mL/ha (260–391 mL/acre)	1	Do not make sequential applications of any group 3 or group 7 fungicides. 12-hr restricted entry interval.
SDHI (group 7)	benzovindiflupyr	Aprovia	500–750 mL/ha (202–304 mL/acre)	1	Do not make sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.4 L/acre)	0	Two consecutive applications can be made before switching to non-group 7 and group 3 fungicides. 12-hr restricted entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	625 mL/ha (253 mL/acre)	1	Do not apply until 21 days after transplanting. Do not apply 6 days before or after metribuzin. Do not make sequential applications of any group 11 or group 3 fungicides. 12-hr restricted entry interval.
polyoxins (group 19)	polyoxin D zinc salt	Diplomat 5SC	278–926 mL/ha (113–375 mL/acre)	0	Suppression. Re-entry permitted once spray deposit has dried.
actin/myosin/ fibrin function (group 50)	metrafenone	Vivando SC	0.75–1.12 L/ha (0.3–0.45 L/acre)	7	Do not make more than two sequential applications. 12-hr restricted entry interval.
microbial (group BMO2)	<i>Bacillus subtilis</i>	Serenade Opti	1.7–3.3 kg/ha (0.7–1.3 kg/acre)	0	Suppression.
not classified (group NC)	<i>Streptomyces lydicus</i>	Actinovate SP	425–840 g in 700 L water/ha (172–340 g in 280 L water/acre)	0	Suppression. Spray to wet but avoid runoff. 1-hr restricted entry interval (or until spray deposit has dried).
	<i>Aureobasidium pullulans</i>	Botector	1 kg/ha (405 g/acre)	0	Suppression. 4-hr restricted entry interval.
	mineral oil	PureSpray Green Spray Oil 13E	10 L in 1,000 L water applied in sufficient volume to ensure thorough coverage	—	Suppression. See label for crop safety and chemical compatibility precautions. 12-hr restricted entry interval.
		Suffoil-X	13 L/1,000 L water	0.5	
	tea tree oil	Timorex Gold	2–12 L/ha (0.81–4.86 L/acre)	2	Do not spray during the warm hours of the day and in hot seasons with temperatures above 35°C. 4-hr restricted entry interval.

Table 3–189. Activity of Insecticides on Tomato Insects

LEGEND: C = control RD = reduction in damage S = suppression
 N = registered, but not considered effective or resistance is documented
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Greenhouse (transplant)	Field												
		<i>Duponchella fovealis</i>	Aphids	Cabbage Looper	Colorado Potato Beetle	Cutworms	<i>Drosophila</i>	Flea Beetle	Hornworm	Mites	Stink Bug	Brown Marmorated Stink Bug	Tarnished Plant Bug	Tomato Fruitworm	Wireworm
carbaryl	Sevin XLR	—	—	—	N	C	—	C	C	—	N	—	C	C	—
acephate	Orthene 97% SG	—	C	—	N	C	—	C	—	—	—	—	—	—	C
dimethoate	Cygon 480	—	C	—	—	—	—	—	—	—	—	—	—	—	—
	Lagon 480 E	—	C	—	—	—	—	—	—	—	—	—	C	—	—
malathion	Malathion 85E	—	N	—	—	—	—	—	—	N	—	—	—	—	—
naled	Dibrom	—	—	—	—	—	C	—	C	—	—	—	—	C	—
cypermethrin	Mako	—	—	—	C	—	—	C	—	—	—	—	—	—	—
	UP-Cyde 2.5 EC	—	—	—	C	—	—	C	—	—	—	—	—	—	—
	Ship 250	—	—	—	C	—	—	C	—	—	—	—	—	—	—
deltamethrin	Decis 5 EC	—	—	—	C	—	—	—	—	—	—	—	—	—	—
	Decis 100 EC	—	—	—	C	—	—	—	—	—	—	—	—	—	—
	Poleci 2.5 EC	—	—	—	C	—	—	—	—	—	—	—	—	—	—
fenpropathrin	Danitol	—	—	—	—	—	—	—	C	C	C	—	—	C	—
lambda-cyhalothrin	Matador 120EC	—	—	—	C	C	—	C	—	—	—	—	C	—	—
	Silencer 120 EC	—	—	—	C	C	—	C	—	—	—	—	C	—	—
	Labamba	—	—	—	C	C	—	—	—	—	—	—	C	—	—
permethrin	Perm-UP	—	—	—	C	C	—	C	C	—	—	—	—	C	—
	Pounce 384EC	—	—	—	C	C	—	C	C	—	—	—	—	C	—
lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	—	—	C	—	C	—	—	C	—	—	—	—	C	—
acetamiprid	Assail 70 WP	—	C	—	C	—	—	—	—	—	—	—	—	—	—
	Aceta 70 WP	—	C	—	C	—	—	—	—	—	—	—	—	—	—
flupyradifurone	Sivanto Prime	—	C	—	C	—	—	—	—	—	—	—	—	—	—
spinetoram	Delegate	—	—	C	—	—	—	—	—	—	—	—	—	—	—
spinosad	Entrust	—	—	C	C	—	—	—	—	—	—	—	—	—	—
	Success	—	—	C	C	—	—	—	—	—	—	—	—	—	—
	Scorpio Ant and Insect Bait	—	—	—	—	C	—	—	—	—	—	—	—	—	RD
abamectin/ cyantraniliprole	Minecto Pro	—	—	C	C	C	—	C	S	C	—	—	—	C	—
<i>Bacillus thuringiensis</i> var. <i>kurstaki</i> strain EVB-113-19	Bioprotec PLUS	C	—	C	—	—	—	—	C	—	—	—	—	C	—
<i>Bacillus thuringiensis</i>	Dipel 2X DF	C	—	C	—	—	—	—	C	—	—	—	—	C	—
<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i>	XenTari WG	—	—	S	—	—	—	—	—	—	—	—	—	S	—
methoxyfenozide	Intrepid	—	—	C	—	—	—	—	—	—	—	—	—	—	—
bifenazate	Acramite 50WS	—	—	—	—	—	—	—	—	C	—	—	—	—	—
spiromesifen	Oberon	—	—	—	—	—	—	—	—	C	—	—	—	—	—
spirotetramat	Movento 240 SC	—	C	—	—	—	—	—	—	—	—	—	—	—	—
cyflumetofen	Nealta	—	—	—	—	—	—	—	—	C	—	—	—	—	—
chlorantraniliprole	Coragen	—	—	C	C	C	—	—	C	—	—	—	—	C	—

¹ See label for details.

Table 3–189. Activity of Insecticides on Tomato Insects

LEGEND: C = control RD = reduction in damage S = suppression
 N = registered, but not considered effective or resistance is documented
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Greenhouse (transplant)	Field												
		<i>Duponchella fovealis</i>	Aphids	Cabbage Looper	Colorado Potato Beetle	Cutworms	Drosophila	Flea Beetle	Hornworm	Mites	Stink Bug	Brown Marmorated Stink Bug	Tarnished Plant Bug	Tomato Fruitworm	Wireworm
cyantraniliprole	Exirel	—	C	C	C	C	—	C	S	—	—	—	—	C	—
cyclaniliprole	Harvanta 50SL	—	—	C	C	—	—	—	—	—	—	—	—	—	—
tetraniliprole	Vayego 200 SC	—	S	—	C	—	—	—	—	—	—	—	—	—	—
flonicamid	Beleaf 50SG	—	C	—	—	—	—	—	—	—	—	—	—	—	—
canola oil	Vegol	—	—	—	—	—	—	—	—	S	—	—	—	—	—
mineral oil	PureSpray Green Spray Oil 13E	—	—	—	—	—	—	—	—	S	—	—	—	—	—
	Suffoil-X	—	RD	—	—	—	—	—	—	S	—	—	—	—	—
potassium salts of fatty acids	Kopa Insecticidal Soap	—	C	—	—	—	—	—	—	C	—	—	—	—	—
	Opal Insecticidal Soap	—	C	—	—	—	—	—	—	C	—	—	—	—	—
<i>Beauveria bassiana</i> strain ANT-03	Bio Ceres G WP	—	RD	—	—	—	—	—	—	—	—	—	—	—	—
<i>Metarhizium anisopliae</i> strain F53	Met52 EC bioinsecticide	—	—	—	—	—	—	—	—	RD	—	—	—	—	—

¹ See label for details.

Table 3–190. Tomato Insect Control — Aphids, Cutworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
Soil and Transplant Applications					
organophosphate (group 1B)	acephate	Orthene 97% SG	928 g in 2,000 L water/ha (375 g in 810 L water/acre)	—	Based on 14,000 plants/ha. Also controls wireworm. Temporary plant damage may occur on sandy soils. 12-hr restricted entry interval.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	See label for rates and application instructions.	45	Soil or irrigation application. See label for application details. Do not use subsequent foliar group 4D insecticides in the same season. 12-hr restricted entry interval.
not classified (group NC)	<i>Beauveria bassiana</i> strain ANT-03	Bio Ceres G WP	2–4 g/L in 500–1,000 L/ha water	0	Reduction in numbers. For greenhouse only. Do not mix with fungicide.
Foliar Applications					
organophosphate (group 1B)	dimethoate	Cygon 480 Lagon 480 E	0.55–1 L/ha (0.22–0.4 L/acre)	7	12-hr restricted entry interval.
	malathion	Malathion 85E	735–975 mL/ha (297–395 mL/acre)	3	Less effective below 20°C. Resistance to this group of products has been documented in some areas. 12-hr restricted entry interval.
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP Aceta 70 WP	56–86 g/ha (23–35 g/acre)	7	Do not apply foliar group 4 insecticides in the same season as a seed treatment. 12-hr restricted entry interval.
butenolide (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	1	Do not apply foliar group 4D insecticides in the same season as a soil or irrigation application. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	0	12-hr restricted entry interval.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (89–148 mL/acre)	1	Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. See label for guidance on adjuvant use. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	1	See label for guidance on adjuvant use. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water applied at 700–1,900 L solution/ha (283–770 L/acre)	0	Do not spray when plants are under stress. Avoid spraying during full sun.

Table 3–190. Tomato Insect Control — Aphids, Cutworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
Soil Applications					
organophosphate (group 1B)	acephate	Orthene 97% SG	928 g in 2,000 L water/ha (375 g in 810 L water/acre)	—	Based on 14,000 plants/ha. Also controls wireworm. Temporary plant damage may occur on sandy soils. 12-hr restricted entry interval.
Foliar Applications					
carbamate (group 1A)	carbaryl	Sevin XLR	45 mL/100 m of row (14 mL/100 ft of row)	2	Apply in 25–30 cm (10–12 in.) band over row. Restricted entry intervals: • scouting, thinning, hand weeding, staking – 0.5 day • tying, hand harvest, pruning, irrigation – 6 days
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	7	Apply in the evening or at night. Do not disturb the soil for 5 days after application. 24-hr restricted entry interval.
		Silencer 120 EC			
		Labamba			
	permethrin	Perm-UP	180–260 mL/ha (73–105 mL/acre)	1	12-hr restricted entry interval.
		Pounce 384EC	180–260 mL/ha (73–105 mL/acre)		Re-entry permitted once spray deposit has dried.
pyrethroid/ diamides (group 3A/28)	lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	7	Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 24-hr restricted entry interval.
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	3	Black cutworm only. Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	370–566 mL/ha (150–225 mL/acre)	7	Tank-mix with a non-ionic surfactant. For early season cutworm control, apply to foliage when rain is not expected in the next 24 hr. Thorough coverage is important to obtain optimum control. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. 12-hr restricted entry interval.
diamides (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Early application on larval stages provides best control. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	1	Early application on larval stages provides best control. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.

Table 3–191. Tomato Insect Control — Colorado Potato Beetle

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
COLORADO POTATO BEETLE					
Transplant or Soil Applications					
organophosphate (group 1B)	acephate	Orthene 97% SG	928 g in 2,000 L water/ha (375 g in 810 L water/acre)	—	Based on 14,000 plants/ha. Also controls wireworm. Temporary plant damage may occur on sandy soils. 12-hr restricted entry interval.
Foliar Applications					
pyrethroid (group 3A)	cypermethrin	Mako	85 mL/ha (34 mL/acre)	3	12-hr restricted entry interval.
		UP-Cyde 2.5 EC	140 mL/ha (57 mL/acre)		
		Ship 250			
	deltamethrin	Decis 5 EC	100–150 mL/ha (40–61 mL/acre)	3	See label precautions on high organic content soils. 12-hr restricted entry interval.
		Decis 100 EC	50–75 mL/ha (20–30 mL/acre)		
		Poleci 2.5 EC	200–300 mL/ha (81–122 mL/acre)		
	lambda- cyhalothrin	Matador 120EC	83–125 mL/ha (34–51 mL/acre)	7	24-hr restricted entry interval.
		Silencer 120 EC			
		Labamba			
	permethrin	Perm-UP	180–260 mL/ha (73–105 mL/acre)	1	12-hr restricted entry interval. Re-entry permitted once spray deposit has dried.
		Pounce 384EC	180–260 mL/ha (73–105 mL/acre)		
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP Aceta 70 WP	40–80 g/ha (16–32 g/acre)	7	Do not apply foliar group 4 insecticides in the same season as a seed treatment. 12-hr restricted entry interval.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	750–1,000 mL/ha (304–405 mL/acre)	1	Do not apply foliar group 4D insecticides in the same season as a soil or irrigation application. 12-hr restricted entry interval.
spinosyn (group 5)	spinosad	Entrust	167 mL/ha (68 mL/acre)	1	Use only on small larvae and low infestations. 12-hr restricted entry interval.
		Success	83 mL/ha (34 mL/acre)		
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	556–670 mL/ha (225–271 mL/acre)	7	Tank-mix with a non-ionic surfactant. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. For control of Colorado potato beetle, make the first application after approximately 50% of the egg masses have hatched and larvae are present. If two applications are needed, limit them to a single Colorado potato beetle generation per crop. 12-hr restricted entry interval.

Table 3–191. Tomato Insect Control — Colorado Potato Beetle

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
COLORADO POTATO BEETLE — Foliar Applications (continued)					
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Early application on larval stages provides best control. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	750–1,000 mL/ha (304–405 mL/acre)	1	Early application on larval stages provides best control. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	cyclaniliprole	Harvanta 50SL	0.8–1.2 L/ha (0.32–0.49 L/acre)	1	Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.

Table 3–192. Tomato Insect Control — Cabbage Looper, Tomato or Tobacco Hornworm

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE LOOPER					
Foliar Applications					
pyrethroid/ diamide (group 3A/28)	lambda- cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	7	Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 24-hr restricted entry interval.
spinosyn (group 5)	spinetoram	Delegate	140–200 g/ha (57–81 g/acre)	1	Application should coincide with peak egg hatch. 12-hr restricted entry interval.
	spinosad	Entrust	346 mL/ha (149 mL/acre)	1	Use only on small larvae and low infestations. 12-hr restricted entry interval.
		Success	182 mL/ha (74 mL/acre)		
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	370 mL/ha (150 mL/acre)	7	Tank-mix with a non-ionic surfactant. Apply to foliage when rain is not expected in the next 24 hr. Thorough coverage is important to obtain optimum control. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. 12-hr restricted entry interval.
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i> var. <i>kurstaki</i> strain EVB-113-19	Bioprotec PLUS	1.4–2.8 L/ha (0.6–1.1 L/acre)	0	Apply at first signs of infestation when larvae are small. 4-hr restricted entry interval or once spray deposit has dried.
		Dipel 2X DF	275–550 g/ha (111–223 g/acre)		
	<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i>	XenTari WG	500–1,000 g/ha (203–405 g/acre)	0	Suppression. For best results apply in evening or on cloudy days. 4-hr restricted entry interval or once spray deposit has dried.
diacylhydrazines (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	1	Acts primarily through ingestion by larvae. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Early application on larval stages provides best control. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	250–500 mL/ha (101–202 mL/acre)	1	Early application on larval stages provides best control. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	cyclaniliprole	Harvanta 50SL	0.8–1.2 L/ha (0.32–0.49 L/acre)	1	Do not make sequential applications of any group 28 insecticide after 2 consecutive applications within a 30-day period. Do not apply foliar group 28 insecticides in the same season as a soil application. 12-hr restricted entry interval.

Table 3–192. Tomato Insect Control — Cabbage Looper, Tomato or Tobacco Hornworm

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
HORNWORM, TOMATO OR TOBACCO					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5–5.25 L/ha (1.0–2.1 L/acre)	2	Apply in 25–30-cm (10–12-in.) band over row. Restricted entry intervals: • scouting, thinning, hand weeding, staking – 0.5 day • tying, hand harvest, pruning, irrigation – 6 days
pyrethroid (group 3A)	fenpropathrin	Danitol	779 mL/ha	7	24-hr restricted entry interval.
	permethrin	Perm-UP	180–260 mL/ha (73–105 mL/acre)	1	12-hr restricted entry interval.
		Pounce 384EC	180–260 mL/ha (73–105 mL/acre)		Re-entry permitted once spray deposit has dried.
pyrethroid/ diamide (group 3A/28)	lambda- cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	7	Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 24-hr restricted entry interval.
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	556 mL/ha (225 mL/acre)	7	Suppression. Tank-mix with a non-ionic surfactant. Apply to foliage when rain is not expected in the next 24 hr. Thorough coverage is important to obtain optimum control. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. 12-hr restricted entry interval.
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i> var. <i>kurstaki</i> strain EVB-113-19	Bioprotec PLUS	0.65–1.1 L/ha (0.26–0.45 L/acre)	0	Apply at first signs of infestation when larvae are small. 4-hr restricted entry interval or once spray deposit has dried.
		Dipel 2X DF	140–275 g/ha (57–111 g/acre)		
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Early application on larval stages provides best control. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	750 mL/ha (304 mL/acre)	1	Suppression. Early application on larval stages provides best results. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 12-hr restricted entry interval.

Table 3–193. Tomato Insect Control — Stink Bug, Brown Marmorated Stink Bug

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
STINK BUG					
carbamate (group 1A)	carbaryl	Sevin XLR	5.25–6.4 L/ha (2.12–2.59 L/acre)	2	Apply in 25–30-cm (10–12-in.) band over row. Restricted entry intervals: scouting, thinning, hand weeding, staking – 0.5 day; tying, hand harvest, pruning, irrigation – 6 days.
pyrethroid (group 3A)	fenpropathrin	Danitol	779 mL/ha	7	24-hr restricted entry interval.

BROWN MARMORATED STINK BUGSee ontario.ca/stinkbug for the most up-to-date information on registrations and brown marmorated stink bug control measures.

Table 3–194. Tomato Insect Control — Tarnished Plant Bug, Two-Spotted Spider Mite, Wireworm

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
TARNISHED PLANT BUG					
carbamate (group 1A)	carbaryl	Sevin XLR	5.25–6.4 L/ha (2.12–2.59 L/acre)	2	Restricted entry intervals: scouting, thinning, hand weeding, staking – 0.5 day; tying, hand harvest, pruning, irrigation – 6 days.
organophosphate (group 1B)	dimethoate	Lagon 480 E	0.55–1 L/ha (0.22–0.4 L/acre)	7	12-hr restricted entry interval.
pyrethroid (group 3A)	lambda- cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	7	24-hr restricted entry interval.
		Silencer 120 EC			
		Labamba			
TWO-SPOTTED SPIDER MITE					
pyrethroid (group 3A)	fenpropathrin	Danitol	779 mL/ha (315 mL/acre)	7	24-hr restricted entry interval.
avermectin/ diamide (group 6/28)	abamectin/ cyantraniliprole	Minecto Pro	385–670 mL/ha (156–271 mL/acre)	7	Tank-mix with a non-ionic surfactant. Apply to foliage when rain is not expected in the next 24 hr. Thorough coverage is important to obtain optimum control. Do not make a foliar application following an in-furrow or soil application of any group 28 insecticide. 12-hr restricted entry interval.
bifenazate (group 20D)	bifenazate	Acramite 50WS	851 g/ha (344 g/acre)	3	12-hr restricted entry interval.
tetrionic and tetramic acid derivatives (group 23)	spiromesifen	Oberon	500–600 mL/ha (202–243 mL/acre)	1	Effective against egg and nymphal stages. Apply before mite populations begin to build up. Control may not be apparent for 2–3 weeks, especially under cool temperatures. An adjuvant may be used to improve coverage and control. 12-hr restricted entry interval.
beta-ketonitrile derivative (group 25A)	cyflumetofen	Nealta	1 L/ha (405 mL/acre)	3	Apply before mites exceed threshold. 12-hr restricted entry interval.
not classified (group NC)	canola oil	Vegol	2% solution, applied at 700–1900 L/ha (283–769 L/acre)	1	Suppression. Begin when pest appears.
	mineral oil	PureSpray Green Spray Oil 13E	10 L in 1,000 L water applied in sufficient volume to ensure thorough coverage	—	Suppression. Also provides reduction in damage for aphids. See label for crop safety and chemical compatibility precautions. 12-hr restricted entry interval.
		Suffoil-X	13 L/ 1,000 L water	0.5	
	<i>Metarhizium anisopliae</i> strain F53	Met52 EC Bioinsecticide	0.5–5.0 L/1,000 L water 108 mL/10 L water	0	Reduction in numbers. Use higher application concentration when pest pressure is high. Entry permitted once spray deposit has dried.
	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water applied at 700–1,900 L solution/ha (283–770 L/acre)	0	Do not spray when plants are under stress. Avoid spraying during full sun.
WIREWORM					
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	3	Reduction in damage. Incorporate into the soil at planting to a depth of 10–20 cm (4–8 in.).

TURNIPS

In this section:

- Table 3–195.** Turnip Seed Treatments
- Table 3–196.** Activity of Fungicides and Insecticides on Turnip Diseases and Insects
- Table 3–197.** Turnip Disease Control
- Table 3–198.** Turnip Insect Control — Flea Beetles, Leaf-Eating Caterpillars, Cutworms
- Table 3–199.** Turnip Insect Control — Aphids, Cabbage Maggot

The information is provided as a guideline only. Many products are under re-evaluation with the PMRA and may change within the lifetime of this publication. See product labels for complete information.

Some products are persistent and may carry over from one year to the next. Where possible, avoid using these products in areas treated during the previous season. Many products also have specific tank-mix precautions and rotational crop restrictions. See product labels for product-specific information.

Table 3–195. Turnip Seed Treatments

Trade Name	Active Ingredient	Rate	Pests Controlled	Notes
Apron XL LS	metalaxyl-M and S-isomer	20–40 mL/100 kg seed	damping-off (<i>Pythium</i> spp.)	For use in commercial seed treatment facilities.
Apron Maxx	fludioxonil + metalaxyl-m	665 mL/100 kg seed	Seed rot, damping-off (<i>Fusarium</i> spp. <i>Rhizoctonia</i> spp. and <i>Pythium</i> spp.)	For use in commercial seed treatment facilities.
Dynasty 100FS	azoxystrobin	25–50 mL/100 kg seed	damping-off (<i>rhizoctonia</i>)	For import use only; do not treat seed in Canada.
Maxim 480FS	fludioxonil	5.2–10.4 mL/100 kg of seed	seed decay, damping-off	For use in commercial seed treatment facilities.
Thiram 75 WP	thiram	90 g/25 kg seed	seed decay and damping-off	Seed box and commercial seed treatment.

Table 3–196. Activity of Fungicides and Insecticides on Turnip Diseases and Insects

LEGEND: C = control S = suppression RD = reduction in damage
 N = registered, but not considered effective or resistance is documented
 — = not registered for control of this pest, or activity on this pest has not been documented

Common Name	Trade Name	Alternaria	Powdery Mildew	Cercospora	Rhizoctonia	Botrytis Gray Mold	Flea Beetles	Leaf-Eating Caterpillars	Cutworms	Aphids	Cabbage Maggot	Swede Midge
FUNGICIDES												
fluxapyroxad	Sercadis	S	C	—	—	—	—	—	—	—	—	—
penthiopyrad	Fontelis	—	C	—	—	C	—	—	—	—	—	—
pydiflumetofen/difenoconazole	Miravis Duo	C	C	—	—	—	—	—	—	—	—	—
fluopyram/trifloxystrobin	Luna Sensation	C	C	—	—	—	—	—	—	—	—	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	—	—	C	—	—	—	—	—	—
azoxystrobin	Quadris Flowable	—	—	—	C	—	—	—	—	—	—	—
	Azoshy 250 SC	—	—	—	C	—	—	—	—	—	—	—
pyraclostrobin	Cabrio EG	C	C	C	—	—	—	—	—	—	—	—
trifloxystrobin	Flint	C	—	—	—	—	—	—	—	—	—	—
INSECTICIDES												
carbaryl	Sevin XLR	—	—	—	—	—	C	C ¹	—	—	—	—
diazinon	Diazinon 500 E	—	—	—	—	—	—	—	—	—	C	—
malathion	Malathion 85E	—	—	—	—	—	—	C ²	—	N	—	—
cypermethrin	Mako	—	—	—	—	—	C	—	—	—	—	—
	Ship 250	—	—	—	—	—	C	—	—	—	—	—
	UP-Cyde 2.5 EC	—	—	—	—	—	C	—	—	—	—	—
permethrin	Pounce 384EC	—	—	—	—	—	C	—	—	—	—	—
	Perm-UP	—	—	—	—	—	C	—	—	—	—	—
imidacloprid	Admire 240 F	—	—	—	—	—	C	—	—	C	—	—
thiamethoxam	Actara 25WG	—	—	—	—	—	—	—	—	C	—	—
sulfoxaflor	Closer	—	—	—	—	—	—	—	—	C	—	—
flupyradifurone	Sivanto Prime	—	—	—	—	—	—	—	—	C	—	—
spinetoram	Delegate WG	—	—	—	—	—	S	C	—	—	—	—
spinosad	Success	—	—	—	—	—	S	C	—	—	—	—
	Scorpio Ant and Insect Bait	—	—	—	—	—	—	—	C	—	—	—
	Entrust	—	—	—	—	—	S	C	—	—	—	—
<i>Bacillus thuringiensis</i>	XenTari WG	—	—	—	—	—	—	C	—	—	—	—
chlorantraniliprole	Coragen	—	—	—	—	—	—	C	C	—	—	C
cyantraniliprole	Exirel	—	—	—	—	—	C	C	C	—	—	—
	Verimark	—	—	—	—	—	RD	—	—	—	C	—
flonicamid	Beleaf 50SG	—	—	—	—	—	—	—	—	C	—	—
potassium salts of fatty acids	Kopa Insecticidal Soap	—	—	—	—	—	—	—	—	C	—	—

¹ For control of imported cabbageworm and diamondback moth only.

² For control of imported cabbageworm and cabbage loopers only.

Table 3–197. Turnip Disease ControlFor resistance management, rotate between fungicides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ALTERNARIA AND CERCOSPORA LEAF BLIGHT					
SDHI (group 7)	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	7	Alternaria. Suppression. Do not make more than two sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.40 L/acre)	7	Alternaria. Do not make more than two sequential applications of any group 3 or group 7 fungicide. 12-hr restricted entry interval.
SDHI/QoI (group 7/11)	fluopyram/ trifloxystrobin	Luna Sensation	300–500 mL/ha (121–202 mL/acre)	7	Alternaria. Also controls white mold at high rate. Do not make sequential applications of any group 11 or more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
QoI (group 11)	pyraclostrobin	Cabrio EG	0.56–1.1 kg/ha (226–445 g/acre)	3	Alternaria. Do not make sequential applications of any group 11 fungicides. 3-day restricted entry interval for hand harvesting. 12-hr restricted entry interval for all other activities.
			0.56–0.84 kg/ha (0.23–0.34 kg/acre)	3	Cercospora. Do not make sequential applications of any group 11 fungicides. 3-day restricted entry interval for hand harvesting. 12-hr restricted entry interval for all other activities.
	trifloxystrobin	Flint	140–210 g/ha (56–85 g/acre)	7	Alternaria and cercospora. Do not make sequential applications of any group 11 fungicides. 12-hr restricted entry interval.
POWDERY MILDEW					
SDHI (group 7)	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	7	Do not make more than two sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
	penthiopyrad	Fontelis	1–1.75 L/ha (0.4–0.7 L/acre)	0	Do not make more than two sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
SDHI/DMI (group 7/3)	pydiflumetofen/ difenoconazole	Miravis Duo	1 L/ha (0.40 L/acre)	7	Do not make more than two sequential applications of any group 3 or group 7 fungicide. 12-hr restricted entry interval.
SDHI/QoI (group 7/11)	fluopyram/ trifloxystrobin	Luna Sensation	300–400 mL/ha (121–162 mL/acre)	7	Do not make sequential applications of any group 11 or more than two sequential applications of any group 7 fungicide. 12-hr restricted entry interval.
QoI (group 11)	pyraclostrobin	Cabrio EG	0.56–0.84 kg/ha (226–340 g/acre)	3	Do not make sequential applications of any group 11 fungicides. 3-day restricted entry interval for hand harvesting. 12-hr restricted entry interval for all other activities.
RHIZOCTONIA — soil application					
QoI (group 11)	azoxystrobin	Quadris Flowable	4–6 mL/ 100 mL of row (1.2–1.8 mL/ 100 ft of row)	40	Do not make sequential applications of any group 11 fungicides. See label for application details. 12-hr restricted entry interval.
		Azoshy 250 SC			
BOTRYTIS GRAY MOLD					
SDHI (group 7)	penthiopyrad	Fontelis	1–1.75 L/ha (0.4–0.7 L/acre)	0	Do not make more than two sequential applications of any group 7 fungicides. 12-hr restricted entry interval.
AP/PP (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	7	Also controls white mold. 12-hr restricted entry interval.
DAMPING OFF, ROOT ROTS					
microbial (group BM02)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Suppression of root rots caused by <i>Rhizoctonia solani</i>, <i>Pythium</i> spp. and <i>Fusarium</i> spp. See label for application instructions.
phthalimide (group M4)	captan	Sharda Captan 80 WDG	7.8–14.1 kg/ha (3.2–5.7 kg/acre)	—	Work into the upper 8–10 cm of soil before planting. 48-hr restricted entry interval.

Table 3–198. Turnip Insect Control — Flea Beetles, Leaf-Eating Caterpillars, Cutworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
FLEA BEETLES					
Soil Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/ 100 m of row (2.3–3.6 mL/ 100 ft of row)	21	Also controls leafhoppers. Do not use subsequent foliar group 4 insecticides in the same season. 24-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Verimark	6.75–9 mL/ 100 m of row (2.1–2.7 mL/ 100 ft of row)	21	Early-season damage reduction. Apply as a narrow band in-furrow. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
Foliar Applications					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	7	5-hr restricted entry interval for hand harvesting and irrigation. 12-hr restricted entry interval for scouting, hand weeding and thinning.
pyrethroid (group 3A)	cypermethrin	Mako	123 mL/ha (49 mL/acre)	21	12-hr restricted entry interval.
		Ship 250	200 mL/ha (81 mL/acre)	21	12-hr restricted entry interval.
		UP-Cyde 2.5 EC			
	permethrin	Pounce 384EC	180 mL/ha (73 mL/acre)	—	12-hr restricted entry interval.
spinosyn (group 5)	spinetoram	Delegate	200 g/ha (80 g/acre)	3	Suppression. 12-hr restricted entry interval.
	spinosad	Entrust	364 mL/ha (146 mL/acre)	3	Suppression. Apply at emergence of adults. Re-entry permitted once spray deposit has dried.
		Success	182 mL/ha (73 mL/acre)	3	
diamide (group 28)	cyantraniliprole	Exirel	500–1,000 mL/ha (202–405 mL/acre)	7	Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.

Table 3–198. Turnip Insect Control — Flea Beetles, Leaf-Eating Caterpillars, Cutworms

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days) — = not specified on label

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAF-EATING CATERPILLARS (IMPORTED CABBAGEWORM, CABBAGE LOOPER, DIAMONDBACK MOTH)					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5–5.25 L/ha (1–2.1 L/acre)	7	Imported cabbage worm and diamondback moth. 5-hr restricted entry interval for hand harvesting and irrigation. 12-hr restricted entry interval for scouting, hand weeding and thinning.
organophosphate (group 1B)	malathion	Malathion 85E	535–1,345 mL/ha (216–544 mL/acre)	3	Imported cabbageworm and cabbage loopers. Apply when temperature is at or above 20°C. 1-day restricted entry interval.
spinosyn (group 5)	spinetoram	Delegate WG	140–200 g/ha (56–81 g/acre)	3	Cabbage looper, imported cabbageworm and diamondback moth. 12-hr restricted entry interval.
	spinosad	Entrust	364 mL/ha (147 mL/acre)	3	Cabbage looper, imported cabbageworm and diamondback moth. Re-entry once spray deposit has dried.
		Success	182 mL/ha (73 mL/acre)	3	
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i> , subsp. <i>aizawai</i>	XenTari WG	500–1,000 g/ha (202–405 g/acre)	0	Cabbage looper, imported cabbageworm and diamondback moth. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Cabbage looper, imported cabbageworm and diamondback moth. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	250–500 mL/ha (101–202 mL/acre)	7	Cabbage looper. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
CUTWORMS					
spinosyn (group 5)	spinosad	Scorpio Ant and Insect Bait	25–50 kg/ha (10–20 kg/acre)	3	Black cutworm only. Apply with a granular insecticide spreader or drop spreader. Scatter the bait on the soil around or near the plants to be protected.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Black and variegated cutworm. Use low rate for black cutworm. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	7	Variegated cutworm. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.

Table 3–199. Turnip Insect Control — Aphids, Cabbage Maggot

For information on insecticides and bee poisoning, see Chapter 1 and Chapter 2.

For resistance management, rotate between insecticides from different chemical groups. See *Resistance Management* in Chapter 1.**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS					
Soil Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5–12 mL/ 100 m of row (2.3–3.6 mL/ 100 ft of row)	21	Also controls leafhoppers. Do not use subsequent foliar group 4 insecticides in the same season. 24-hr restricted entry interval.
Foliar Applications					
organophosphate (group 1B)	malathion	Malathion 85E	535–1,345 mL/ha (216–544 mL/acre)	3	Control of aphids with malathion has been inconsistent in many areas. Apply when temperature is at or above 20°C. 1-day restricted entry interval.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Do not apply foliar group 4 insecticides in the same season as a soil application. 24-hr restricted entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Do not apply foliar group 4 insecticides in the same season as a soil application. 24-hr restricted entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–61 mL/acre)	7	12-hr restricted entry interval or re-entry permitted once spray deposit has dried.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	7	12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	7	Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	3	12-hr restricted entry interval.
not classified (group NC)	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water Apply at 700–1,900 L/ha (283–770 L/acre)	0	Do not spray when plants are under stress. See label for crop tolerance information. Avoid spraying during full sun.
CABBAGE MAGGOT					
Soil Applications					
organophosphate (group 1B)	diazinon	Diazinon 500 E	2.2 L/ha (0.9 L/acre)	14	Apply as a banded soil drench application only. See label for restricted entry intervals.
diamide (group 28)	cyantraniliprole	Verimark	10–15 mL/ 100 m of row (3–4.6 mL/ 100 ft of row)	21	Apply as a narrow band in-furrow. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.

4. Pesticides Used on Vegetable Crops in Ontario

In this section:

Table 4–1. Restricted Entry Intervals (REI) for Pesticides Used on Vegetable Crops

This information is provided as a guideline only. Some products are under re-evaluation with the PMRA and may change within the lifetime of this publication. See product labels for complete information.

Table 4–1. Restricted Entry Intervals (REI) for Pesticides Used on Vegetable Crops

If the restricted entry interval is not stated on the label for agricultural crops, assume the REI is 12 hr.

See *Restricted Entry Intervals*, on page 20, for more information.

Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
Acapela	picoxystrobin	12 hr	onions, potatoes, sugarbeets, sweet corn
Aceta 70WP	acetamiprid	12 hr	asparagus, celery, endive, lettuce (head and leaf), parsley, peas, peppers, potatoes, rhubarb, rutabagas, spinach, sweet corn, Swiss chard, tomatoes
		scouting: 2 days all other activities: 4 days	brassica crops (see label)
		hand-detasseling: not permitted hand-harvesting: 10 days all other activities: 12 hr	sweet corn
Acramite 50WS	bifenazate	12 hr	cucurbit crops (see label), eggplant, peppers, tomatoes
Acrobat 50WP	dimethomorph	12 hr	brassica crops (see label), cucurbit crops (see label), eggplants, garlic, herbs (see label), leek, lettuce (head and leaf), onion (bulb, green), peppers, potatoes, shallot, tomatoes
Actara 240SC	thiamethoxam	12 hr	brassica crops (see label), celery, parsley, lettuce (head and leaf), endive, potatoes, spinach
Actara 25WG	thiamethoxam	12 hr	beets (table), carrots, celery, endive, parsley, horseradish, lettuce (head and leaf), parsnips, potatoes, radishes, rutabagas, spinach, sweet potatoes, Swiss chard, turnips
Actinovate SP	<i>Streptomyces lydicus</i>	1 hr	cucurbit crops (see label), peppers, tomatoes
Admire 240	imidacloprid	24 hr	beets (table), brassica crops (see label), carrots, celery, cucurbit crops (see label), endive, herbs (see label), parsley, horseradish, lettuce (head and leaf), parsnips, peas, potatoes, radishes, rutabagas, spinach, sweet potatoes, Swiss chard, turnips
Agri-mek SC	abamectin	12 hr	celery, garlic, onions (dry bulb), potatoes, shallots
		hand weeding: 13 days hand-set irrigation: 4 days thinning, scouting: 1 day all other activities: 12 hr	leeks, onions (green)
Alias 240 SC	imidacloprid	24 hr	brassica crops (see label), cucurbit crops (see label), eggplant, lettuce (head and leaf), potatoes, sweet potatoes, tomatoes

Table 4–1. Restricted Entry Intervals (REI) for Pesticides Used on Vegetable Crops

If the restricted entry interval is not stated on the label for agricultural crops, assume the REI is 12 hr.

See *Restricted Entry Intervals*, on page 20, for more information.

Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
Aliette WDG	fosetyl-AL	12 hr	brassica crops (see label), lettuce, onions, rutabagas, spinach
Allegro 500F	fluazinam	24 hr	beans, brassica crops (see label), cantaloupe, carrots, peppers, potatoes,
		hand weeding: 3 days all other activities: 24 hr	onion (bulb)
Aprovia	benzovindiflupyr	12 hr	cucurbit crops (see label), eggplant, garlic, leeks, onions (dry bulb and green), peppers, potatoes, shallots, tomatoes
Aprovia Top	benzovindiflupyr/ difenoconazole	12 hr	cucurbit crops (see label), eggplant, pepper, potatoes, sweet potato, tomatoes
Assail 70 WP	acetamiprid	12 hr	asparagus, celery, endive, lettuce (head and leaf), parsley, peas, peppers, potatoes, rhubarb, rutabagas, spinach, sweet corn, Swiss chard, tomatoes
		scouting: 2 days all other activities: 4 days	brassica crops (see label)
		hand-detasseling: not permitted hand-harvesting: 10 days all other activities: 12 hr	sweet corn
Azoshy 250 SC	azoxystrobin	12 hr	asparagus, beans, beets (table), cabbage, carrots, celery, horseradish, parsley, peas, potatoes, radishes, rutabagas, spinach, sugarbeets, sweet corn, tomatoes, turnips
Beleaf 50SG	flonicamid	12 hr	beets (table), brassica crops (see label), carrots, celery, cucurbit crops (see label), eggplant, endive, horseradish, lettuce (head and leaf), endive, mint (see label), parsley, parsnips, peppers, potatoes, radishes, rhubarb, rutabagas, spinach, sweet potatoes, Swiss chard, tomatoes, turnips
BioCeres EC/G WP	<i>Beauveria bassiana</i> strain ANT-03	4 hr or until spray has dried	greenhouse transplants: Asian water spinach, brassica crops (see label), cucumbers, eggplants, herbs (see label), peppers, tomatoes, sweet potato slips
Bioprotec CAF/PLUS	<i>Bacillus thuringiensis</i> var <i>kurstaki</i> strain EVB-113-19	4 hr or until spray has dried	beans, brassica crops (see label), celery, garlic, herbs (see label), leeks, lettuce, onions (bulb and green), peppers, potatoes, shallots, spinach, sweet corn, tomatoes
Botanigard ES	<i>Beauveria bassiana</i> strain GHA	4 hr	herbs (greenhouse transplants)
Botector	<i>Aureobasidium pullulans</i> DSM 14940 and DSM 14941	4 hr	eggplant, endive, herbs (see label), lettuce (head and leaf), parsley, pepper, tomato

Table 4–1. Restricted Entry Intervals (REI) for Pesticides Used on Vegetable Crops

If the restricted entry interval is not stated on the label for agricultural crops, assume the REI is 12 hr.
See *Restricted Entry Intervals*, on page 20, for more information.

Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
Bravo ZN/ZNC	chlorothalonil	12 hr	celery, cucurbit crops (see label)
		scouting: 4 days all other activities: 12 hr	asparagus
		scouting: 5 days topping (Brussels sprouts): 5 days all other activities: 12 hr	broccoli, Brussels sprouts, cauliflower
		scouting, thinning: 2 days hand weeding: 1 day all other activities: 12 hr	cabbage
		scouting: 7 days hand harvesting: 22 days all other activities: 12 hr	carrot
		scouting: 1 day hand weeding: 6 days all other activities: 12 hr	onion (dry bulb and green)
		scouting: 5 days hand harvesting: 21 days all other activities: 12 hr	parsnip
		scouting: 3 days handset irrigation: 23 days roguing (seed): 19 days all other activities: 12 hr	potato
		scouting: 1 day hand harvesting: 18 days mechanical harvesting: 14 days all other activities: 12 hr	sweet corn
		scouting: 7 days all other activities: 12 hr	tomatoes (processing)
Bumper 432 EC	propiconazole	12 hr	asparagus, rutabaga
		hand-harvesting, detasseling: 1 day all other activities: 12 hr	sweet corn
Cabrio EG	pyraclostrobin	hand-harvesting: 3 days all other activities: 12 hr	beets (table), carrots, horseradish, radishes, rutabagas, turnips
		hand-harvesting, thinning, pruning: 3 days all other activities: 12 hr	cucurbit crops (see label)
		12 hr	eggplant, peppers, tomatoes
		thinning: 3 days all other activities: 12 hr	garlic, leeks, onions, shallots
Cabrio Plus	pyraclostrobin/ metiram	12 hr	potatoes
Cantus WDG	boscalid	12 hr	beans (succulent), carrots, cucurbit crops (see label), eggplant, garlic, lettuce (head and leaf), onions (dry and green), leeks, shallots, peas (succulent), peppers, potatoes, tomatoes
Caramba	metconazole	12 hr	sugarbeets
		hand harvesting: 18 days handset irrigation: 3 days all other activities: 12 hr	sweet corn
Citation 75WP	cyromazine	12 hr	brassica crops (see label), celery, endive, lettuce (head and leaf), parsley, spinach, Swiss chard

Table 4–1. Restricted Entry Intervals (REI) for Pesticides Used on Vegetable Crops

If the restricted entry interval is not stated on the label for agricultural crops, assume the REI is 12 hr.

See *Restricted Entry Intervals*, on page 20, for more information.

Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
Closer	sulfoxaflor	12 hr	beets (table), brassica crops (see label), carrots, celery, endive, horseradish, lettuce (head and leaf), parsley, parsnips, potatoes, radishes, rhubarb, rutabagas, spinach, sugarbeets, sweet corn, sweet potatoes, Swiss chard, turnips
Clutch 50 WDG	clothianidin	12 hr	cucurbit crops (see label), potatoes, sweet potatoes
Concept	imidacloprid/deltamethrin	12 hr	brassica crops (see label), potato, tomatoes
Confine Extra	mono- and di-potassium salts of phosphorus	Re-entry permitted once spray deposit has dried.	brassica crops (see label), cucurbit crops (see label), eggplant, endive, herbs (see label), lettuce (head and leaf), peppers, potatoes, tomatoes
Copper 53W	copper sulphate	48 hr	beans, beets (table), broccoli, Brussels sprouts, cabbage, cauliflower, carrots, celery, cucurbit crops (see label), eggplant, potatoes, peppers, spinach, tomatoes
Copper Spray	copper oxychloride	48 hr	celery, cucurbit crops (see label), onions, potatoes, tomatoes
Coppercide WP	copper hydroxide	24 hr	peppers (transplants), tomatoes (transplants)
		none specified	beans, cucumbers, peppers (field), potatoes, sugarbeets, tomatoes (field)
Coragen	chlorantraniliprole	12 hr	beans, beets (table), brassica crops (see label), carrots, celery, chives, cucurbit crops (see label), eggplant, endive, horseradish, leeks, lettuce (head and leaf), mint, parsley, parsnips, peas, peppers, potatoes, onions (green), radishes, rhubarb, rutabagas, spinach, sugarbeets, sweet corn, sweet potatoes, Swiss chard, tomatoes, turnips
Cormoran	acetamiprid/novaluron	hand weeding, scouting, tying, training: 2 days all other activities: 12 hr	brassica crops (see label)
		12 hr	kale, pepper, potato, sweet corn
Cosavet	sulphur	24 hr	peas
Cueva	copper octanoate	4 hr	beans, beets (table), brassica crops (see label), celery, chives, cucurbit crops (see label), garlic, leeks, onions, parsley, peas, peppers, potatoes, shallots, sugarbeets, tomatoes
Curzate 60 DF	cymoxanil	24 hr	potatoes
Cyclone	citric acid/lactic acid	4 hr or until spray has dried	cucurbit crops (see label), tomatoes
Cygon 480	dimethoate	12 hr	asparagus, beans, brassica crops (see label), eggplant, peas, peppers, potatoes, tomatoes
		3 days	beet greens, kale, lettuce (leaf), Swiss chard, turnip greens
		4 days	bok choy, Chinese broccoli
		5 days	broccoli, Brussels sprouts, cauliflower

Table 4–1. Restricted Entry Intervals (REI) for Pesticides Used on Vegetable Crops

If the restricted entry interval is not stated on the label for agricultural crops, assume the REI is 12 hr.
See *Restricted Entry Intervals*, on page 20, for more information.

Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
Danitol	fenpropathrin	Hand set irrigation: 15 days Harvesting, training: 7 days All other activities: 24 hr	cucumbers
		Hand set irrigation: 20 days Hand harvesting, mechanically assisted harvesting, training: 9 days Mechanical harvesting: 7 days All other activities: 24 hr	cucurbit crops (see label)
		Hand set irrigation: 11 days Hand harvesting, mechanically assisted harvesting, tying/training: 7 days Mechanical harvesting: 3 days All other activities: 24 hr	eggplant, peppers
		Hand set irrigation: 17 days Hand harvesting, mechanically assisted harvesting, tying/training: 6 days Mechanical harvesting: 3 days All other activities: 24 hr	tomatoes
Decis 5EC	deltamethrin	12 hr	asparagus, brassica crops (see label), onions, peppers, potatoes, sweet corn, tomato
Decis 100 EC	deltamethrin	12 hr	asparagus, beans, brassica crops (see label), onions, peas, peppers, potatoes, sugarbeets, sweet corn, tomato
Decree 50 WDG	fenhexamid	4 hr	tomatoes (transplants)
Delegate	spinetoram	12 hr	asparagus, beans (snap), beet greens, brassica crops (see label), carrot, celery, endive, eggplant, garlic, herbs (see label), horseradish, leeks, lettuce (head and leaf), onions (dry bulb and green), parsley, peppers, potatoes, radishes, rhubarb, rutabagas, shallots, spinach, sweet corn, Swiss chard, tomatoes, turnips
Diazinon 500 E	diazinon	12 hr	onions (bulb and green)
		foliar contact scouting: 25 days thinning, hand weeding: 15 days handset irrigation: 45 days non-foliar contact scouting, all other activities: 12 hr	rutabagas, turnips
Dibrom	naled	48 hr	beans, broccoli, Brussels sprouts, cabbage, cauliflower, lettuce, onions (bulb), peas, potatoes, sugarbeets, tomatoes
Diplomat 5SC	polyoxin D zinc salt	Re-entry permitted once spray deposit has dried.	cucurbit crops (see label), eggplants, lettuce (head and leaf), peppers, potato, spinach, tomatoes
Double Nickel 55	<i>Bacillus amyloliquefaciens</i>	Re-entry permitted once spray deposit has dried.	cucurbit crops (see label), eggplant, lettuce (head and leaf), peppers, potatoes, tomatoes

Table 4–1. Restricted Entry Intervals (REI) for Pesticides Used on Vegetable Crops

If the restricted entry interval is not stated on the label for agricultural crops, assume the REI is 12 hr.

See *Restricted Entry Intervals*, on page 20, for more information.

Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
Echo 720	chlorothalonil	0.5 day	celery, cucurbit crops (see label)
Echo 90DF		scouting: 5 days topping (Brussels sprouts): 5 days all other activities: 0.5 day	broccoli, Brussels sprouts, cauliflower
		scouting, thinning: 2 days hand weeding: 1 day all other activities: 0.5 day	cabbage
		scouting: 7 days hand harvesting: 22 days all other activities: 0.5 day	carrot
		scouting: 1 days hand weeding: 6 days all other activities: 0.5 day	onion (dry bulb and green)
		scouting: 5 days hand harvesting: 21 days all other activities: 0.5 day	parsnip
		scouting: 3 days handset irrigation: 23 days roguing (seed): 19 days all other activities: 0.5 day	potato
		scouting: 1 day hand harvesting: 18 days mechanical harvesting: 14 days all other activities: 0.5 day	sweet corn
		30 days	tomatoes (processing)
		1 day	tomatoes (not for processing)
Elatus A	azoxystrobin	12 hr	beans, peas, potatoes
Elatus B	benzovindiflupyr	12 hr	beans, peas, potatoes
Entrust	spinosad	Re-entry permitted once spray deposit has dried.	asparagus, beans, celery, chives, endive, garlic, herbs (see label), horseradish, leeks, lettuce (head and leaf), onions (dry bulb and green), parsley, radishes, rhubarb, rutabagas, shallots, spinach, Swiss chard, turnips
		Re-entry permitted once spray deposit has dried.	brassica crops (see label), brassica crops (transplants, see label)
		12 hr	eggplant, peppers, potatoes, tomatoes
		hand-harvesting, detasseling: 7 days Re-entry permitted for all other activities once spray deposit has dried.	sweet corn
Excalia	inpyrfluxam	12 hr	sugarbeets
Exirel	cyantraniliprole	12 hr	beans, beets (table), brassica crops (see label), carrots, celery, chives, cucurbit crops (see label), eggplant, endive, garlic, horseradish, leeks, lettuce (head and leaf), onions (dry bulb and green), parsley, parsnips, peas, peppers, potatoes, radishes, rhubarb, rutabagas, shallots, spinach, sweet potatoes, Swiss chard, tomatoes, turnips
Falgro Tablet	gibberellic acid	12 hr	potato seed
Fitness	propiconazole	12 hr	asparagus, rutabaga
		hand-harvesting, detasseling: 1 day all other activities: 12 hr	sweet corn

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Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
Flint	trifloxystrobin	12 hr	asparagus, beets (table), carrots, celery, horseradish, parsnips, radishes, rutabagas, sugarbeets, turnips
Folicur 432F	tebuconazole	12 hr	asparagus
Folpan 80 WDG	folpet	24 hr	cucurbit crops (see label), tomatoes
Fontelis	penthiopyrad	12 hr	beans, beets (table), brassica crops (see label), carrots, celery, chives, cucurbit crops (see label), eggplant, endive, garlic, horseradish, lettuce (head and leaf), onions (dry bulb and green), leeks, shallots, parsley, parsnips, peas, peppers, radishes, rhubarb, rutabagas, spinach, Swiss chard, tomatoes, turnips
Forum	dimethomorph	hand-harvesting and irrigation: 7 days scouting: 5 days all other activities: 12 hr	brassica crops (see label)
		hand harvesting, pruning, thinning: 2 days all other activities: 12 hr	cucurbit crops (see label)
		thinning: 2 days all other activities: 12 hr	garlic, leeks, onions (dry bulb), shallots
		hand-harvesting: 2 days all other activities: 12 hr	lettuce (head and leaf), onions (green)
		12 hr	eggplant, peppers, potatoes, tomatoes
Function SC	azoxystrobin/ propiconazole	12 hr	beans, mint, peas, sweet corn
Gavel DF	zoxamide/ mancozeb	48 hr	onions (bulb), potatoes
Granuflo-T	thiram	24 hr	celery, sweet potatoes
Harvanta	cyclaniliprole	12 hr	brassica crops (see label), cucurbit crops (see label), eggplant, endive, lettuce (head and leaf), parsley, pepper, potatoes, spinach, sweet potatoes, Swiss chard, tomatoes
Headline EC	pyraclostrobin	12 hr	beans, peas, potatoes, sugarbeets, sweet corn
Imidan 70-WP	phosmet	5 days See label for further details on restricted entry interval.	carrots, celery, potatoes
Intrepid	methoxyfenozide	12 hr	beans, brassica crops (see label), celery, cucurbit crops (see label), eggplant, endive, herbs (see label), lettuce (head and leaf), parsley, peas, peppers, rhubarb, spinach, sweet corn, sweet potato, Swiss chard, tomatoes
Kanemite 15 SC	acequinocyl	12 hr	eggplant, summer squash
Kasumin 2L	kasugamycin	12 hr	eggplant, peppers, tomatoes
Kenja 400SC	isofetamid	12 hr	beans, lettuce (head and leaf), peas
Kocide 2000	copper hydroxide	field applications: 48 hr greenhouse transplants: 24 hr	beans, cucumbers, peppers (field and transplants), potatoes, sugarbeets, tomatoes (field and transplants)

Table 4–1. Restricted Entry Intervals (REI) for Pesticides Used on Vegetable Crops

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See *Restricted Entry Intervals*, on page 20, for more information.

Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
Labamba	lambda-cyhalothrin	24 hr	asparagus, beans, carrots, celery, cucurbit crops (see label), garlic, leeks, lettuce (head and leaf), onions (dry bulb), peas, potatoes, shallots, sweet corn, sweet potatoes, tomatoes
		for scouting: 4 days hand-pruning, topping, irrigation, thinning, tying: 6 days all other activities: 24 hr	brassica crops (see label)
		hand-harvesting, thinning: 10 days all other activities: 24 hr	onions (green)
Lagon 480 E	dimethoate	12 hr	asparagus, beans, eggplant, peas, peppers, potatoes, tomatoes
		3 days	beets (table and greens), celery, kale, lettuce (leaf), Swiss chard, turnip greens
		4 days	bok choy, Chinese broccoli
		5 days	broccoli, cauliflower
		2 days	Brussels sprouts
Lance WDG	boscalid	12 hr	beans, peas, potatoes
Lannate Toss-N-Go (TNG)	methomyl	12 hr	broccoli, Brussels sprouts, cabbage, cauliflower, lettuce, peas, sweet corn
Lorsban 15G	chlorpyrifos	24 hr	broccoli, Brussels sprouts, cabbage, onions (dry bulb and pickling), shallots, sweet corn, rutabagas
		10 days	cauliflower
Lorsban 4E	chlorpyrifos	24 hr	brassica crops (see label), carrots, celery, cucumbers, garlic, onions (bulb, green and pickling), peppers (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn
		10 days	cauliflower
Lorsban 50W	chlorpyrifos	24 hr	broccoli, Brussels sprouts, cauliflower, cabbage, celery, carrots, cucumbers, peppers (green), potatoes, onions, rutabaga, sweet corn
Lorsban NT	chlorpyrifos	24 hr	broccoli, Brussels sprouts, cabbage, carrots, celery, Chinese broccoli, Chinese cabbage, cucumbers, garlic, onions (bulb, green and pickling), pak choy, peppers (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn
		10 days	cauliflower
Luna Sensation	fluopyram/ trifloxystrobin	12 hr	beets (table), brassica crops (see label), carrot, celery, cucurbit crops (see label), endive, horseradish, lettuce (head and leaf), parsley, parsnip, radish, rhubarb, rutabaga, spinach, Swiss chard, turnip
Luna Tranquility	fluopyram/ pyrimethanil	hand thinning: 24 hr all other activities: 12 hr	chives, garlic, leeks, onions, shallots
		12 hr	potatoes, tomatoes
Maestro 80DF	captan	48 hr For greenhouses, ventilate before re-entry.	celery (transplants), brassica crops (transplants), cucumbers, eggplant (transplants), peppers (transplants), potatoes, tomatoes (field and transplants)
Mako	cypermethrin	12 hr	asparagus, broccoli, Brussels sprouts, cabbage, carrot, cauliflower, celery, lettuce, onions, potatoes, rutabaga, sweet corn, tomatoes, turnip

Table 4–1. Restricted Entry Intervals (REI) for Pesticides Used on Vegetable Crops

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Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
Malathion 85E	malathion	12 hr	asparagus, eggplant, garlic, leeks, onions (bulb and green), peppers, potatoes, radishes, rutabagas, shallots, sugarbeets, tomatoes
		24 hr	beans, beets (table), carrots, celery, collards, cucurbit crops (see label), endive, horseradish, kale, kohlrabi, lettuce (head and leaf), parsley, parsnips, peas, spinach, Swiss chard, turnips
		48 hr	broccoli, Brussels sprouts, cabbage, cauliflower
Manzate Pro-Stick	mancozeb	24 hr	cantaloupe, carrots, celery, cucumbers, melons, onions (dry bulb), potatoes, pumpkins, squash, sugarbeets, tomatoes
Matador 120EC	lambda-cyhalothrin	24 hr	asparagus, beans, carrots, celery, cucurbit crops (see label), garlic, leeks, lettuce (head and leaf), onions (dry bulb), peas, potatoes, shallots, sweet corn, sweet potatoes, tomatoes
		for scouting: 4 days hand-pruning, topping, irrigation, thinning, tying: 6 days all other activities: 24 hr	brassica crops (see label)
		hand-harvesting, thinning: 10 days all other activities: 24 hr	onions (green)
Met52	<i>Metarhizium anisopliae</i> strain F52	Re-entry permitted once spray deposit has dried.	eggplant, pepper, tomato, zucchini
Mettle 125ME	tetraconazole	hand set irrigation: 8 days all other activities: 12 hr	cucurbit crops (see label)
		hand set irrigation: 7 days hand harvesting, tying/training: 2 days all other activities: 12 hr	eggplant, peppers, tomatoes
Mettle 210 ME	tetraconazole	irrigation: 3 days all other activities: 12 hr	sugarbeets
Microscopic Sulphur	sulphur	24 hr	rutabagas
Microthiol Disperss	sulphur	24 hr	peas, sugarbeets
MilStop	potassium bicarbonate	4 hr	cucurbit crops (see label), herbs, mint, peppers
Minecto Duo	thiamethoxam/cyantraniliprole	12 hr	brassica crops (see label), celery, endive, lettuce (head and leaf), parsley, potatoes, rhubarb, spinach, Swiss chard
Minecto Pro	abamectin/cyantraniliprole	12 hr	celery, cucurbit crops (see label), eggplant, endive, lettuce (head and leaf), parsley, pepper, potato, spinach, sweet potato, Swiss chard, rhubarb, tomato
Miravis Duo	pydiflumetofen/difenoconazole	12 hr	beets (table), carrots, cucurbit crops (see label), eggplant, garlic, horseradish, leeks, onions (bulb and green), parsnips, peppers, potatoes, radishes, rutabagas, shallots, sugarbeets, sweet potatoes, tomatoes, turnips
		scouting/topping/tying/training: 3 days weeding: 4 days hand harvesting: 5 days	brassica crops (head and stem)
		weeding: 4 hr	brassica crops (leafy)
Miravis Prime	pydiflumetofen/fludioxonil	12 hr	celery, cilantro, endive, lettuce (head and leaf), parsley

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Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
Movento 240 SC	spirotetramat	12 hr	beans, brassica crops (see label), carrot, celery, chives, cucurbit crops (see label), eggplant, endive, garlic, leeks, lettuce (head and leaf), onions (dry bulb and green), parsley, peas, peppers, potatoes, rhubarb, shallots, spinach, sugarbeets, sweet corn, sweet potatoes, Swiss chard, tomatoes
Nealta	cyflumetofen	12 hr	tomatoes
Nimitz	fluensulfone	12 hr	cucurbit crops (see label), eggplant, peppers, tomatoes
Nova	myclobutanil	2 days	asparagus
		12 hr	cucurbit crops (see label)
Nufos 4E	chlorpyrifos	24 hr	broccoli, Brussels sprouts, cabbage, Chinese broccoli, Chinese cabbage, carrots, celery, cucumbers, garlic, onions (bulb), pak choi, peppers (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn
		10 days	cauliflower
Oberon Flowable	spiromesifen	12 hr	beans, celery, cucurbit crops (see label), eggplant, endive, mint, lettuce (head and leaf), parsley, peppers, rhubarb, spinach, sweet corn, sweet potatoes, Swiss chard, potatoes, tomatoes
		hand harvesting, hand pruning: 2 days all other activities: 12 hr	brassica crops (see label)
Orondis Ultra	mandipropamid/ oxathiapiprolin	12 hr	basil, brassica crops (see label), cilantro, chives, cucurbit crops (see label), dill, eggplant, endive, garlic, leeks, lettuce (head and leaf), onion (bulb and green), parsley, peppers, potatoes, shallots, spinach, tomatoes, Swiss chard
Orondis Ultra A + Orondis Ultra B	mandipropamid + oxathiapiprolin	12 hr	brassica crops (see label), cucurbit crops (see label), eggplant, garlic, lettuce (head and leaf), onion (bulb), peppers, potatoes, shallots, spinach, tomatoes
Orthene 97% SG	acephate	12 hr	Brussels sprouts, cabbage, cauliflower, tomatoes
		1 day	celery*, lettuce (head)*, peppers (sweet bell), potatoes* * Workers must wear required personal protective equipment in the field for a certain period of time following applications, even after the REI. See label for information.
		5 days	sweet corn* * Workers must wear required personal protective equipment in the field for a certain period of time following applications, even after the REI. See label for information.
Oxidate 2.0	hydrogen peroxide 27%/ peroxyacetic acid 2.5%	4 hr or until spray deposit has dried.	beans, broccoli, cauliflower, celery, cucurbit crops (see label), lettuce, potatoes, sugarbeets, tomatoes
Parasol Flowable	copper hydroxide	48 hr	beans, cucumbers, peppers, potatoes, tomatoes
Parasol WG	copper hydroxide	48 hr	beans, cucumbers, peppers, potatoes, sugarbeets, tomatoes

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Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
Penncozeb 75DF Raincoat	mancozeb	24 hr	carrots, celery, cucurbit crops (see label), onions (dry bulb), potatoes, tomatoes
Perm-UP	permethrin	12 hr	asparagus, beans (snap), beets (table), brassica crops (see label), carrots, horseradish, lettuce, onions, peas, peppers, potatoes, radishes, sugarbeets, tomatoes, turnips
		hand detasselling, hand harvest: 8 days all other activities: 12 hr	sweet corn
Phostrol	mono- and dibasic sodium, potassium and ammonium phosphites	12 hr	brassica crops (see label), celery (transplants), chives, cucurbit crops (see label), endive, garlic, leeks, lettuce (head and leaf), onions (bulb and green), peas, potatoes, shallots, tomatoes
Poleci	deltamethrin	12 hr	asparagus, brassica crops (see label), onions, peppers, potatoes, sweet corn, tomatoes
Polyram DF	metiram	hand set irrigation: 30 days roguing: 5 days all other activities: 12 hr	potatoes
Pounce 384EC	permethrin	Re-entry permitted once spray deposit has dried.	asparagus, beans (snap), beets (table), brassica crops (see label), carrots, horseradish, lettuce, onions, peas, peppers, potatoes, radishes, sugarbeets, sweet corn, tomatoes, turnips
Presidio	fluopicolide	12 hr	basil, beans, brassica crops (see label), cucurbit crops (see label), endive, horseradish, lettuce (head and leaf), peppers, potatoes, radish, rhubarb, rutabagas, spinach, Swiss chard, tomatoes, turnip
Prestop WG	<i>Gliocladium catenulatum</i>	foliar applications: 4 hr	broccoli (transplants), cauliflower (transplants), cucumber (transplants), herbs (transplants: basil, dill, oregano, parsley, thyme), lettuce (transplants), pepper (transplants), tomato (transplants)
Priaxor	fluxapyroxad/pyraclostrobin	12 hr	beans, peas, sugarbeets, sweet corn
Princeton	propiconazole	12 hr	asparagus, rutabaga
		hand-harvesting, detasseling: 1 day all other activities: 12 hr	sweet corn
Pristine WG	boscalid/pyraclostrobin	4 days	brassica crops (see label)
		hand-harvesting: 3 days Re-entry permitted for all other activities once spray deposit has dried.	carrots
		hand-thinning, hand-harvesting: 9 days all other activities: 24 hr	celery, spinach
		hand-harvesting, thinning, pruning and turning: 3 days all other activities: 12 hr	cucurbit crops (see label)
		thinning: 3 days Re-entry permitted for all other activities once spray deposit has dried.	chives, garlic, leeks, onions (dry bulb and green), shallots
Proline 480 SC	prothioconazole	hand line irrigation: 3 days all other activities: 24 hr	cucurbit crops (see label)
		24 hr	sugarbeets
		hand-harvesting: 20 days all other activities: 24 hr	sweet corn
Property	pyriofenone	12 hr	cucurbit crops (see label), tomatoes

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Propi Super	propiconazole	12 hr	asparagus, rutabaga
		hand-harvesting, detasseling: 1 day all other activities: 12 hr	sweet corn
Purespray Green Spray Oil 13E	mineral oil	12 hr	cucurbit crops, eggplant, peppers, rutabagas, tomatoes
Pyrifos 15G	chlorpyrifos	24 hr	broccoli, Brussels sprouts, cabbage, onions (dry bulb and pickling), potato, sweet corn, rutabagas
		10 days	cauliflower
Pyrinex 480 EC	chlorpyrifos	24 hr	brassica crops (see label), carrots, celery, cucumbers, garlic, onions (dry bulb and pickling), peppers (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn
		10 days	cauliflower
Quadris Flowable	azoxystrobin	12 hr	asparagus, beans, beets (table), cabbage, carrots, celery, horseradish, parsley, peas, potatoes, radishes, rutabagas, spinach, sugarbeets, sweet corn, tomatoes, turnips
Quadris Top	azoxystrobin/ difenoconazole	12 hr	carrots, chives, cucurbit crops (see label), eggplant, garlic, leeks, onions (dry bulb and green), peppers, potatoes, shallots, sugarbeets, sweet potatoes, tomatoes
		hand-harvesting: 3 days scouting: 1 day all other activities: 12 hr	brassica crops (see label)
Quash	metconazole	hand set irrigation: 7 days roguing: 2 days scouting: 12 hr	potatoes
Quilt	azoxystrobin/ propiconazole	12 hr	beans, mint, peas
		hand harvesting, detasseling: 1 day all other activities: 12 hr	sweet corn
Quintec	quinoxifen	12 hr	lettuce (head and leaf), melons, pumpkins, winter squash
Rampart	mono- and di- potassium salts of phosphorous acid	4 hr	potatoes
Ranman 400SC	cyazofamid	12 hr	potatoes
Reason 500SC	fenamidone	Re-entry permitted once spray deposit has dried.	cucurbit crops (see label), onions (dry bulb and green), garlic, leeks, shallots, potatoes
		12 hr	basil, beans, tomatoes
		2 days	brassica crops (see label)
		not specified	carrots
Regalia Maxx	extract of <i>Reynoutria sachalinensis</i>	Re-entry permitted once spray deposit has dried.	eggplant, cucurbit crops (see label), peppers, tomatoes
Revus	mandipropamid	12 hr	basil, beans, brassica crops (see label), cucurbit crops (see label), eggplant (transplants), garlic, lettuce (head and leaf), onions (dry bulb), pepper (transplants), potatoes, shallots, spinach, tomatoes
Ridomil Gold 1G	metalaxyl-M and S-isomer	12 hr	carrots, lettuce (head)
Ridomil Gold 480SL	metalaxyl-M and S-isomer	12 hr	beans (snap), cucumbers, radishes, spinach, potatoes

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Ridomil Gold MZ 68WG	metalaxyl-M and S-isomer/mancozeb	24 hr	lettuce (head), onions, potatoes
Rimon 10 EC	novaluron	12 hr	beans (snap), brassica crops (see label), carrots, celery, peppers, potatoes, spinach
		hand detasseling, hand harvesting: 9 days all other activities: 12 hr	sweet corn
Rootshield Granules	<i>Trichoderma harzianum</i>	greenhouse applications: 4 hr	cucumbers, peppers, tomatoes
Rootshield PLUS	<i>Trichoderma harzianum</i>	greenhouse applications: 4 hr	brassica crops (see label), celery, cucurbit crops (see label), endive, eggplant, garlic, herbs (see label), leeks, lettuce (head and leaf), onions (bulb and green), parsley, peppers, shallots, Swiss chard, tomatoes
Scala SC	pyrimethanil	hand-thinning: 24 hr all other activities: 12 hr	chives, garlic, leeks, onions (bulb and green), shallots
		12 hr	potatoes, tomatoes
Sercadis	fluxapyroxad	12 hr	beets (table), brassica crops (see label), carrots, celery, chives, cucurbit crops (see label), eggplant, endive, garlic, horseradish, leeks, lettuce (head and leaf), onions (bulb and green), parsley, parsnips, peppers, potatoes, radishes, rutabaga, shallots, sweet potatoes, tomatoes, turnip
Sevin XLR	carbaryl	low contact activities: 0.5 day high contact activities: 6 days	asparagus, tomatoes
		low contact activities: 0.5 day high contact activities: 6 days hand-harvesting: not permitted	beans (snap)
		low contact activities: 0.5 day high contact activities: 5 days	beets (table), celery, Chinese cabbage, horseradish, kohlrabi, lettuce (head), mustard greens, parsley, parsnips, peas, radishes, rutabaga, spinach, Swiss chard, turnip
		low contact activities: 0.5 day	carrots
		low contact activities: 0.5 day high contact activities: 2 days	cucurbit crops (see label)
		low contact activities: 3 day high contact activities: 7 days	eggplant
Sharda Captan 80 WDG	captan	48 hr	cucumbers, broccoli, Brussels sprouts, cabbage, cauliflower, kale, eggplant, peas, peppers, rhubarb, rutabaga, tomatoes, turnips
Sharda Captan 80 WSP	captan	hand set irrigation: 10 days hand harvesting, mechanically assisted harvesting, training/tying: 3 days all other activities: 12 hr	cucumbers
		hand set irrigation: 10 days hand harvesting, mechanically assisted harvesting, training/tying: 3 days all other activities: 12 hr	tomatoes
Sharphos	chlorpyrifos	24 hr	brassica crops (see label), carrots, celery, cucumbers, garlic, onions (dry bulb), peppers (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn
		10 days	cauliflower

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Ship 250SC	cypermethrin	12 hr	asparagus, broccoli, Brussels sprouts, cabbage, cauliflower, carrots, celery, lettuce, onions, potatoes, rutabagas, tomatoes, turnips
		hand harvesting: 5 days all other activities: 12 hr	sweet corn
Silencer 120 EC	lambda-cyhalothrin	24 hr	asparagus, beans, carrots, garlic, lettuce (head and leaf), onions (dry bulb), leeks, shallots, peas, potatoes, sweet corn, sweet potatoes, tomatoes
		hand-pruning, topping, irrigation, thinning, tying: 6 days scouting: 4 days all other activities: 24 hr	brassica crops (see label)
		hand-harvesting, thinning: 10 days all other activities: 24 hr	onions (green)
Sirocco	potassium bicarbonate	4 hr	herbs (see label), peppers
Sivanto Prime	flupyradifurone	12 hr	beans, beets (table), brassica crops (see label), carrots, celery, cucurbit crops (see label), eggplant, endive, horseradish, lettuce (head and leaf), parsley, parsnips, peas, peppers, potatoes, radishes, rhubarb, rutabagas, spinach, sweet corn, sweet potatoes, Swiss chard, tomatoes, turnips
Stargus	<i>Bacillus amyloliquefaciens</i> strain F727	4 hr or until spray has dried	beans, cucurbit crops (see label), peas, potatoes
Storox	hydrogen peroxide 27%	Re-entry permitted once spray deposit has dried.	potatoes, sweet potatoes
Stratego Pro	trifloxystrobin/prothioconazole	detasseling: 12 days all other activities: 24 hr	sweet corn
Success	spinosad	Re-entry permitted once spray deposit has dried.	asparagus, beans (snap), celery, chives, endive, garlic, herbs (see label), horseradish, leeks, lettuce (head and leaf), onions, parsley, radishes, rhubarb, rutabagas, shallots, spinach, Swiss chard, turnips
		hand-harvesting, irrigation, pruning, topping, thinning, tying: 3 days after greenhouse drench applications: 24 hr Re-entry permitted for all other activities once spray deposit has dried.	brassica crops (see label), brassica crops (transplants)
		12 hr	eggplant, peppers, potatoes, tomatoes
		hand-harvesting, detasseling: 7 days Re-entry permitted for all other activities once spray deposit has dried.	sweet corn
Suffoil-X	mineral oil	12 hr	brassica crops (see label), cucurbit crops (see label), eggplant, onions, peppers, potatoes, tomatoes
Superior 70 Oil	mineral oil	12 hr	potatoes, rutabagas
Supra Captan 80 WDG	captan	48 hr	cucumbers, celery (transplants), eggplant (transplants), pepper (transplants), tomatoes (transplants and field)

Table 4–1. Restricted Entry Intervals (REI) for Pesticides Used on Vegetable Crops

If the restricted entry interval is not stated on the label for agricultural crops, assume the REI is 12 hr.

See *Restricted Entry Intervals*, on page 20, for more information.

Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
Switch 62.5 WG	cyprodinil/ fludioxonil	12 hr	beans, beets (table), brassica crops (see label), carrots, celery, chives, leeks, garlic, horseradish, onions (dry bulb and green), parsnips, peppers, radishes, rutabagas, shallots, tomatoes, turnips
		harvesting: 3 days all other activities: 12 hr	spinach
Tanos 50 DF	famoxadone/ cymoxanil	24 hr	potatoes
		12 hr	tomatoes
Thimet 20-G	phorate	48 hr	potatoes
Tilt 250E	propiconazole	hand-harvesting, detasseling: 1 day all other activities: 12 hr	sweet corn
		12 hr	asparagus, rutabagas, sugarbeets
Timorex Gold	tea tree oil	4 hr	peppers, potatoes, tomatoes
Titan	clothianidin	12 hr	potatoes
Tivano	citric and lactic acid	4 hr or once spray deposit has dried	cucumbers, pumpkins, squash, tomatoes
Torrent 400SC	cyazofamid	12 hr	basil, beans, brassica crops (see label), brassica crops (transplants), carrots, chives, cucumber (transplants), cucurbit crops (see label), garlic, leeks, lettuce (transplants and field; head and leaf), onions (bulb and green), pepper (transplants), shallots, spinach, tomatoes (transplants and field)
Triatum P	<i>Trichoderma harzianum</i> Rifai strain T22	4 hr	brassica crops (see label), carrots, cilantro, chives, cucurbit crops (see label), dill, eggplant, endive, herbs (see label), leeks, lettuce (head and leaf), onions (bulb and green), parsley, peppers, shallots, spinach, tomatoes
Trivapro A	azoxystrobin/ propiconazole	hand harvesting, detasseling: 1 day all other activities: 12 hr	sweet corn
Trivapro B	benzovindiflupyr	12 hr	sweet corn
TwinGuard	sulfoxaflor/ spinetoram	12 hr	potatoes
UP-Cyde 2.5 EC	cypermethrin	12 hr	asparagus, broccoli, Brussels sprouts, cabbage, cauliflower, carrots, celery, lettuce, onions, potatoes, rutabagas, tomatoes, turnips
		hand harvesting: 5 days all other activities: 12 hr	sweet corn
Vayego 200 SC	tetraniliprole	12 hr	brassica crops (see label), cilantro, dill, eggplant, endive, lettuce (head and leaf), parsley, peppers, potatoes, sweet corn, sweet potatoes, tomatoes
Velum Prime	fluopyram	12 hr	brassica crops (see label), cucurbit crops (see label), eggplants, sweet potatoes, peppers, potatoes, tomatoes
Verimark	cyantraniliprole	12 hr	beets (table), brassica crops (see label), carrots, horseradish, parsnips, potatoes, radishes, rutabagas, turnips
Versys	afidopyropen	12 hr	brassica crops (see label), celery, cucurbit crops (see label), eggplant, endive, lettuce (head and leaf), parsley, pepper, potatoes, rhubarb, spinach, sweet potato, Swiss chard, tomatoes

Table 4–1. Restricted Entry Intervals (REI) for Pesticides Used on Vegetable Crops

If the restricted entry interval is not stated on the label for agricultural crops, assume the REI is 12 hr.

See *Restricted Entry Intervals*, on page 20, for more information.

Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
Vertisan	penthiopyrad	12 hr	potatoes, sugarbeets, sweet potatoes
		hand-detasseling: 3 days all other activities: 12 hr	sweet corn
Vivando SC	metrafenone	12 hr	cucurbit crops (see label), eggplant, peppers, tomatoes
Voliam Xpress	lambda-cyhalothrin/ chlorantraniliprole	24 hr	beans, cucurbit crops (see label), eggplant, peas, peppers, potatoes, sweet corn, sweet potatoes, tomatoes
		hand weeding, topping: 7 days scouting, hand pruning, irrigation, thinning, tying, training: 6 days all other activities: 24 hr	brassica crops (see label)
Vydate L	oxamyl	irrigation: 3 days roguing: 1 day all other activities: 12 hr	potatoes
Warhawk 480 EC	chlorpyrifos	24 hr	brassica crops (see label), carrots, celery, cucumbers, garlic, onions (bulb), peppers (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn
		10 days	cauliflower
XenTari	<i>Bacillus thuringiensis</i> , subsp. <i>aizawai</i>	Re-entry permitted once spray deposit has dried.	beets (garden), brassica crops (see label), chives, eggplant, endive, garlic, horseradish, leeks, lettuce (head and leaf), parsley, peppers, onions (bulb and green), radish, rutabaga, shallots, spinach, sugarbeets, sweet potato, Swiss chard, tomatoes, turnip
Zampro	ametoctradin/ dimethomorph	12 hr	brassica crops (see label), cucurbit crops (see label), eggplant, endive, garlic, leeks, lettuce (head and leaf), onions (dry bulb and green), peppers, potatoes, shallots, tomatoes

Appendices

Appendix A.

Ontario Ministry of Agriculture, Food and Rural Affairs Vegetable Crop Advisory Staff

A complete list of OMAFRA advisory staff is available on the OMAFRA website at ontario.ca/crops.

Specialty	Staff	Tel/Fax	E-mail
Application Technology Specialist	Jason Deveau	Tel: 519-209-1883	jason.deveau@ontario.ca
Crop Protection Specialist	Denise Beaton	Tel: 519-400-3636	denise.beaton@ontario.ca
Entomologist, Horticulture	Hannah Fraser	Tel: 519-824-4120, ext. 52671	hannah.fraser@ontario.ca
Horticulture IPM Specialist, Specialty Crops	Melanie Filotas	Tel: 519-428-4340	melanie.filotas@ontario.ca
Minor Use Coordinator	Jim Chaput	Tel: 519-546-2482	jim.chaput@ontario.ca
New Crop Development Specialist	Evan Elford	Tel: 519-420-9343	evan.elford@ontario.ca
Horticulture Sustainability Specialist	Vacant		
Soil Fertility Specialist, Horticulture	Tejendra Chapagain	Tel: 519-824-4120, ext. 52480	tejendra.chapagain@ontario.ca
Pathologist, Horticulture	Katie Goldenhar	Tel: 519-824-4120, ext. 58910	katie.goldenhar@ontario.ca
Weed Management Specialist, Horticulture	Kristen Obeid	Tel: 519-738-1232	kristen.obeid@ontario.ca
Soil Management Specialist, Horticulture	Anne Verhallen	Tel: 519-359-6707	anne.verhallen@ontario.ca
Vegetable Crops Specialist	Travis Cranmer	Tel: 519-835-3382	travis.cranmer@ontario.ca
Vegetable Crops Specialist	Elaine Roddy	Tel: 519-401-5890	elaine.rodny@ontario.ca
Vegetable Crops Specialist	Dennis Van Dyk	Tel: 519-766-5337	dennis.vandyk@ontario.ca
Vegetable Crops Specialist	Amanda Tracey	Tel: 519-350-7134	amanda.tracey@ontario.ca

Agricultural Information Contact Centre

Provides province-wide, toll-free technical and business information to commercial farms, agri-businesses and rural businesses.

1 Stone Rd. W.

Guelph, ON N1G 4Y2

Tel: 1-877-424-1300

Fax: 519-826-3442

E-mail: ag.info.omafra@ontario.ca

Appendix B.**Ontario Ministry of the Environment, Conservation and Parks Regional Contact Information**

Please contact the Ministry's local District or Area office. The local District Office contact information can be found from the Government of Ontario Employee and Organization Directory at www.infogo.gov.on.ca/infogo/home.html#orgProfile/-270/en.

After business hours, please contact the Pollution Hotline at 1-866-MOE-TIPS (1-866-663-8477).

REGION County	Address	Telephone/Fax
Central Region Toronto, Halton, Peel York, Durham, Muskoka, Simcoe	5775 Yonge St., 8th Floor Toronto, ON M2M 4J1	Tel 416-326-6700 Toll-free 1-800-810-8048
West-Central Region Haldimand, Norfolk, Niagara, Hamilton-Wentworth, Dufferin, Wellington, Waterloo, Brant	Ontario Government Building 119 King St. W., 12th Floor Hamilton, ON L8P 4Y7	Tel 905-521-7640 Toll-free 1-800-668-4557
Eastern Region Frontenac, Hastings, Lennox & Addington, Prince Edward, Leeds & Grenville, Prescott & Russell, Stormont/Dundas & Glengarry, Haliburton, Peterborough, City of Kawartha Lakes, Northumberland, Renfrew, Ottawa, Lanark (Township of South Algonquin)	1259 Gardiners Rd., Unit 3 P.O. Box 22032 Kingston, ON K7P 3J6	Tel 613-549-4000 Toll-free 1-800-267-0974
Southwestern Region Elgin, Middlesex, Oxford, Essex, Kent, Lambton, Bruce, Grey, Huron, Perth	733 Exeter Rd., 2nd Floor London, ON N6E 1L3	Tel 519-873-5000 Toll-free 1-800-265-7672
Northern Region (West) Manitoulin, Nipissing, Parry Sound, Sudbury, Algoma (East), Timiskaming, Sault Ste. Marie, Algoma (West), Cochrane, Kenora, Rainy River, Timmins, Thunder Bay	435 James St. S., Ste. 331 Thunder Bay, ON P7E 6S7	Tel: 807-475-1205 Toll-free: 1-800-875-7772
Standards Development Branch	Pesticides Section 40 St. Clair Ave. W., 9th Floor Toronto, ON M4V 1M2	Tel 416-327-5519
Environmental Approvals Branch	Pesticides Licensing 135 St. Clair Ave. W. 1st Floor Toronto, ON M4V 1P5	Tel 416-314-8001 Toll-free 1-800-461-6290

Appendix C. Accredited Soil-Testing Laboratories in Ontario

The following labs are accredited to perform soil tests for pH, buffer pH, P, K, Mg and Nitrate-N on Ontario soils.

Laboratory Name	Address	Telephone/Fax/E-mail	Contact
A & L Canada Laboratories Inc. www.alcanada.com	2136 Jetstream Rd. London, ON N5V 3P5	Tel: 519-457-2575 Fax: 519-457-2664 E-mail: alcanadalabs@alcanada.com	Greg Patterson Ian McLachlin
Eurofins Environment Testing Canada Inc. www.eurofins.com/environment-testing/lab-services/soil-testing	8-146 Colonnade Road, Ottawa, ON K2E 7Y1	Tel: 613-727-5692 Fax: 613-727-5222 E-mail: infocanada@eurofins.com	Rebecca Koshy
SGS Agri-food Laboratories www.agtest.com	503 Imperial Rd. Unit #1 Guelph, ON N1H 6T9	Tel: 519-837-1600 1-800-265-7175 Fax: 519-837-1242 E-mail: ca.agri.guelph.lab@sgs.com	Jack Legg Dr. David Boyle
Brookside Laboratories, Inc. www.blinc.com	200 White Mountain Dr. New Bremen, OH 45869	Tel: 419-753-2448 Fax: 419-753-2949 E-mail: info@blinc.com	Jackie Brackman
University of Guelph Laboratory Services www.afl.uoguelph.ca	University of Guelph P.O. Box 3650 95 Stone Rd. W. Guelph, ON N1H 8J7	Tel: 519-767-6299 Fax: 519-767-6240 E-mail: aflinfo@uoguelph.ca	Nick Schrier
Stratford Agri Analysis www.stratfordagri.ca	1131 Erie St. Box 760 Stratford, ON N5A 6W1	Tel: 519-273-4411 1-800-323-9089 Fax: 519-273-2163 E-mail: info@stratfordagri.ca	Keith Lemp Mark Aikman
Activation Laboratories Ltd. www.actlabs.com/agriculture-life-sciences	41 Bittern Street Ancaster, ON L9G 4V5	Tel: 905-648-9611 1-888-228-5227 Fax: 905-648-9613 E-mail: victoriapechorina@actlabs.com	Rob Deakin Victoria Pechorina
Honeyland Ag Services www.honeylandag.com	3918 West Corner Drive Ailsa Craig, ON N0M 1A0	Tel: 226-377-8485 E-mail: croelands@honeylandag.com	Chris Roelands

There is no official accreditation in Ontario for tissue analysis, but all the accredited soil-testing labs are monitored for proficiency on tissue analyses.

Appendix D. Production Insurance

Production Insurance (PI) covers production losses and yield reductions caused by insured perils. This includes adverse weather, disease, wildlife and insect infestations. Depending on the plan, coverage is available on a total-yield, dollar-value or acreage-loss basis. Producers can choose the type and level of coverage that best meets their needs. When enrolled in PI, producers are guaranteed a level of production, based on their yield history and their chosen coverage level. Claims are paid when an insured peril causes a yield to fall below the guaranteed production.

In Ontario, Agricorp administers PI on behalf of the Government of Ontario and Agriculture and Agri-Food Canada. More than 15,000 producers and 2 million hectares (5 million acres) of Ontario farmland are insured each year.

PI is available to all Ontario farmers, landlords and sharecroppers who grow or manage eligible agricultural products.

For more information, contact Agricorp.

Agricorp

1 Stone Rd. W.
Box 3660, Stn. Central
Guelph, ON N1H 8M4

Open weekdays, 7 AM–5 PM

Tel: 1-888-247-4999
TTY: 1-877-275-1380
Fax: 519-826-4118
E-mail: contact@agricorp.com
Web: www.agricorp.com

Appendix E. Other Contacts

Agriculture and Agri-Food Canada Research Centres

www.agr.gc.ca

Ottawa Research and Development Centre

960 Carling Ave.
Ottawa, ON K1A 0C6
Tel: 613-759-1858

Harrow Research and Development Centre

2585 County Road 20
Harrow, ON N0R 1G0
Tel: 519-738-2251

London Research and Development Centre

1391 Sandford St.
London, ON N5V 4T3
Tel: 519-457-1470

Vineland Research Farm

4902 Victoria Ave. N., P.O. Box 6000
Vineland, ON L0R 2E0
Tel: 905-562-4113

Guelph Research and Development Centre

93 Stone Road W
Guelph, N1G 5C9
Tel: 519-829-2400

Canadian Food Inspection Agency Regional Offices (Plant Protection)

www.inspection.gc.ca

Belleville

345 College St. E., Unit 6
Belleville, ON K8N 5S7
Tel: 613-969-3320

Brantford

625 Park Rd. N., Suite 6
Brantford, ON N3T 5P9
Tel: 519-753-3478

Hamilton

709 Main St. W., 1st Floor, Room 101
Hamilton, ON L8S 1A2
Tel: 905-572-2201

London

19-100 Commissioners Rd. E.
London, ON N5Z 4R3
Tel: 519-691-1300

St. Catharines

395 Ontario St., Unit 13, PO Box 19
St. Catharines, ON L2N 7N6
Tel: 905-937-7434

Ottawa District

38 Auriga Dr., Unit 8
Ottawa, ON K2E 8A5
Tel: 613-773-8616

Toronto

1124 Finch Ave. W., Unit 2
Toronto, ON M3J 2E2
Tel: 416-665-5055

Guelph

174 Stone Rd W
Guelph, ON N1G 4T1
Tel: 519-837-9400

University of Guelph

Main Campus

Guelph, ON N1G 2W1
Tel: 519-824-4120
www.uoguelph.ca

Ridgetown Campus

120 Main Street E.
Ridgetown, ON N0P 2C0
Tel: 519-674-1500
www.ridgetownc.uoguelph.ca

Department of Plant Agriculture

www.plant.uoguelph.ca

Department of Plant Agriculture, Guelph

50 Stone Rd. W.
Guelph, ON N1G 2W1
Tel: 519-824-4120, ext. 56086

Department of Plant Agriculture, Muck Crops

1125 Woodchoppers Lane
King, ON L7B 0E9
Tel: 905-775-3783

Department of Plant Agriculture, Simcoe

1283 Blueline Road, PO Box 587
Simcoe, ON N3Y 4N5
Tel: 519-426-7127

Department of Plant Agriculture, Vineland

4890 Victoria Ave. N., PO Box 7000
Vineland Station, ON L0R 2E0
Tel: 905-562-4141

Lab Services Division

95 Stone Rd. W., PO Box 3650
Guelph, ON N1H 8J7
Tel: 519-767-6299
www.uoguelph.ca/labserv

Trace Organics and Pesticides Contaminants

Tel: 519-823-1268

Vineland Research and Innovation Centre

4890 Victoria Ave. N., Box 4000
Vineland Station, ON L0R 2E0
Tel: 905-562-0320
www.vinelandresearch.com

Appendix F. Diagnostic Service

Samples for disease diagnosis, insect or weed identification, nematode counts and verticillium testing can be sent to:

University of Guelph
Laboratory Services Division
Pest Diagnostic Clinic
95 Stone Rd. W.
Guelph, ON N1H 8J7

Tel 519-767-6299
Fax 519-767-6240
E-mail aflinfo@uoguelph.ca

www.guelphlabservices.com

Payment must accompany samples at the time of submission.
Submission forms are available at:
www.guelphlabservices.com/AFL/submit_samples.aspx

How to Sample for Nematodes

Soil

When to sample

Soil and root samples can be taken at any time of the year that the soil is not frozen. In Ontario, nematode soil population levels are generally at their highest in May and June and again in September and October.

How to sample soil

Use a soil sampling tube, trowel or narrow-bladed shovel to take samples. Sample soil to a depth of 20–25 cm (8–10 in.). If the soil is bare, remove the top 2 cm (1 in.) prior to sampling. A sample should consist of 10 or more subsamples combined. Mix well. Then take a sample of 0.5–1 L (1 pint–1 quart) from this. No single sample should represent more than 2.5 ha (6.25 acres). Mix subsamples in a clean pail or plastic bag.

Sampling pattern

If living crop plants are present in the sample area, take samples within the row and from the area of the feeder root zone (with trees, this is the drip line).

Number of subsamples

Based on the total area sampled:

500 m ² (5,400 ft ²)	10 subsamples
500 m ² –0.5 ha (5,400 ft ² –1.25 acres)	25 subsamples
0.5 ha–2.5 ha (1.25–6.25 acres)	50 subsamples

Roots

For small plants, sample the entire root system plus adhering soil. For large plants, 10–20 g (½–1 oz.), dig fresh weight from the feeder root zone and submit.

Problem areas

Take soil and root samples from the margins of the problem area where the plants are still living. If possible, also take samples from healthy areas in the same field. If possible, take both soil and root samples from problem and healthy areas in the same field.

Sample Handling

Soil samples

Place in plastic bags as soon as possible after collecting.

Root samples

Place in plastic bags and cover with moist soil from the sample area.

Storage

Store samples at 5°C–10°C and do not expose them to direct sunlight or extreme heat or cold (freezing). Only living nematodes can be counted. Accurate counts depend on proper handling of samples.

Submitting Plant for Disease Diagnosis or Identification

Sample submission forms

Sample submission forms can be found online at the University of Guelph Agriculture & Food Laboratory at: : afl.uoguelph.ca/submitting-samples. Carefully fill in all the categories on the form. In the space provided, draw the most obvious symptom and the pattern of the disease in the field. It is important to include the cropping history of the area for the past 3 years and pesticide use records from this year.

Choose a complete, representative sample showing early symptoms. Submit as much of the plant as is practical, including the root system, or several plants showing a range of symptoms. If symptoms are general, collect the sample from an area where they are of intermediate severity. Completely dead material is usually inadequate for diagnosis.

With plant specimens submitted for identification, include at least a 20–25-cm sample of the top portion of the stem with lateral buds, leaves, flowers or fruits in identifiable condition. Wrap plants in newspaper and put in a plastic bag. Tie the root system off in a separate plastic bag to avoid the soil drying out and contaminating the leaves. Do not add moisture, as this encourages decay in transit. Cushion specimens and pack in a sturdy box to avoid damage during shipping. Avoid leaving specimens to bake or freeze in a vehicle or in a location where they could deteriorate.

Delivery

Deliver to the Pest Diagnostic Clinic as soon as possible by first-class mail or courier at the beginning of the week.

Submitting Insect Specimens for Identification

Collecting samples

Place dead, hard-bodied insects in vials or boxes and cushion with tissues or cotton. Place soft-bodied insects and caterpillars in vials containing alcohol. Do not use water, as this results in rot. Do not tape insects to paper or send them loose in an envelope.

Place live insects in a container with enough plant “food” to support them during transit. Be sure to write “live” on the outside of the container.

Appendix G. The Metric System and Abbreviations

Metric units
Linear measures (length)
10 millimetres (mm) = 1 centimetre (cm)
100 centimetres (cm) = 1 metre (m)
1,000 metres = 1 kilometre (km)
Square measures (area)
100 m × 100 m = 10,000 m ² = 1 hectare (ha)
100 ha = 1 square kilometre (km ²)
Cubic measures (volume)
Dry measure
1,000 cubic millimetres (mm ³) = 1 cubic centimetre (cm ³)
1,000,000 cm ³ = 1 cubic metre (m ³)
Liquid measure
1,000 millilitres (mL) = 1 litre (L)
100 L = 1 hectolitre (hL)
Weight-volume equivalents (for water)
(1.00 kg) 1,000 grams = 1 litre (1.00 L)
(0.50 kg) 500 g = 500 mL (0.50 L)
(0.10 kg) 100 g = 100 mL (0.10 L)
(0.01 kg) 10 g = 10 mL (0.01 L)
(0.001 kg) 1 g = 1 mL (0.001 L)
Weight measures
1,000 milligrams (mg) = 1 gram (g)
1,000 g = 1 kilogram (kg)
1,000 kg = 1 tonne (t)
1 mg/kg = 1 part per million (ppm)
Dry-liquid equivalents
1 cm ³ = 1 mL
1 m ³ = 1,000 L
Metric conversions
5 mL = 1 tsp
15 mL = 1 tbsp
28.5 mL = 1 imp. fl. oz.
Handy metric conversion factor (approximate)
litres per hectare × 0.4 = litres per acre
kilograms per hectare × 0.4 = kilograms per acre

Application rate conversions
Metric to imperial or U.S. (approximate)
litres per hectare × 0.09 = Imp. gallons per acre
litres per hectare × 0.11 = U.S. gallons per acre
litres per hectare × 0.36 = Imp. quarts per acre
litres per hectare × 0.43 = U.S. quarts per acre
litres per hectare × 0.71 = Imp. pints per acre
litres per hectare × 0.86 = U.S. pints per acre
millilitres per hectare × 0.014 = U.S. fluid ounces per acre
grams per hectare × 0.014 = ounces per acre
kilograms per hectare × 0.89 = pounds per acre
tonnes per hectare × 0.45 = tons per acre
Imperial or U.S. to metric (approximate)
Imp. gallons per acre × 11.23 = litres per hectare (L/ha)
U.S. gallons per acre × 9.35 = litres per hectare (L/ha)
Imp. quarts per acre × 2.8 = litres per hectare (L/ha)
U.S. quarts per acre × 2.34 = litres per hectare (L/ha)
Imp. pints per acre × 1.4 = litres per hectare (L/ha)
U.S. pints per acre × 1.17 = litres per hectare (L/ha)
Imp. fluid ounces per acre × 70 = millilitres per hectare (mL/ha)
U.S. fluid ounces per acre × 73 = millilitres per hectare (mL/ha)
tons per acre × 2.24 = tonnes per hectare (t/ha)
pounds per acre × 1.12 = kilograms per hectare (kg/ha)
pounds per acre × 0.45 = kilograms per acre (kg/acre)
ounces per acre × 70 = grams per hectare (g/ha)
Dry weight conversions (approximate)
Metric Imperial
grams or kilograms/hectare ounces or pounds/acre
100 g/ha = 1½ oz/acre
200 g/ha = 3 oz/acre
300 g/ha = 4¼ oz/acre
500 g/ha = 7 oz/acre
700 g/ha = 10 oz/acre
1.10 kg/ha = 1 lb/acre
1.50 kg/ha = 1¼ lb/acre
2.00 kg/ha = 1¾ lb/acre
2.50 kg/ha = 2¼ lb/acre
3.25 kg/ha = 3 lb/acre
4.00 kg/ha = 3½ lb/acre
5.00 kg/ha = 4½ lb/acre
6.00 kg/ha = 5¼ lb/acre
7.50 kg/ha = 6¾ lb/acre
9.00 kg/ha = 8 lb/acre
11.00 kg/ha = 10 lb/acre
13.00 kg/ha = 11½ lb/acre
15.00 kg/ha = 13½ lb/acre

Conversion tables – metric to imperial (approximate)**Length**

1 millimetre (mm) = 0.04 inches

1 centimetre (cm) = 0.40 inches

1 metre (m) = 39.40 inches

1 metre (m) = 3.28 feet

1 metre (m) = 1.09 yards

1 kilometre (km) = 0.62 miles

Area1 square centimetre (cm²) = 0.16 square inches1 square metre (m²) = 10.77 square feet1 square metre (m²) = 1.20 square yards1 square kilometre (km²) = 0.39 square miles

1 hectare (ha) = 107,636 square feet

1 hectare (ha) = 2.5 acres

Volume (dry)1 cubic centimetre (cm³) = 0.061 cubic inches1 cubic metre (m³) = 1.31 cubic yards1 cubic metre (m³) = 35.31 cubic feet1,000 cubic metres (m³) = 0.81 acre-feet

1 hectolitre (hL) = 2.8 bushels

Volume (liquid)

1 millilitre (mL) = 0.035 fluid ounces (Imp.)

1 litre (L) = 1.76 pints (Imp.)

1 litre (L) = 0.88 quarts (Imp.)

1 litre (L) = 0.22 gallons (Imp.)

1 litre (L) = 0.26 gallons (U.S.)

Weight

1 gram (g) = 0.035 ounces

1 kilogram (kg) = 2.21 pounds

1 tonne (t) = 1.10 short tons

1 tonne (t) = 2,205 pounds

Pressure1 kilopascal (kPa) = 0.15 pounds/in.²**Speed**

1 metre per second = 3.28 feet per second

1 metre per second = 2.24 miles per hour

1 kilometre per hour = 0.62 miles per hour

Temperature

°F = (°C × 1.8) + 32

Conversion tables – imperial to metric (approximate)**Length**

1 inch = 2.54 cm

1 foot = 0.30 m

1 yard = 0.91 m

1 mile = 1.61 km

Area1 square foot = 0.09 m²1 square yard = 0.84 m²

1 acre = 0.40 ha

Volume (dry)1 cubic yard = 0.76 m³

1 bushel = 36.37 L

Volume (liquid)

1 fluid ounce (Imp.) = 28.41 mL

1 pint (Imp.) = 0.57 L

1 gallon (Imp.) = 4.55 L

1 gallon (U.S.) = 3.79 L

Weight

1 ounce = 28.35 g

1 pound = 453.6 g

1 ton = 0.91 tonne

Pressure

1 pound per square inch = 6.90 kPa

Temperature

°C = (°F – 32) × .5556

Abbreviations

% = per cent

ai = active ingredient

AP = agricultural powder

cm = centimetre

cm² = square centimetre

CS = capsule suspension

DF = dry flowable

DG = dispersible granular

DP = dispersible powder

E = emulsifiable

EC = electrical conductivity

e.g. = for example

F = flowable

g = gram

Gr = granules, granular

ha = hectare

kg = kilogram

km/h = kilometres per hour

kPa = kilopascal

L = litre

m = metre

m² = square metre

mL = millilitre

mm = millimetre

m/s = metres per second

SC = sprayable concentrate

SP = soluble powder

t = tonne

W = wettable (powder)

WDG = water dispersible granular

WG = wettable granule

WP = wettable powder

Emergency and First-Aid Procedures for Pesticide Poisoning

For pesticide poisonings and pesticide injuries, call the Ontario Poison Centre: Toronto 1-800-268-9017

PREVENT ACCIDENTS

- **Read the label.** Follow all the precautions the label recommends. Read the First Aid section of the label BEFORE you begin to handle any pesticide.
- **Make sure that someone knows** what pesticides you are working with and where you are.
- **Keep a file of labels and product Safety Data Sheets (SDS) for the pesticides you use.** Make sure everyone knows where to find this in case of an emergency.
- **Post emergency numbers near all telephones.**
- **Keep clean water, paper towels, extra gloves and clean coveralls close by** in case you spill pesticide on yourself.

If someone has been working with pesticides and you see any possible symptoms of pesticide poisoning or injury, take emergency action immediately.

IF AN ACCIDENT OR POISONING HAPPENS

- Protect yourself from injury first.
- Stop the exposure to the pesticide. Move the victim away from the contaminated area.
- Check the four basic facts — identify the pesticide, the quantity, the route of entry and time of exposure.

- Call an ambulance or the Ontario Poison Centre.
- Start first aid. This is not a substitute for professional medical help.
- **Provide the label, SDS sheet, container or a clear photo of the container to emergency personnel** at the scene — or take it with you to the hospital. Do not transport pesticide containers in the passenger compartment of the vehicle.

FIRST AID

If a pesticide comes in contact with skin:

- remove all contaminated clothing; wash skin thoroughly with lots of soap and warm water.
- dry skin well and cover with clean clothing or other clean material.

If pesticide comes in contact with eyes:

- hold eyelids open; wash the eyes with clean running water for 15 minutes or more.

If pesticide was inhaled:

- move the victim to fresh air and loosen tight clothing.
- give artificial respiration if the victim is not breathing.

Do not breathe in the exhaled air from the victim — you could also be poisoned.

If a pesticide was swallowed:

- call the Ontario Poison Centre IMMEDIATELY.

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Agricultural Information Contact Centre

1-877-424-1300
1-855-696-2811 (TTY)
email: ag.info.omafra@ontario.ca
ontario.ca/omafra

For a major spill, a theft or a fire involving a pesticide:

Call the Ontario Ministry of the Environment, Conservation and Parks **Spills Action Centre** at
1-800-268-6060 (24 hr a day, 7 days a week).
Notify your municipality.

